

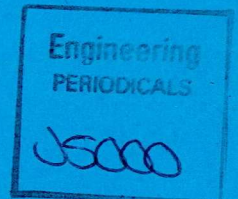
UNIVERSITY OF GLASGOW

DEPARTMENT OF

AEROSPACE ENGINEERING

DATA FOR A NACA 23012C AEROFOIL PITCHED ABOUT ITS QUARTER CHORD AXIS

VOLUME I: *Pressure data from static and ramp function tests,
with photographs of oil-flow visualisation tests.*



By
M.W.GRACEY
and
R.A.McD. GALBRAITH

13 January 1988

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PITCHED ABOUT ITS QUARTER CHORD AXIS.

Herein is presented the collected data for tests in which a NACA 23012C aerofoil was subjected to a variety of ramp type displacements in pitch about the quarter chord position at low Reynolds numbers. In addition, the results of static tests and oil-flow visualisation experiments on the aerofoil are displayed.

VOLUME I
PRESSURE DATA FROM RAMP FUNCTION TESTS,
WITH PHOTOGRAPHS OF OIL-FLOW
VISUALISATION TESTS.

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NACA 23012C - VOLUME I

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Nomenclature

c	= chord
C_m	= pitching moment coefficient
C_n	= normal force coefficient
C_p	= pressure coefficient
C_t	= thrust force coefficient
D.P.	= dynamic pressure
k	= reduced frequency
Re	= Reynolds number
V	= velocity
x/c	= chordwise dimension
α	= angle of attack
ω	= rotational frequency

1. Introduction

The phenomenon of dynamic stall, the onset of which is largely controlled by the behaviour of the viscous boundary layer on the aerofoil surface, plays an important role in the successful aerodynamic design of the helicopter rotor. During high speed forward flight conditions, the blades on the retreating side of the rotor disc encounter a reduced dynamic pressure, and hence rotor trim requirements dictate a high aerofoil lift coefficient. These high lift coefficients are generated through large angles of incidence, often exceeding the maximum static stall value and so take advantage of the dynamic effects on the stalling process. Aerofoil dynamic stall is imprecisely understood and is currently the subject of extensive experimental and theoretical investigation by, amongst others, LEISHMAN AND BEDDOES [1]. As has been shown by HARRIS AND PRUYN [2], attempts to predict rotor performance without a mathematical model of retreating blade stall have met with little success. Furthermore, the modelling is complicated by the highly three-dimensional flowfield of the rotor. It is clear, however, that in order to formulate modelling techniques for use in rotor airload calculations, a basic understanding of the unsteady stall process must be established.

An experimental investigation of retreating blade stall together with a boundary layer analysis on a model rotor by McCROSKEY ET AL. [3,4] pointed to the modelling of blade dynamic stall by an oscillating aerofoil in the nominally two-dimensional flow environment of a wind-tunnel. Many such experiments of aerofoils oscillating through stall have since been performed, and data has been gathered for both the analysis of the fluid mechanics of the dynamic stall phenomenon itself and for use in mathematical model development.

One such series of experiments was performed on a NACA 23012 aerofoil by LEISHMAN ET AL. [5] in the dynamic stall test facility at Glasgow University.³ Following these tests, a series of ramp tests was performed on the same aerofoil by SETO AND GALBRAITH [9] in order to study the effects of pitch rate alone. To supplement the data yielded by these tests, a series of oil-flow visualisation experiments was carried out on the aerofoil by SETO ET AL. [10].

This report, the first of two, presents the collected data from a series of ramp tests performed on a NACA 23012C aerofoil. The design procedure for this aerofoil has been described by GRACEY AND GALBRAITH [11], and the profile and coordinates of the aerofoil are displayed in Table 1.

VOLUME I

Pressure data from static and ramp function tests, with photographs of oil-flow visualisation tests.

VOLUME II

Pressure data from oscillatory tests.

A brief description of the rig and testing procedures is also included in each volume.

These tests were performed by rotating the aerofoil about its quarter-chord axis. A previous series of tests was performed on this aerofoil by rotating it about the perpendicular axis through the point ($c/4, c/22$). The results of these tests have been reported by GRACEY AND GALBRAITH [12,13].

*2. Description of test facility**2.1 Aerofoil and wind tunnel*

The general arrangement of the aerofoil in the wind tunnel was as shown in Fig. 1. The aerofoil, of chord length 0.55m and span 1.61m, was constructed of fibre glass mounted on an aluminium spar and filled with an epoxy resin foam. A very smooth hand-finished surface was obtained, and the profile was accurate to better than 0.1mm. The instrumented model was fitted vertically into Glasgow University's 'Handley-Page' wind-tunnel.

³ See GALBRAITH AND LEISHMAN [6]; LEISHMAN [7]; GALBRAITH [8].

The 'Handley Page' wind tunnel is a low speed closed - return type with a 1.61 x 2.13m octagonal working section (Fig. 2). The model was pivoted about the quarter chord position on two tubular steel shafts connected to the main support via two self aligning bearings, with the weight being taken by a single thrust bearing on the top support beam. The dynamic and aerodynamic loadings from the aerofoil were reacted to the wind tunnel framework by two transversely mounted beams.

2.2 Pitch drive mechanism

2.2.1 Actuator

Angular movement of the model was obtained using a linear hydraulic actuator and crank mechanism. The actuator was mounted horizontally below the wind tunnel working section on the supporting structure, with the crank rigidly connected to the tubular part of the spar by a welded sleeve and keyway. The actuator was a UNIDYNE 907/1 type with a normal dynamic thrust of 6.1 KN operated from a supply pressure of 7.0 MN². A MOOG 76 series 450 servo valve was used via a UNIDYNE servo controller unit to control the movement of the actuator. A suitable feedback signal for the controller was provided by a precision linear angular displacement transducer geared to the main spar of the model.

2.2.2 Command signal

The input signal to the actuator controller for incrementing the model's angle of attack during the 'static test', was provided under software control by the data acquisition unit's own digital to analogue converter. This was possible because sufficient time between sampling was available to set the model at the required angle of attack and, during the sampling, the angle of attack was fixed. The two activities were separate and were carried out sequentially. Such was not the case during the unsteady tests, however, where sampling and control of the model motion were required simultaneously.

The control of the aerofoil's motion and simultaneous data recording was not possible on the DEC MINC (the data logging unit) and so, for the present tests, the input signal was provided by a separate function generator. This generator comprised a BBC microcomputer and a 12-bit bipolar digital to analogue converter. A second 12-bit bipolar digital to analogue converter was used to allow software control of the

maximum desired voltage for the given amplitude or arc length. The required output function was digitised into 512 equal time steps in 2's complement code and stored in EPROM. The frequency of the function was controlled using the internal interrupts of the BBC microcomputer.

2.3 Instrumentation and data logging

2.3.1 Pressure transducers

To provide the chordwise pressure distribution at mid-span, thirty ENTRAN EPIL-080B-5S ultra-miniature pressure transducers were installed just below the surface of the centre section of the model. These transducers were of sealed gauge type with one side of the pressure-sensitive diaphragm sealed to a reference pressure at the time of manufacture. Each transducer was fitted with a temperature compensation module, which minimised the change in zero offset and sensitivity with temperature. The locations of the pressure transducers in the model are shown in Fig. 3.

The low voltage outputs from the thirty pressure transducers were suitably amplified and conditioned in a bank of differential amplifiers. The conditioned signals were passed to a 'sample-and-hold' unit⁴ to overcome the time skew problem arising from the sequential conversion of the analogue signals into digital form.

2.3.2 Dynamic pressure

The dynamic pressure in the wind tunnel working section was determined by measuring the difference between the static pressure in the working section, 1.2m upstream of the leading edge, and the static pressure in the settling chamber, as measured by a FURNESS FC012 micromanometer. The pressure tappings were connected to a FURNESS FC012 micromanometer, which provided an analogue signal suitable for the acquisition unit's analogue to digital converter. This dynamic pressure reading was recorded as the sample-and-holds were triggered to sample the output from the pressure transducers.

2.3.3 Incidence

The instantaneous angle of attack of the aerofoil was determined by an angular displacement transducer geared to the model's main spar. The signal voltage from the transducer was fed

⁴ See GALBRAITH ET AL. [14]

into an amplifier/splitter to produce three signals for the following purposes:

- i. connection to the multiplexer for recording the aerofoil's angle of attack;
- ii. connection to the Schmitt trigger for initiation of data sampling when a preset angle (voltage) was reached;
- iii. a feedback signal to the hydraulic actuator controller.

2.3.4 Acquisition unit

The actual data acquisition unit was a DEC MINC-11 microcomputer, configured with an LSI-11/32 16-bit microprocessor and laboratory modules which included:

- a. an analogue to digital converter module, with a 16-channel multiplexer incorporated. The converter was a 12-bit successive approximation type with a conversion time of 30 μ s, but the multiplexer's settling time and the need to transfer the data from the analogue to digital converter into system memory increased the conversion time to 44 μ s;
- b. a multiplexer module, of 16 single-ended channels, which increased the number of channels that could be sampled to 32;
- c. a real-time clock module, with two Schmitt triggers. This was used as a time-base generator to accurately set the sampling frequency. The sample frequency was determined at run time from the frequency of oscillation and the requirement that 128 sample sweeps be obtained during each cycle. One of the Schmitt triggers was used to start data sampling, by setting its reference voltage to a value corresponding to the angular displacement transducer's output for the required starting angle of attack;
- d. a digital to analogue converter module which housed four independent 12-bit digital to analogue converters. This was used to provide the command signal for the hydraulic actuator during static tests.

The path of data flow and system layout is shown diagrammatically in Fig. 4. The main control programs for the tests were written in FORTRAN IV as described by MURRAY-SMITH AND GALBRAITH [15]. These programs prompt the user for specific run information before calling a specialised sub-program written in MACRO 11 assembly language to receive and store the digitised data. The timing and control of the analogue to digital

converter and associated circuitry was performed by the processor's hardware, but channel selection and data management were done under software control.

3 Test series and procedure

3.1 Static test

For a static test the model's angle of attack is increased in steps of approximately 0.5 ° from the required starting angle. After each increment in angle the flow is allowed to stabilize for a few seconds before each transducer's output is sampled 100 times and the mean value for each stored. After 64 sweeps of data have been recorded, the model is returned to the starting angle, data sampling is maintained at the same rate on the return cycle to record any delay in the reattachment of the flow.

3.2 Unsteady static test

To record any fluctuations in the post stall characteristics the model's angle of attack is set at the required value and then a continuous sample of 256 data sweeps are recorded at a preset frequency (100 Hz).

3.3 Ramp test (up and down)

During a ramp test the model's angle of attack is changed at a constant pitch rate, over a preset arc. 5 sets of 256 data sweeps are recorded as the test is repeated.

3.4 Procedure

Due to the thermal characteristics of the tunnel, a precise sequence had to be followed before initialising a test. Prior to any series of tests, the tunnel was run for approximately 20-25 minutes to achieve thermal stability between 20 and 30 ° Centigrade. Before each individual set of tests, the tunnel was shut down and the air flow allowed to cease before the transducer offsets were logged. Immediately after this logging, the appropriate data acquisition routine was initiated whilst the tunnel was brought up to speed and thence data gathered as per the software prompts. Provided that the air temperature in the tunnel had not risen by more than 2 °C from that at which the offsets were logged, further tests were performed.

3.5 Data presentation

All data collected by the data acquisition routines were stored in unformatted form on magnetic tape. A library of programs is available for the reduction and presentation of the raw data by the MINC and VAX 750. The data reduction programs were used to convert the cycles of raw data into averaged or unaveraged non-dimensional pressure coefficients by applying offsets, gains and calibrations, to the raw data. The results were stored in formatted form on a DEC VAX 750, where details are stored on the Glasgow University aerofoil database, as described by LEITCH AND GALBRAITH [16]. A library of programs is available for the presentation and analysis of the data stored on the VAX.

4 Results and discussion

4.1 Tunnel performance

Assessment of the quality of the data can only be made with a clear insight of the tunnel effects. Unfortunately the tunnel performance was such that, for the time scales of the model motion, the dynamic pressure in the working section could not be held constant whilst the blockage altered due to the pitching of the model. During the static test (ie $k=0.0$), this variation was as shown in Fig. 5, where it may be seen that there was approximately a 30% reduction in dynamic pressure as the angle of attack was increased from 0 to 30 degrees. As may be seen in Fig. 6 and 7, this reduction in dynamic pressure decreases as the reduced frequency increases.

Fig. 8 shows that, in ramps, there is a drastic reduction and subsequent unsteadiness in the dynamic pressure during a test. The model was pitched to an angle of 40 degrees so that uniform ramp conditions existed at the stall. Once the aerofoil had stalled, however, the data of interest had already been collected and the corresponding dynamic pressure reduction was only in the region of 10%. The subsequent data is of little relevance to the current work and is presented merely for completeness.

4.2 Averaging of the data

The main data presented in this report is the average of a number of cycles. Individual runs are presented in Fig. 9 and 10 where it may be seen that, whilst minor random differences do exist from cycle to cycle, the salient features are highlighted by the averaging process. The given data may be considered as typical of aerofoil

performance in a given individual cycle. This is particularly relevant when considering the detailed flow phenomena of separation and reattachment.

4.3 Test data

The test data is grouped for each motion type with compact details of the specific tests are given in Tables 2 to 5.

5 Oil-flow visualisation

The last experiments performed on the aerofoil were oil-flow visualisation tests. The flow visualisation was effected using a mixture of saturn yellow 'dayglo' powder, odina oil and paraffin. The aerofoil was first rotated about the quarter chord until it was at the desired angle of attack. Then a thin layer of the oil mixture was uniformly smeared over the upper surface of the aerofoil, the wind speed was then raised from zero to the desired velocity. The development of the flow pattern was allowed to proceed until either no further development was likely or, in regions of oil accumulations, gravitational effects began to distort the result. The flow pattern was illuminated by ultra-violet light, causing the 'dayglo' pigment to fluoresce in the visible range. Black and white photographs were taken to record the results and are presented in Fig. 12.

The tests were carried out at a Reynolds number of 1.5×10^6 and are summarised in Table 6. A graph of the chordwise location of the separation point versus the angle of attack is presented in Fig. 11.

6 Acknowledgements

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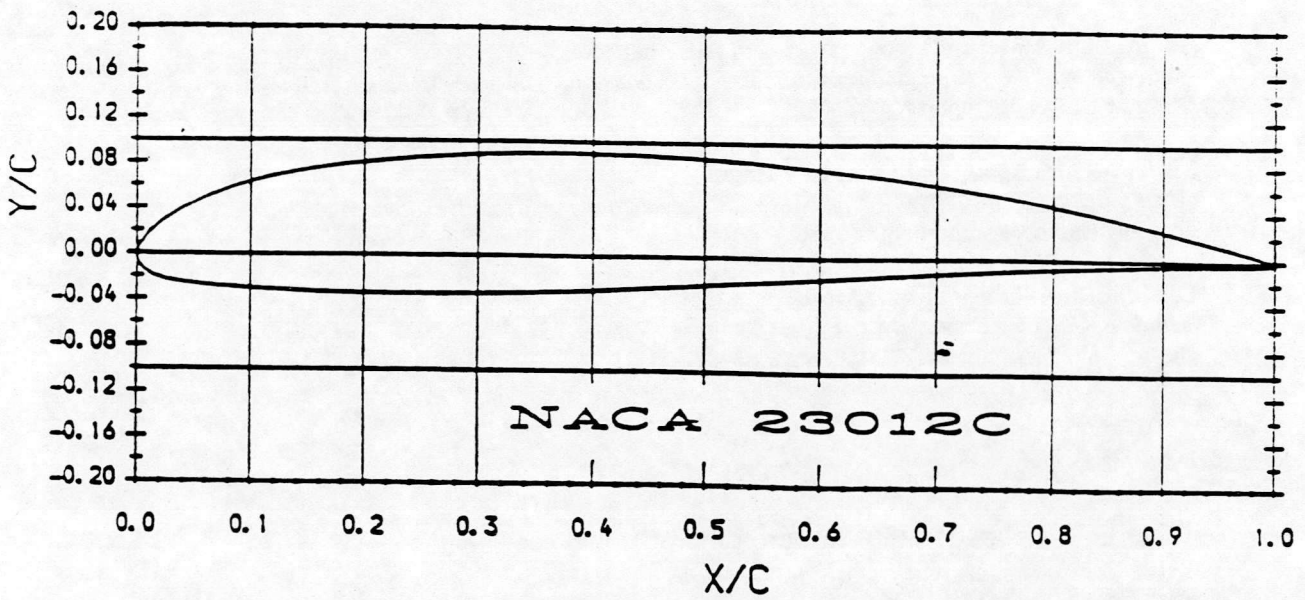
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TABLE 1. NACA 23012C AEROFOIL PROFILE AND COORDINATES.



Upper surface		Lower surface	
Station	Ordinate	Station	Ordinate
0.000	0.000	0.000	0.000
0.341	0.917	0.657	-1.453
1.124	1.932	1.472	-1.948
2.366	3.009	2.614	-2.310
4.071	4.097	4.064	-2.568
6.232	5.136	5.811	-2.757
8.826	6.072	7.854	-2.905
11.813	6.862	10.206	-3.038
15.139	7.489	12.892	-3.167
18.741	7.965	15.942	-3.291
22.585	8.339	19.393	-3.386
24.873	8.529	23.243	-3.401
29.023	8.783	29.525	-3.345
33.467	8.942	33.969	-3.245
38.184	8.985	38.681	-3.062
43.156	8.914	43.641	-2.830
48.362	8.702	48.829	-2.515
53.782	8.335	54.223	-2.187
59.395	7.803	59.803	-1.857
65.178	7.105	65.546	-1.533
71.108	6.243	71.429	-1.224
77.162	5.222	77.429	-0.931
83.316	4.046	83.523	-0.657
89.547	2.684	89.686	-0.419
95.829	1.136	95.892	-0.340
100.000	0.000	100.000	-0.288

(Stations and ordinates given in %chord)

TABLE 2. DETAILS OF STATIC TESTS.

Table 2.1. Summary of static tests (nominal).

Reynolds Number	1.0x10 ⁶	1.5x10 ⁶	2.0x10 ⁶
Angle of attack	-2° to 30°		

(All permutations)

Table 2.2. List of static tests.

Run No.	Start angle (°)	Sweep (°)	Reynolds No. x10 ⁻⁶
05011	-2	32	1.52
05341	-2	32	1.49
05351	-2	32	1.00
05361	-2	32	1.97
06611	-2	32	1.51
07911	-5	32	1.52

TABLE 3. DETAILS OF RAMP UP TESTS."

Table 3.1. Summary of ramps from -1 ° to 40 °(nominal).

Pitch Rate	Reynolds No. x 10 ⁻⁶	Pitch Rate	Reynolds No. x 10 ⁻⁶	Pitch Rate	Reynolds No. x 10 ⁻⁶
0.75	1.5	75.0	1.5	215.0	1.5
1.5	1.5	90.0	1.5	230.0	1.5
3.0	1.5	100.0	1.0 1.5 2.0	245.0	1.5
4.5	1.5	115.0	1.5	260.0	1.5
6.0	1.5	130.0	1.5	275.0	1.5
7.5	1.5	145.0	1.5	290.0	1.5
15.0	1.5	160.0	1.5	300.0	1.0 1.5 2.0
30.0	1.0 1.5 2.0	175.0	1.5	315.0	1.5
45.0	1.5	190.0	1.5	330.0	1.5
60.0	1.5	200.0	1.0 1.5 2.0	345.0	1.5

(All permutations)

Table 3.3. List of ramp up tests (actual).

Run No.	Arc. ($^{\circ}$)	Rate. ($^{\circ}$ s $^{-1}$)	Reduced pitch rate	Reynolds No. $\times 10^{-6}$
27531	41	29.5	0.0052	1.00
27541	41	99.6	0.0173	1.00
27551	41	190.3	0.0331	1.00
27561	41	271.9	0.0473	1.00
27571	41	0.7	0.0001	1.50
27581	41	1.5	0.0002	1.48
27591	41	3.0	0.0003	1.47
27601	41	4.4	0.0005	1.47
27611	41	6.0	0.0007	1.46
27621	41	7.3	0.0008	1.46
27631	41	14.8	0.0017	1.48
27641	41	29.4	0.0034	1.47
27651	41	44.3	0.0051	1.47
27661	41	59.5	0.0070	1.46
27671	41	74.4	0.0087	1.46
27681	41	89.7	0.0105	1.46
27691	41	99.8	0.0116	1.46
27701	41	113.2	0.0132	1.46
27711	41	128.5	0.0149	1.48
27721	41	141.8	0.0164	1.47
27731	41	156.5	0.0181	1.47
27741	41	167.1	0.0194	1.47
27751	41	180.4	0.0210	1.47
27761	41	189.1	0.0220	1.47
27771	41	203.2	0.0237	1.47
27781	41	214.7	0.0250	1.46
27791	41	229.0	0.0267	1.47
27801	41	241.2	0.0281	1.47
27811	41	247.8	0.0288	1.47
27821	41	260.3	0.0303	1.46
27831	41	267.2	0.0311	1.47
27841	41	273.1	0.0318	1.47
27851	41	286.4	0.0333	1.47
27861	41	292.9	0.0341	1.46
27871	41	29.5	0.0026	1.93
27881	41	98.0	0.0086	1.92
27891	41	185.3	0.0163	1.92
27901	41	257.9	0.0226	1.91

TABLE 4. DETAILS OF RAMP DOWN TESTS.

Table 4.1 Summary of ramps from 40° to -1° (nominal)

Pitch Rate	Reynolds No. x 10 ⁻⁶	Pitch Rate	Reynolds No. x 10 ⁻⁶	Pitch Rate	Reynolds No. x 10 ⁻⁶
-0.75	1.5	-75.0	1.5	-215.0	1.5
-1.5	1.5	-90.0	1.5	-230.0	1.5
-3.0	1.5	-100.0	1.5	-245.0	1.5
-4.5	1.5	-115.0	1.5	-260.0	1.5
-6.0	1.5	-130.0	1.5	-275.0	1.5
-7.5	1.5	-145.0	1.5	-290.0	1.5
-15.0	1.5	-160.0	1.5	-300.0	1.5
-30.0	1.5	-175.0	1.5	-315.0	1.5
-45.0	1.5	-190.0	1.5	-330.0	1.5
-60.0	1.5	-200.0	1.5	-345.0	1.5

(All permutations)

Table 4.2 Summary of ramps ending at -5° (nominal)

Ramp Arc (°)	-19	-21	-23	-25	-27	-30	-32	-35
Pitch Rate (°s ⁻¹)	-150*			-300				
Reynolds No. x 10 ⁻⁶	1.5							

(All permutations ; * ramp arc between -35° and -30° only)

Table 4.3 Summary of ramps starting at 30° (nominal)

Ramp Arc (°)	-5	-10	-15	-20	-25	-30	-40
Pitch Rate (°s ⁻¹)	-50		-150			-300	
Reynolds No. x 10 ⁻⁶	1.5						

(All permutations)

Table 4.4. List of ramp down tests (actual).

Run No.	Arc. (°)	Rate. (° S ⁻¹)	Reduced pitch rate.	Reynolds No. x10 ⁻⁶
37921	-41	-0.7	-.0001	1.51
37931	-41	-1.4	-.0002	1.49
37941	-41	-2.9	-.0003	1.48
37951	-41	-4.3	-.0005	1.48
37961	-41	-5.8	-.0007	1.48
37971	-41	-7.2	-.0008	1.47
37981	-41	-14.3	-.0017	1.48
37991	-41	-28.3	-.0033	1.48
38001	-41	-43.0	-.0050	1.48
38011	-41	-56.0	-.0066	1.48
38021	-41	-69.2	-.0081	1.47
38031	-41	-81.9	-.0096	1.47
38041	-41	-91.4	-.0107	1.47
38051	-41	-104.6	-.0122	1.47
38061	-41	-116.6	-.0137	1.49
38071	-41	-128.2	-.0150	1.48
38081	-41	-141.2	-.0165	1.48
38091	-41	-153.5	-.0180	1.48
38101	-41	-167.4	-.0196	1.48
38111	-41	-175.7	-.0206	1.48
38121	-41	-187.3	-.0219	1.48
38131	-41	-198.8	-.0233	1.47
38141	-41	-209.5	-.0244	1.49
38151	-41	-217.7	-.0253	1.48
38161	-41	-226.6	-.0263	1.48
38171	-41	-235.9	-.0274	1.48
38181	-41	-240.9	-.0280	1.49
38191	-41	-256.2	-.0297	1.48
38201	-41	-262.5	-.0305	1.48
38211	-41	-270.7	-.0314	1.48
38221	-40	-278.1	-.0324	1.51
38231	-40	-156.0	-.0181	1.50
38241	-35	-279.4	-.0325	1.50
38251	-35	-161.5	-.0188	1.50
38261	-32	-279.8	-.0326	1.50
38271	-32	-160.5	-.0187	1.49
38281	-30	-278.0	-.0323	1.49
38291	-30	-161.1	-.0187	1.49
38301	-27	-275.1	-.0322	1.49
38311	-25	-269.0	-.0314	1.48
38321	-23	-263.9	-.0308	1.48
38331	-21	-253.4	-.0295	1.48
38341	-19	-248.6	-.0290	1.48

NACA 23012C - VOLUME I

Run No.	Arc. (°)	Rate. (° S ⁻¹)	Reduced pitch rate.	Reynolds No. x10 ⁻⁶
38351	-40	-282.0	-.0330	1.48
38361	-40	-162.3	-.0189	1.48
38371	-40	-48.8	-.0057	1.48
38381	-30	-273.8	-.0321	1.47
38391	-30	-157.6	-.0185	1.47
38401	-30	-48.5	-.0057	1.47
38411	-25	-269.9	-.0315	1.48
38421	-25	-150.7	-.0176	1.47
38431	-25	-48.2	-.0056	1.47
38441	-20	-264.1	-.0309	1.47
38451	-20	-150.0	-.0175	1.47
38461	-20	-46.9	-.0055	1.47
38471	-15	-238.0	-.0279	1.47
38481	-15	-137.4	-.0161	1.47
38491	-15	-45.9	-.0054	1.47
38501	-10	-193.6	-.0227	1.47
38511	-10	-143.6	-.0168	1.47
38521	-10	-47.9	-.0056	1.46
38531	-5	-120.2	-.0141	1.47
38541	-5	-95.8	-.0112	1.46
38551	-5	-42.9	-.0050	1.46

TABLE 5. DETAILS OF UNSTEADY STATIC TESTS.

Run No.	Angle of attack (°)	Sample frequency (Hz)	Reynolds No. $\times 10^{-6}$
47221	-8	100.0	1.49
47231	-4	100.0	1.49
47241	0	100.0	1.48
47251	2	100.0	1.48
47261	4	100.0	1.48
47271	6	100.0	1.48
47281	8	100.0	1.48
47291	9	100.0	1.48
47301	10	100.0	1.48
47311	11	100.0	1.48
47321	12	100.0	1.49
47331	13	100.0	1.49
47341	14	100.0	1.48
47351	15	100.0	1.48
47361	16	100.0	1.48
47371	17	100.0	1.48
47381	18	100.0	1.48
47391	19	100.0	1.48
47401	20	100.0	1.48
47411	21	100.0	1.48
47421	22	100.0	1.48
47431	23	100.0	1.48
47441	24	100.0	1.48
47451	26	100.0	1.48
47461	32	100.0	1.48

TABLE 6 DETAILS OF OIL-FLOW VISUALISATION TESTS.

Figure number	Angle of attack
12(a)	-8°
12(b)	-4°
12(c)	0°
12(d)	2°
12(e)	4°
12(f)	6°
12(g)	8°
12(h)	9°
12(i)	10°
12(j)	11°
12(k)	12°
12(l)	13°
12(m)	14°
12(n)	15°
12(o)	16°
12(p)	17°
12(q)	18°
12(r)	19°
12(s)	20°
12(t)	21°
12(u)	22°
12(v)	23°
12(w)	24°
12(x)	26°
12(y)	26°*
12(z)	32°

(* taken from leading edge)

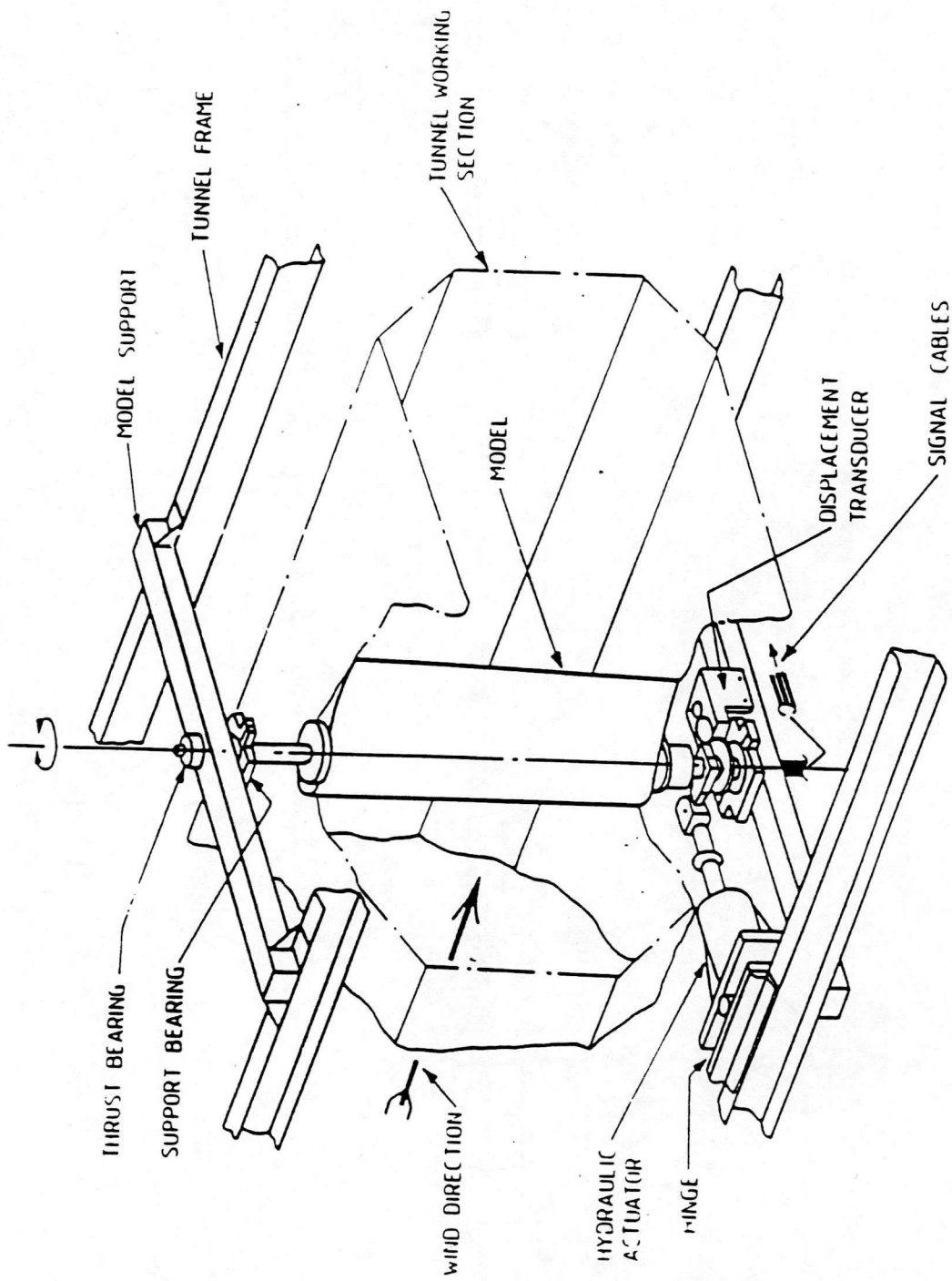


FIGURE 1 : GLASGOW UNIVERSITY'S DYNAMIC STALL RIG

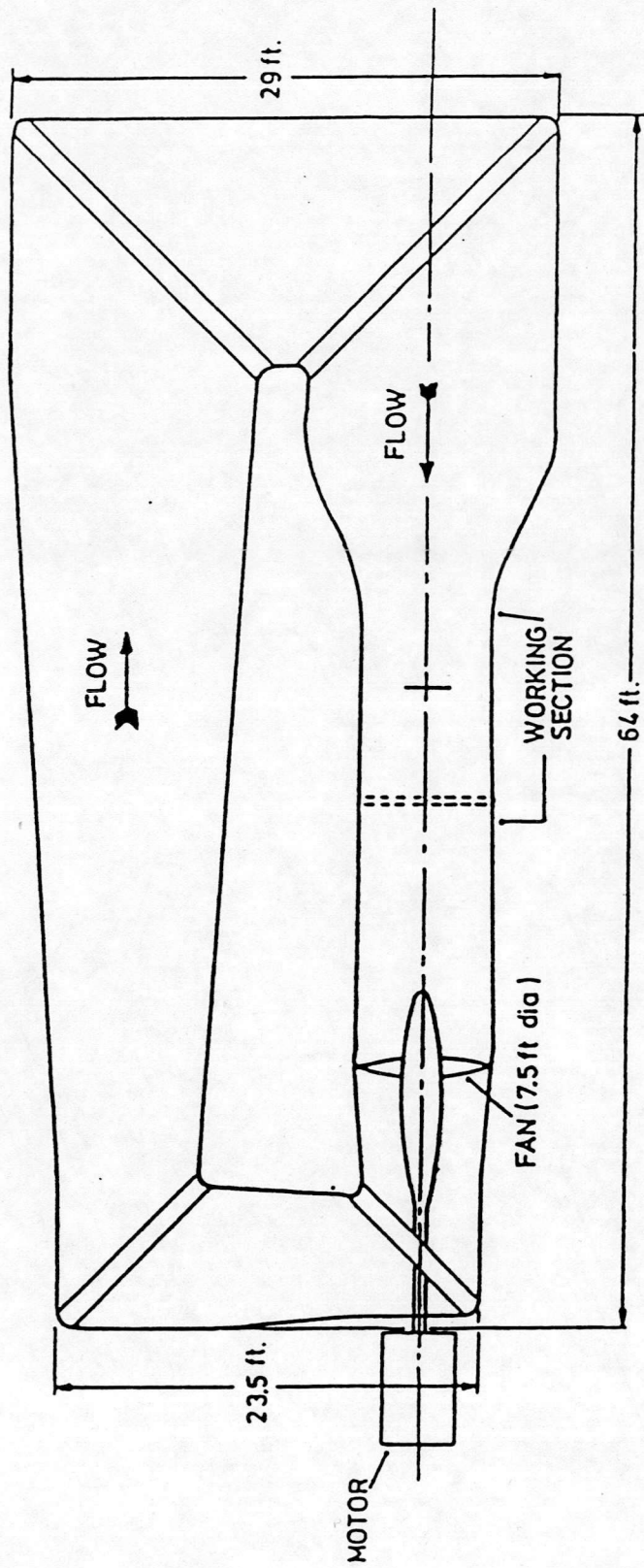
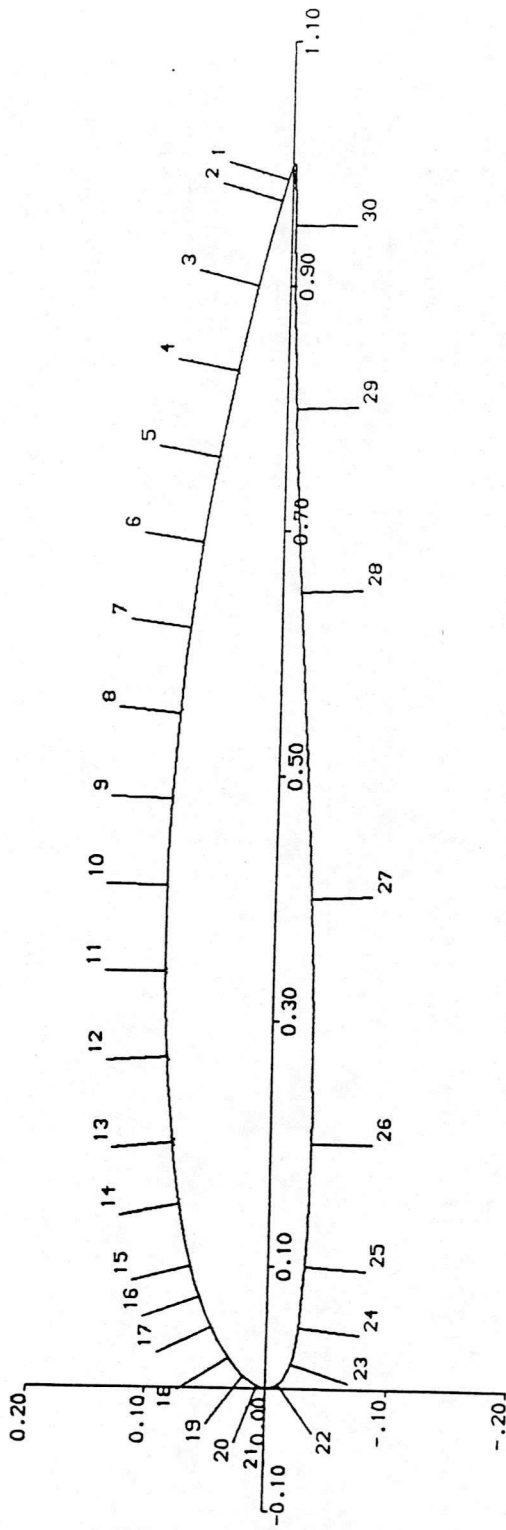


FIGURE 2 : PLAN VIEW OF THE GLASGOW UNIVERSITY "HANDLEY PAGE" 7ft X 5ft 3in WIND TUNNEL



X(1)/C= 0.9875	X(11)/C= 0.3400	X(21)/C= 0.0000
X(2)/C= 0.9700	X(12)/C= 0.2700	X(22)/C= 0.0040
X(3)/C= 0.9000	X(13)/C= 0.2000	X(23)/C= 0.0200
X(4)/C= 0.8300	X(14)/C= 0.1500	X(24)/C= 0.0500
X(5)/C= 0.7600	X(15)/C= 0.1000	X(25)/C= 0.1000
X(6)/C= 0.6900	X(16)/C= 0.0750	X(26)/C= 0.2000
X(7)/C= 0.6200	X(17)/C= 0.0500	X(27)/C= 0.4000
X(8)/C= 0.5500	X(18)/C= 0.0250	X(28)/C= 0.6500
X(9)/C= 0.4800	X(19)/C= 0.0100	X(29)/C= 0.8000
X(10)/C= 0.4100	X(20)/C= 0.0025	X(30)/C= 0.9500

FIGURE 3 : PRESSURE TRANSDUCER LOCATIONS FOR NACA 23012C.

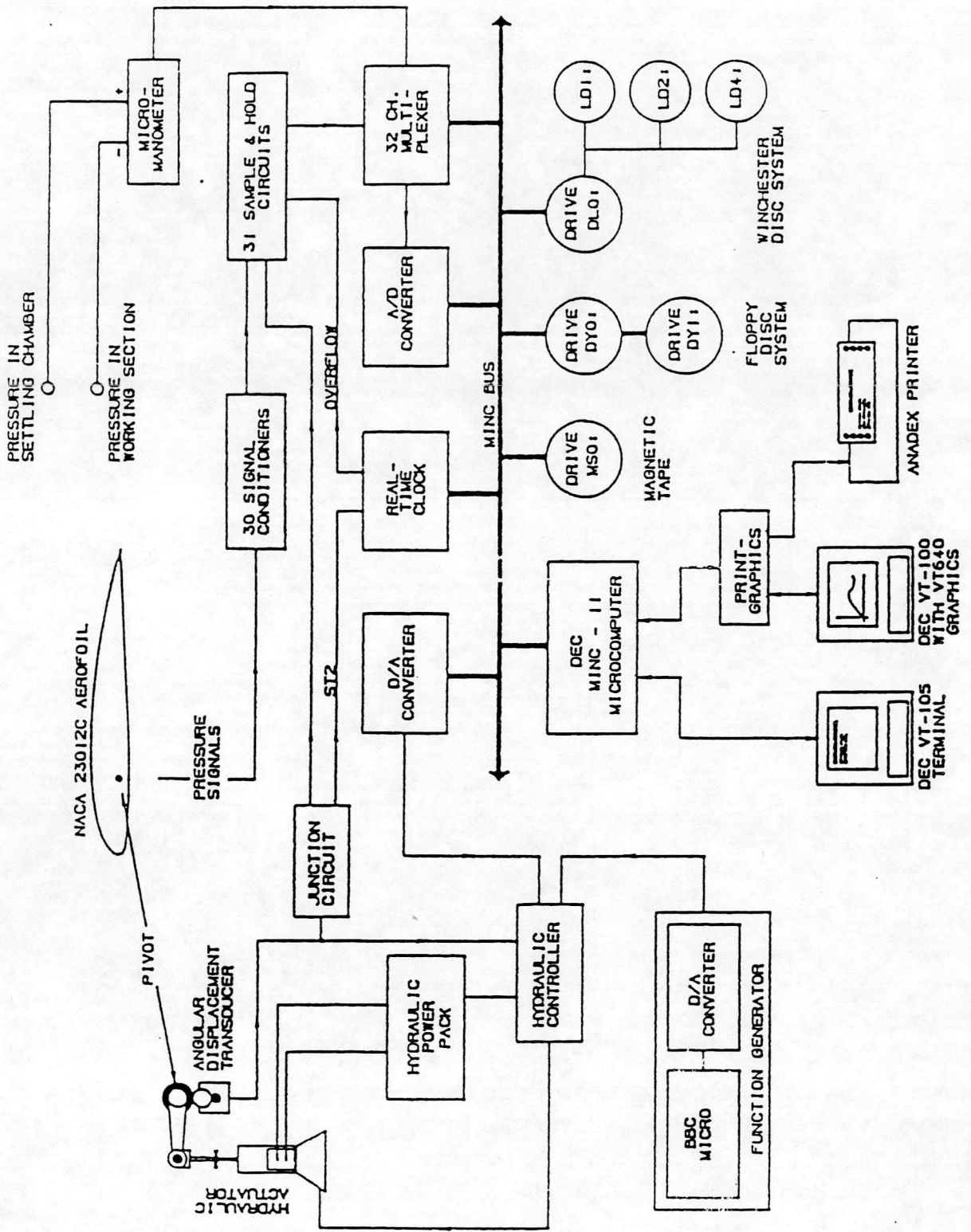
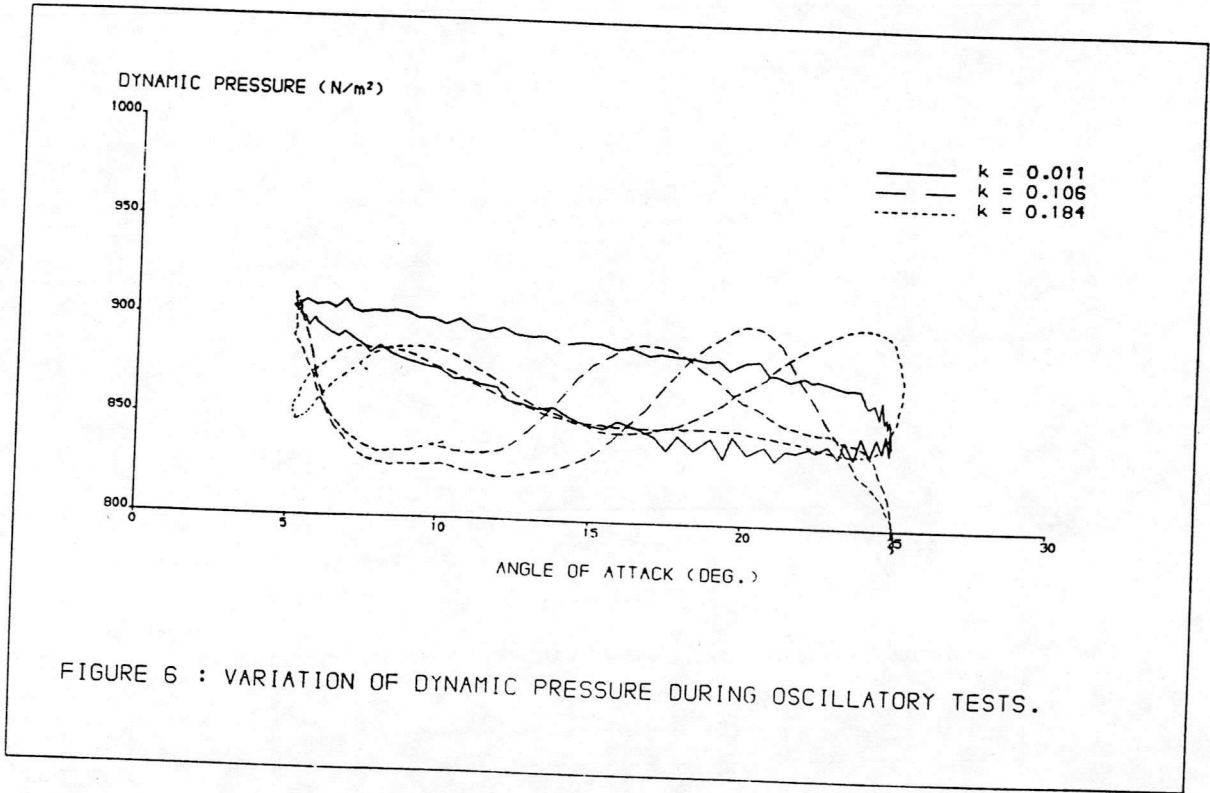
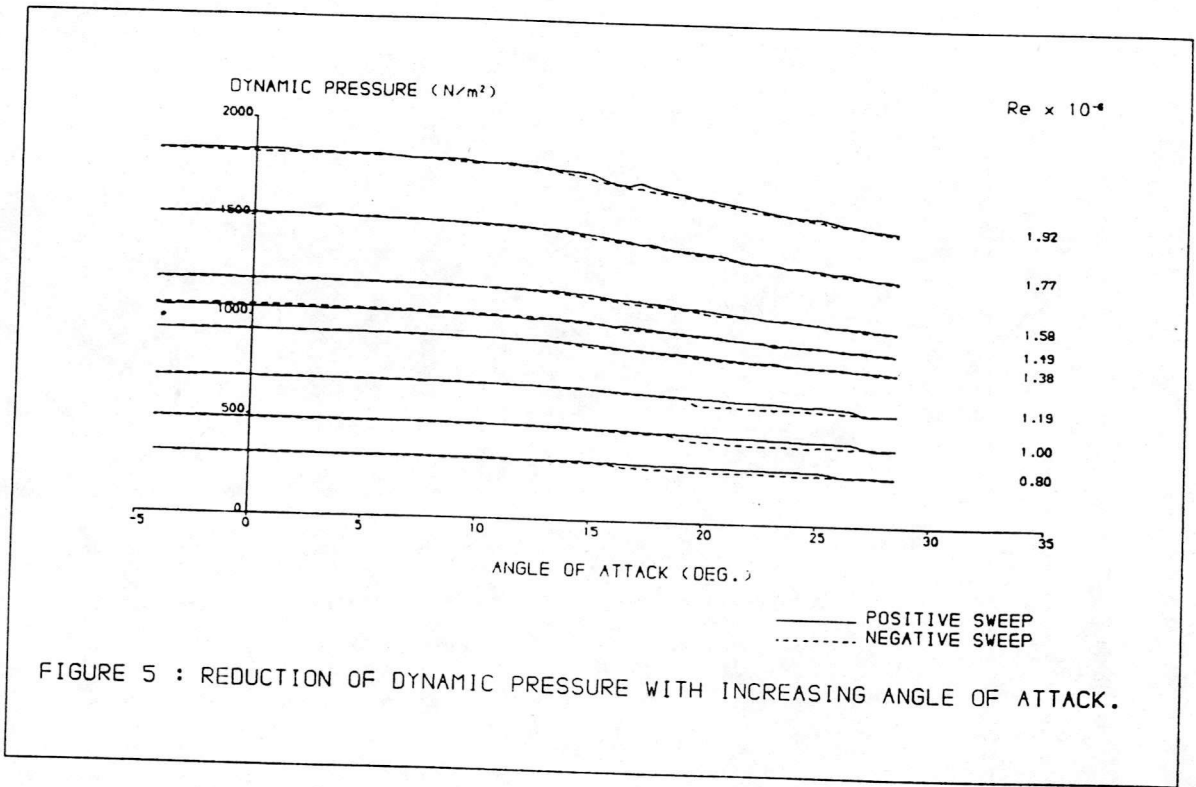
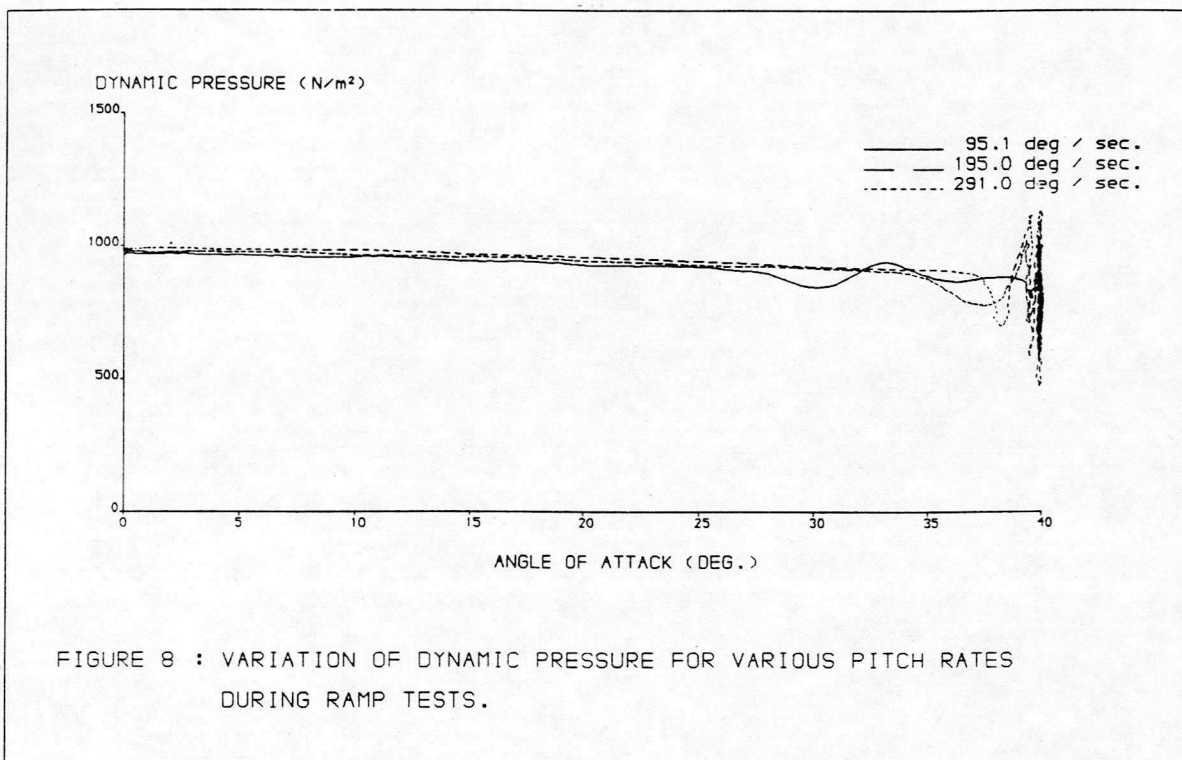
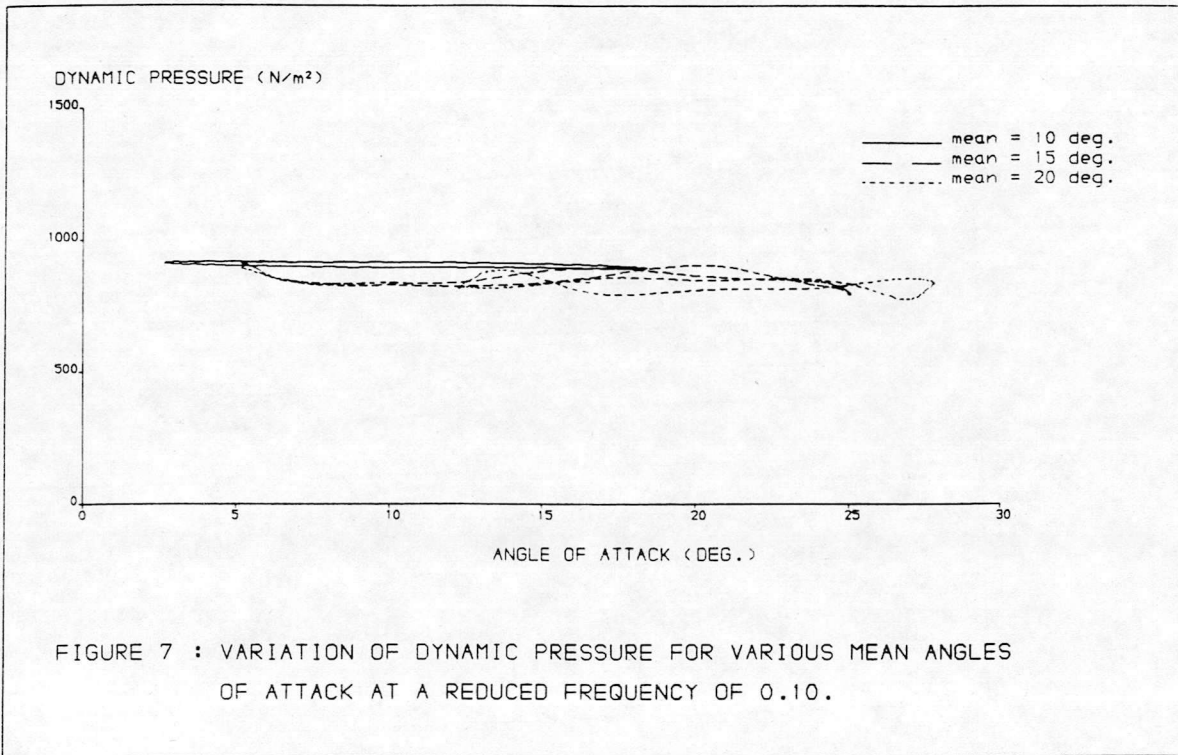


FIGURE 4: SYSTEMATIC ARRANGEMENT OF DATA ACQUISITION AND CONTROL SYSTEM





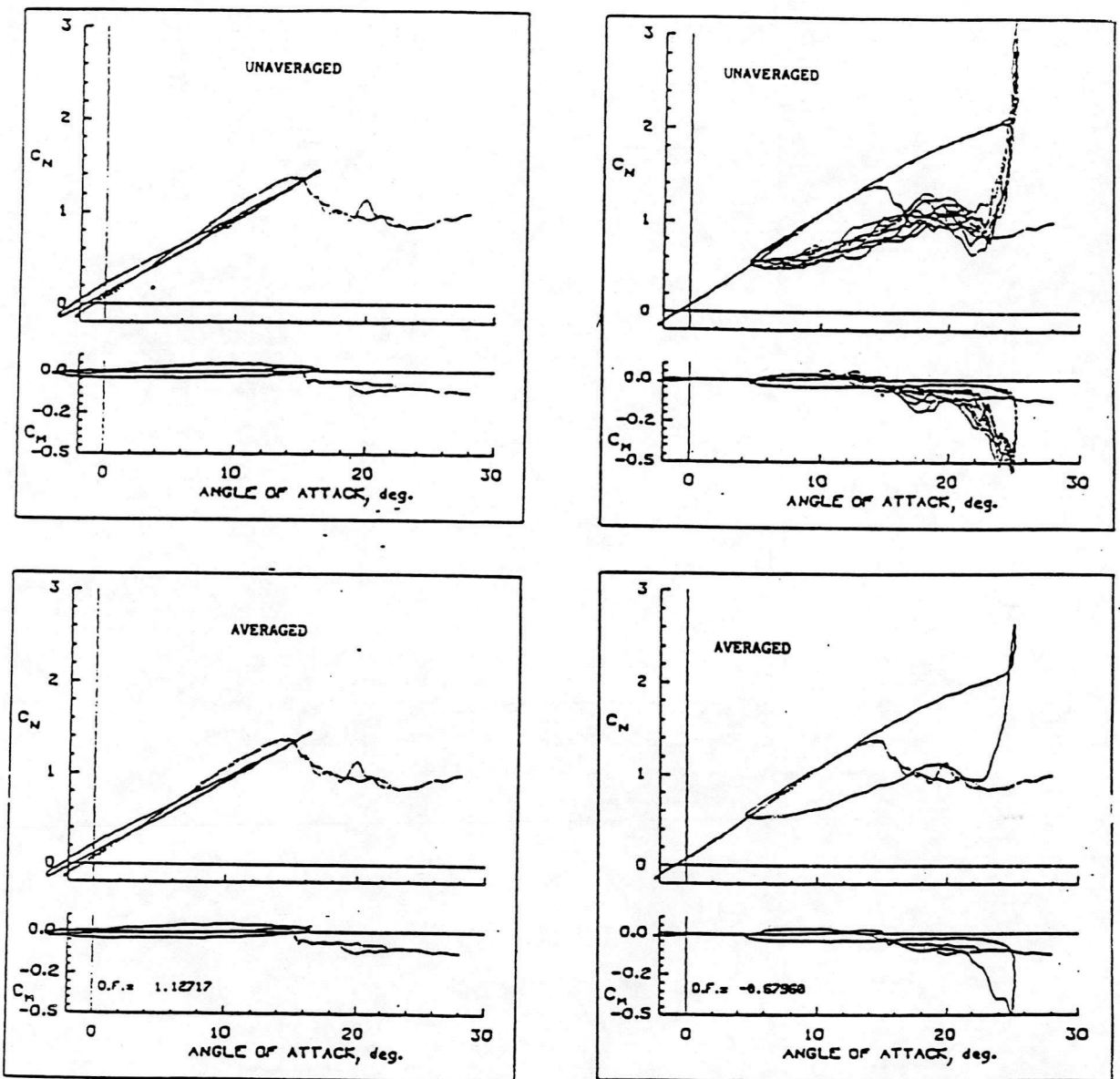


FIGURE 9: EFFECT OF AVERAGING ON THE NORMAL FORCE AND PITCHING MOMENT FOR OSCILLATORY TESTS.

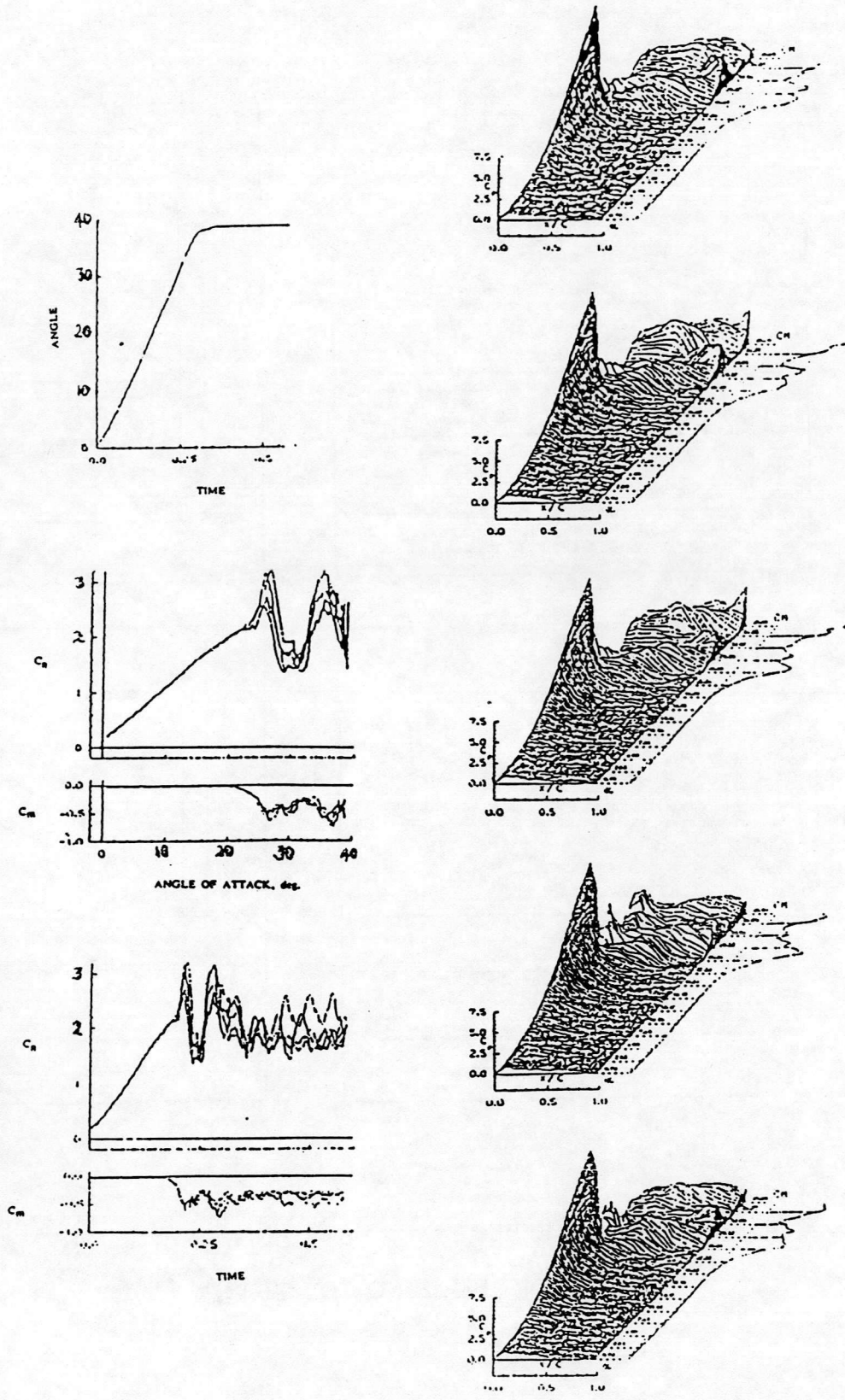


FIGURE 10: TYPICAL UNAVERAGED DATA FOR RAMP TESTS.

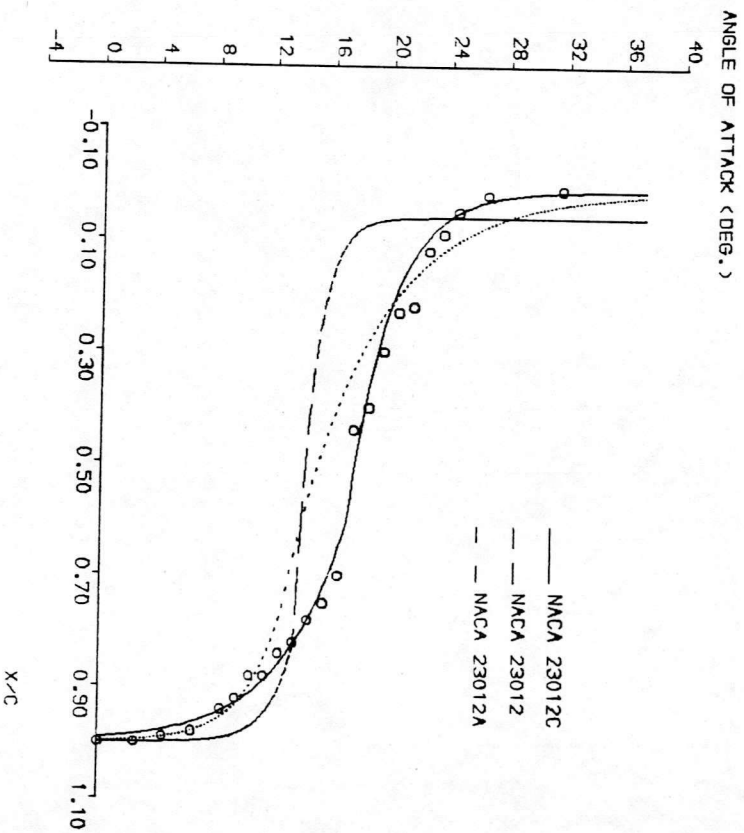
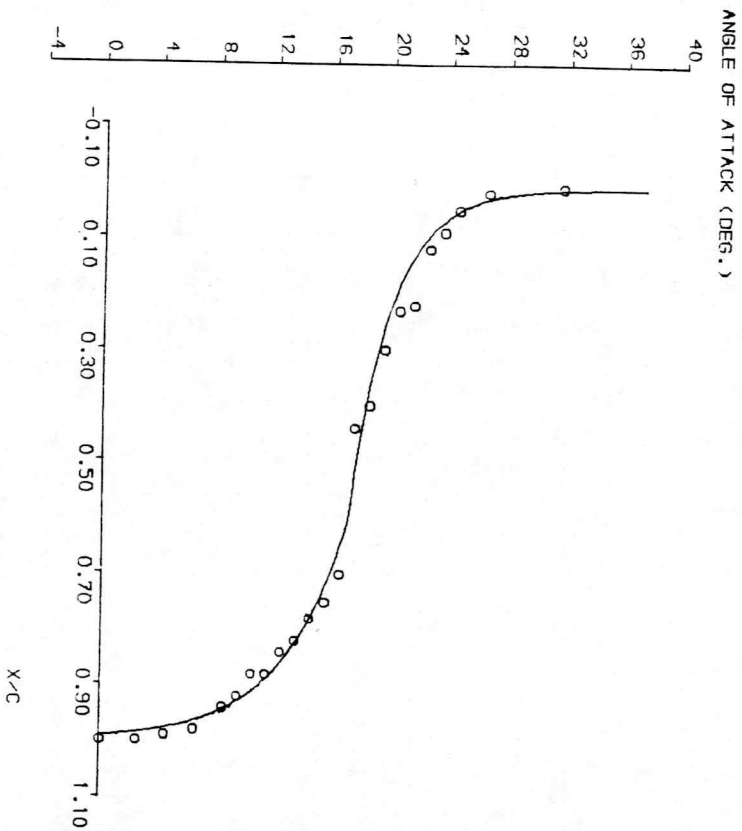


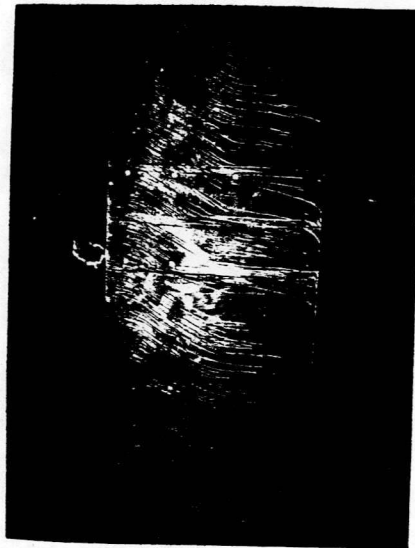
FIGURE 11 : TRAILING EDGE SEPARATION FOR AEROFOIL NACA 23012C
AS DETERMINED FROM OIL-FLOW VISUALISATION TESTS.



(a) -8 degrees



(b) -4 degrees



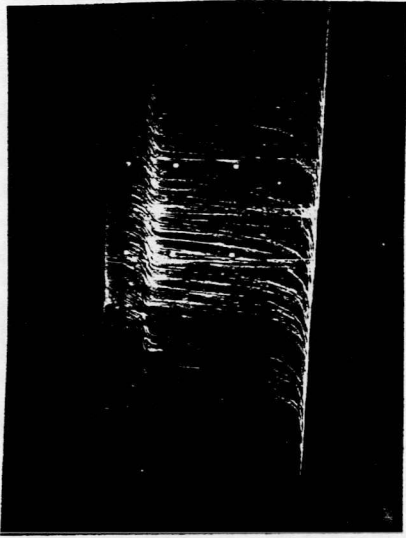
(c) 0 degrees



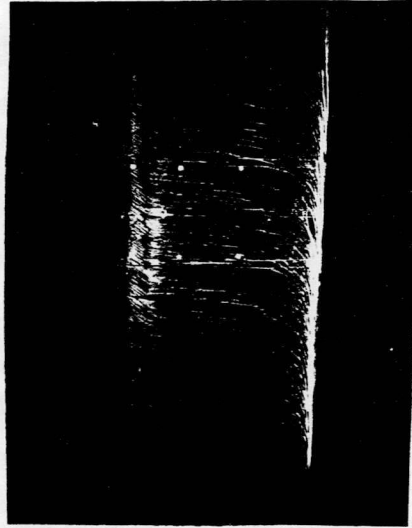
(d) 2 degrees

Reynolds Number = 1.5×10^6

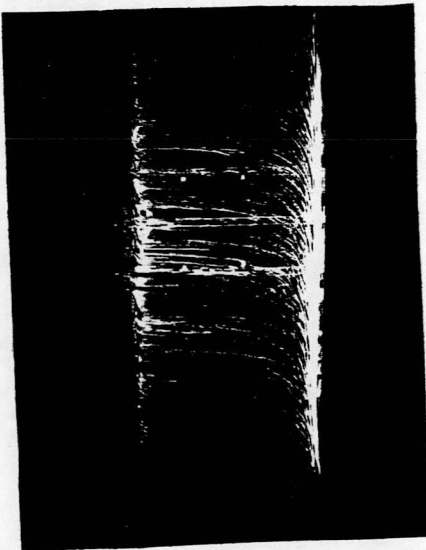
FIGURE 12: NACA 23012C AEROFOIL OIL-FLOW VISUALISATION.



(e) 4 degrees



(f) 6 degrees



(g) 8 degrees



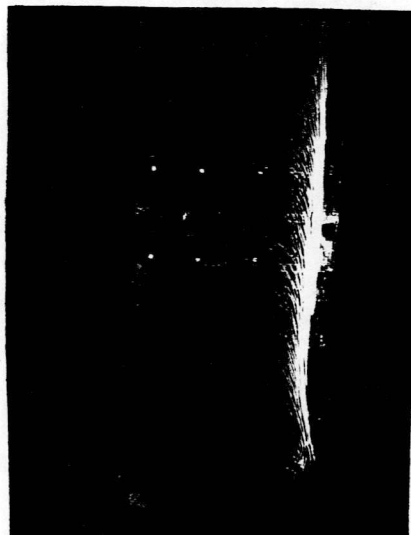
(h) 9 degrees

Reynolds Number = 1.5×10^6

FIGURE 12: NACA 23012C AEROFOIL OIL-FLOW VISUALISATION.



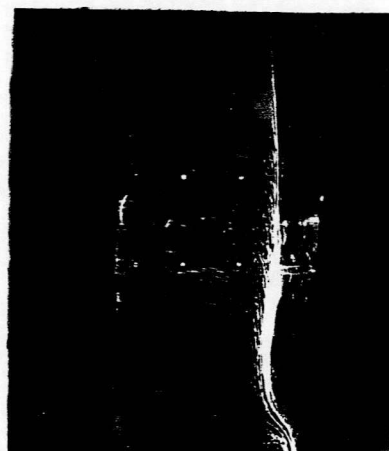
(i) 10 degrees



(j) 11 degrees



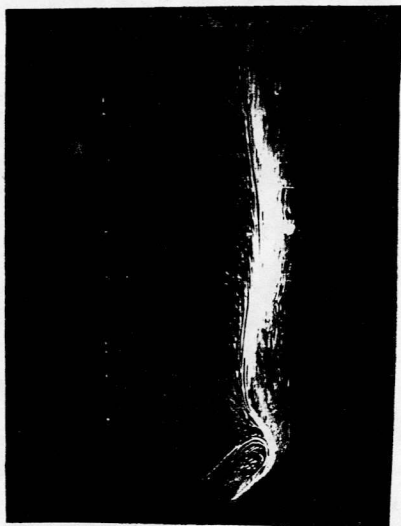
(k) 12 degrees



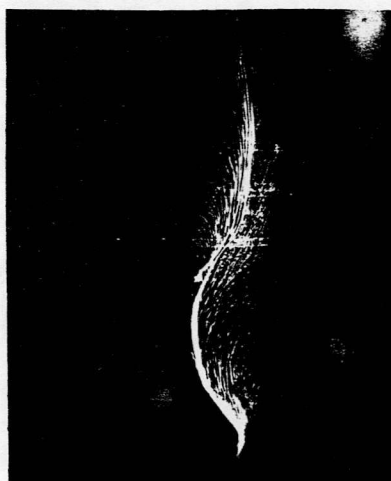
(l) 13 degrees

Reynolds Number = 1.5×10^6

FIGURE 12: NACA 23012C AEROFOIL OIL-FLOW VISUALISATION.



(m) 14 degrees



(n) 15 degrees



(o) 16 degrees



(p) 17 degrees

Reynolds Number = 1.5×10^6

FIGURE 12: NACA 23012C AEROFOIL OIL-FLOW VISUALISATION.



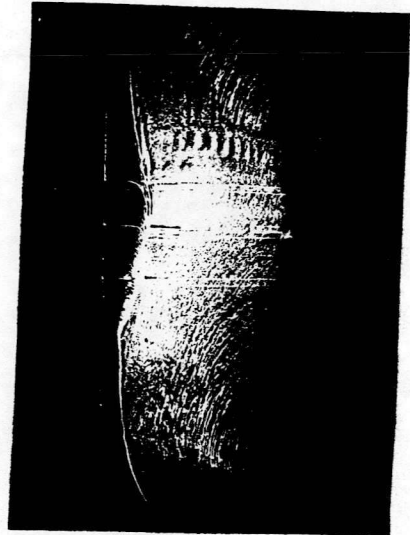
(q) 18 degrees



(r) 19 degrees



(s) 20 degrees



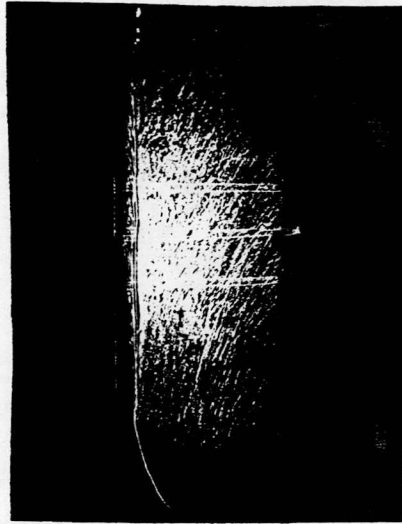
(t) 21 degrees

Reynolds Number = 1.5×10^6

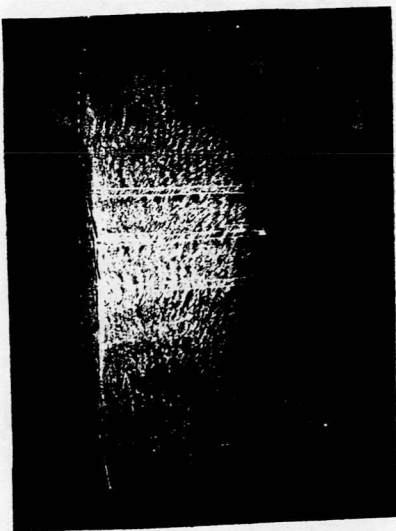
FIGURE 12: NACA 23012C AEROFOIL OIL-FLOW VISUALISATION.



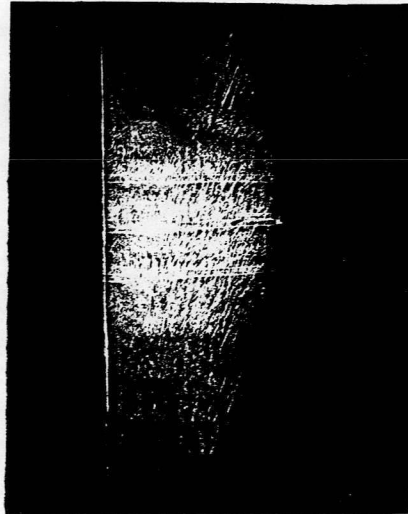
(u) 22 degrees



(v) 23 degrees



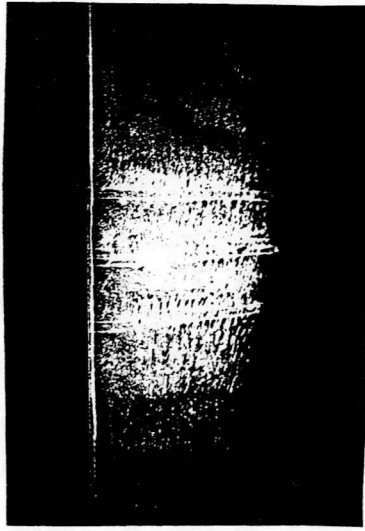
(w) 24 degrees



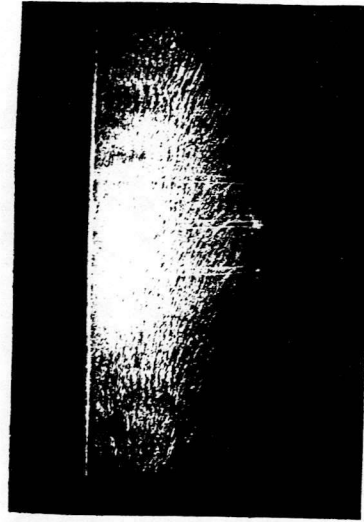
(x) 26 degrees

Reynolds Number = 1.5×10^6

FIGURE 12: NACA 23012C AEROFOIL OIL-FLOW VISUALISATION.



(y) 26 degrees
(from leading edge)



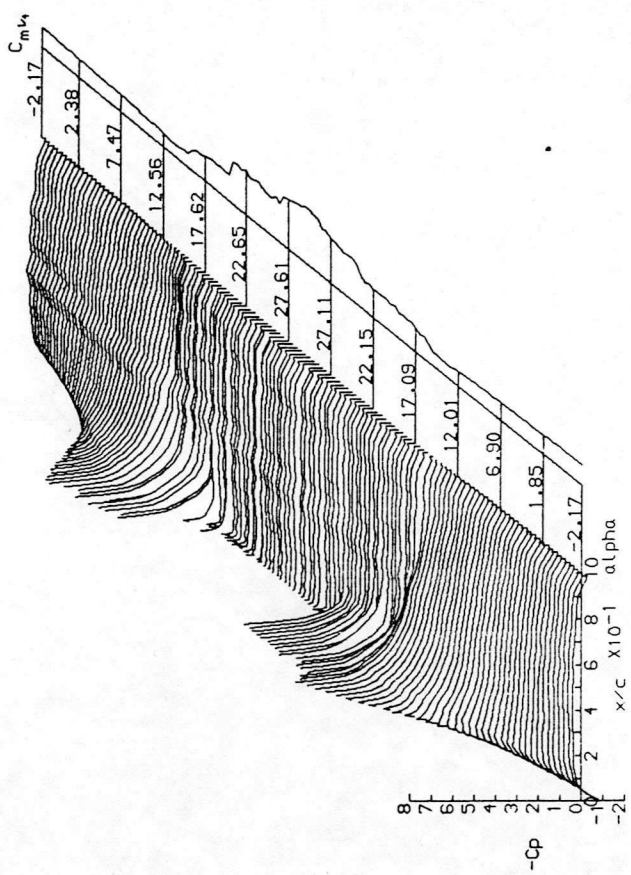
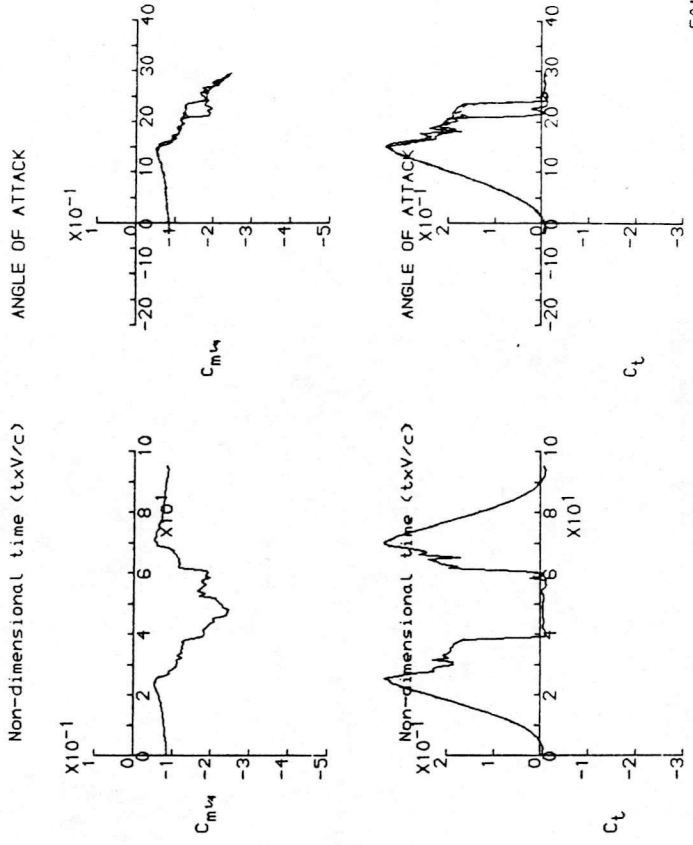
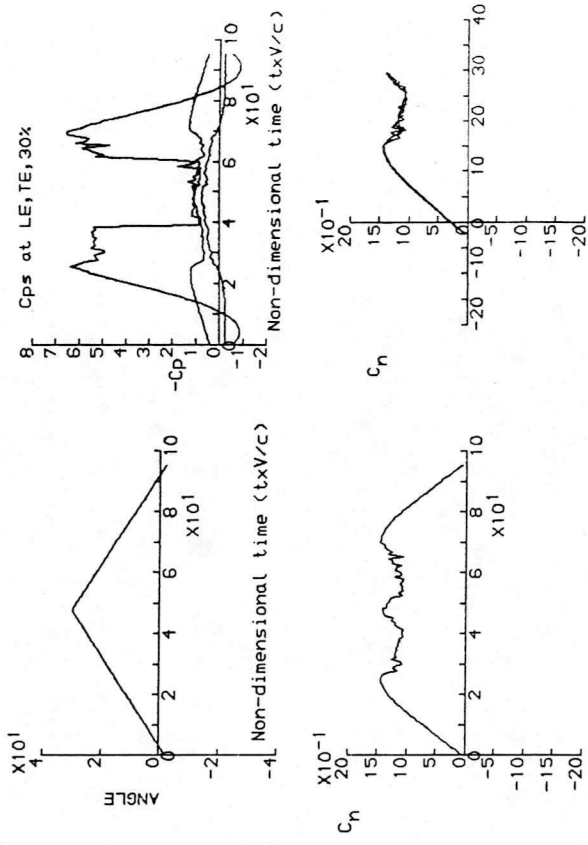
(z) 32 degrees

Reynolds Number = 1.5×10^6

FIGURE 12: NACA 23012C AEROFOIL OIL-FLOW VISUALISATION.

DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

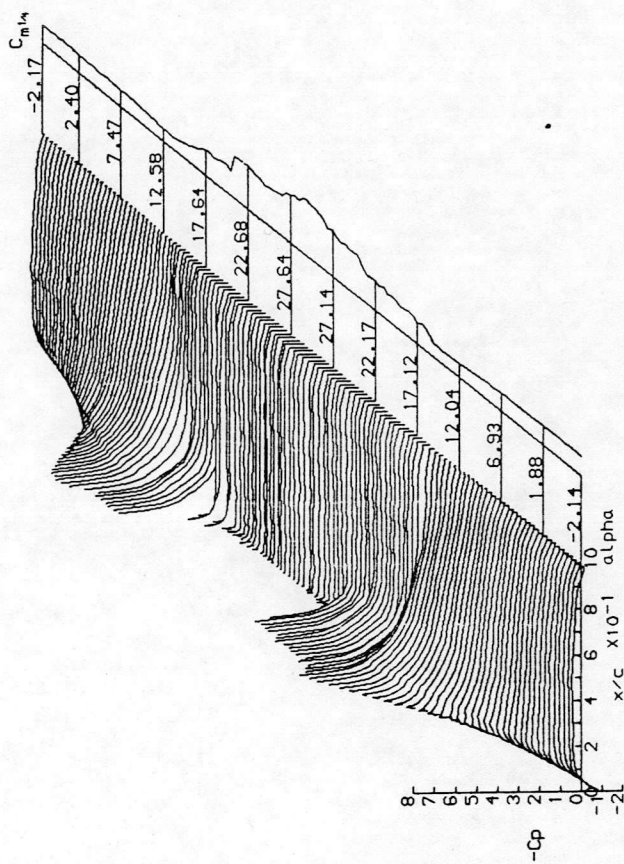
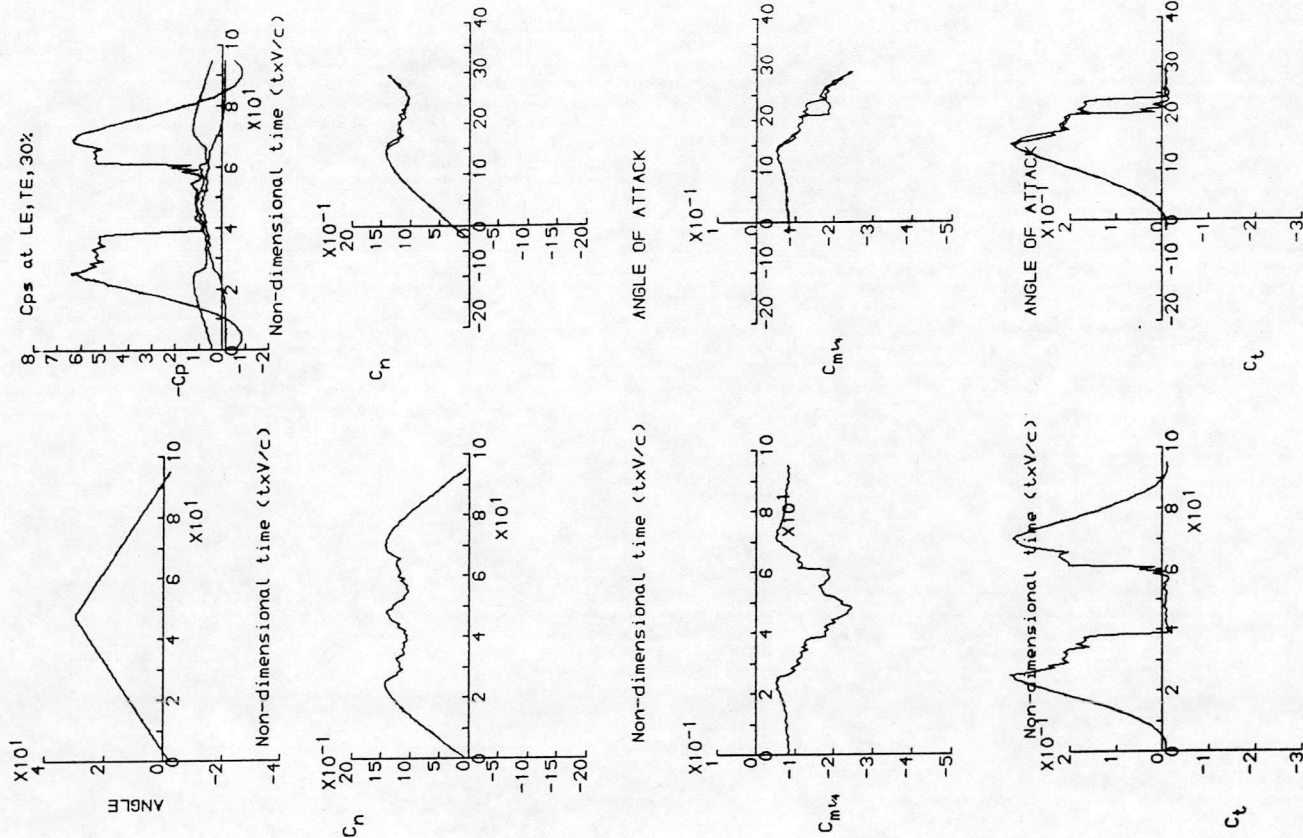
RUN REFERENCE NUMBER: 5011
 REYNOLDS NUMBER = 1516834.
 DATE OF TEST: 12/12/88
 MACH NUMBER = 0.119
 DYNAMIC PRESSURE = 1025.35 Nm⁻²
 AIR TEMPERATURE = 24.3°C
 NUMBER OF CYCLES = 1
 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: STATIC
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

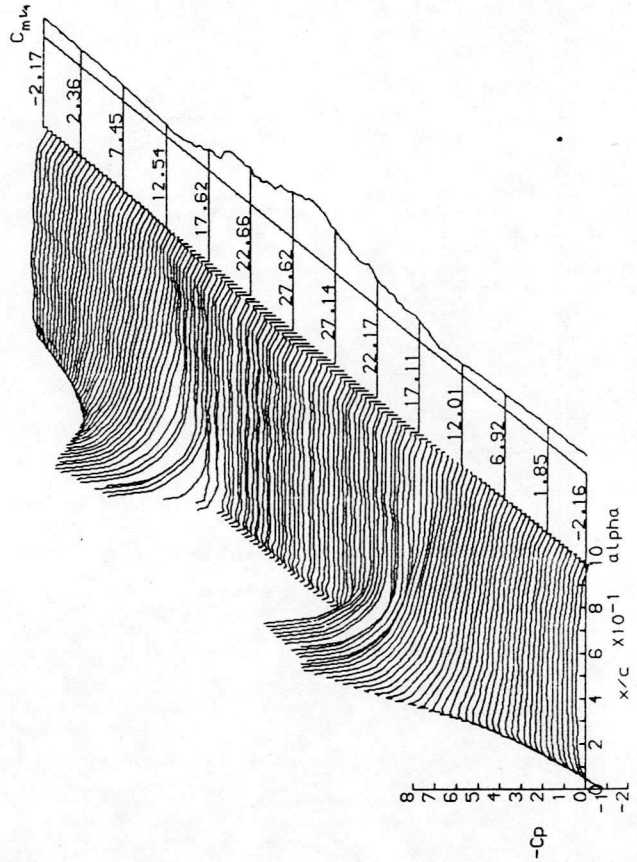
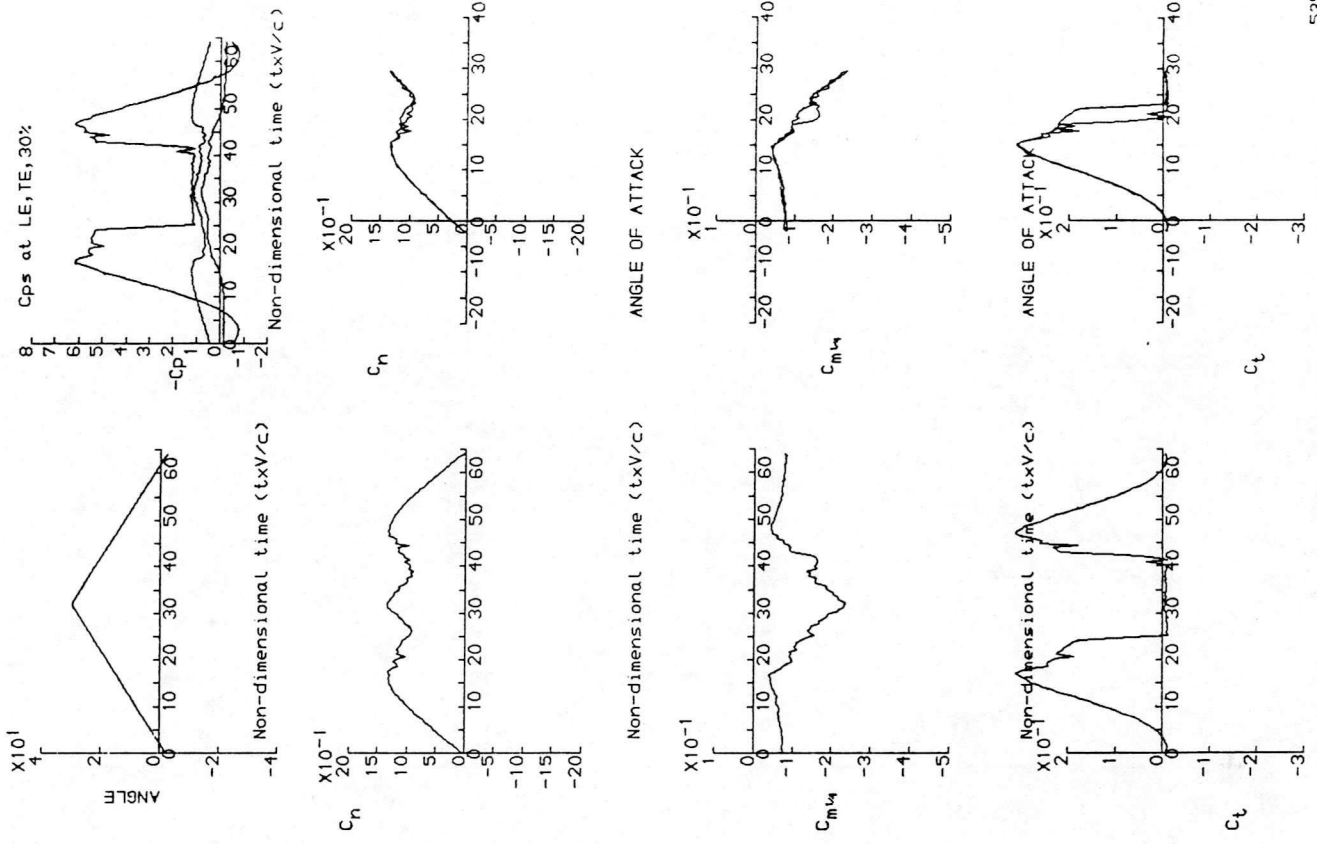
RUN REFERENCE NUMBER: 5341
 RETNOLDS NUMBER = 1.494816.
 DYNAMIC PRESSURE = 1012.22 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: STATIC

DATE OF TEST: 12/12/88
 MACH NUMBER = 0.1119
 AIR TEMPERATURE = 26.2°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



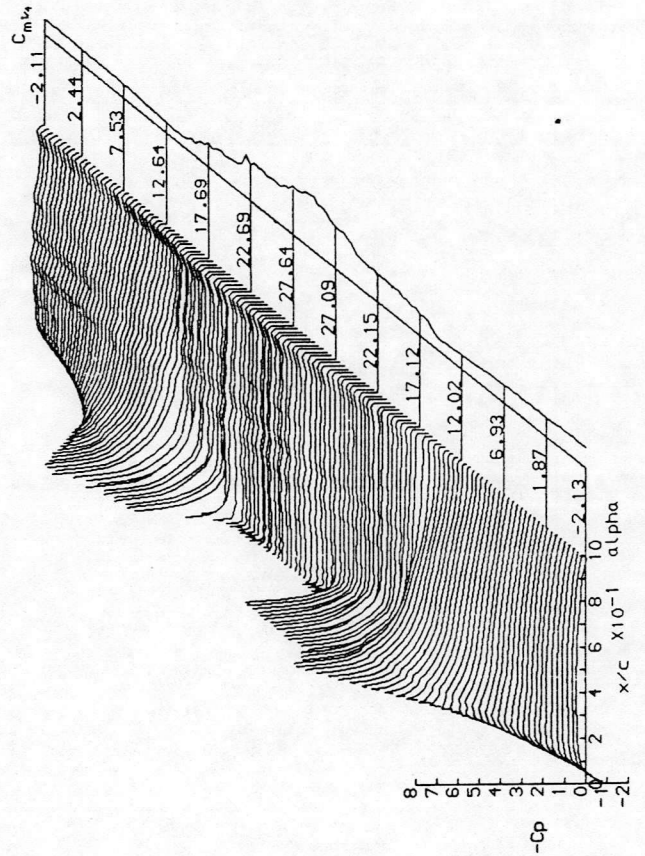
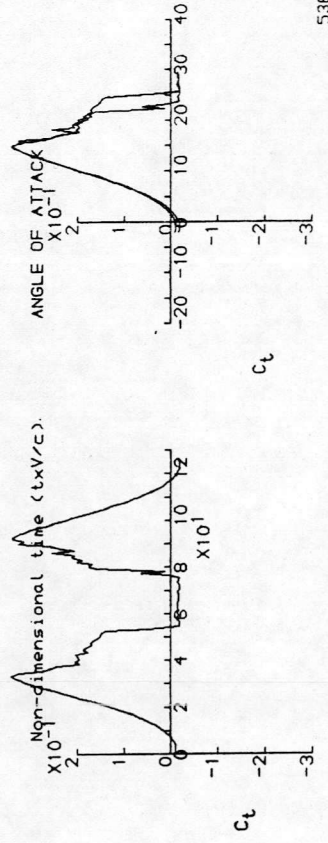
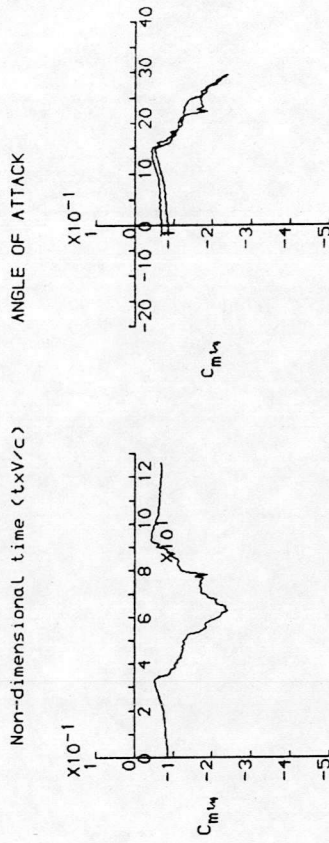
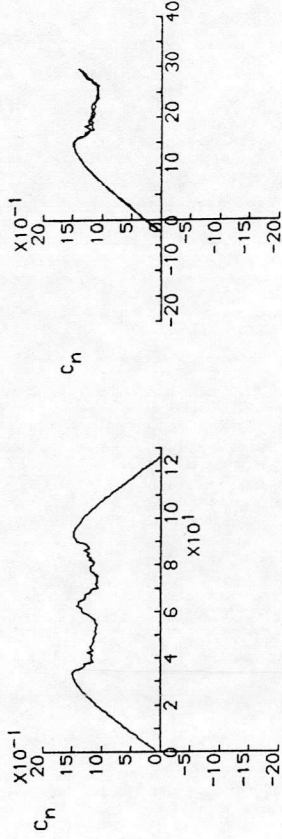
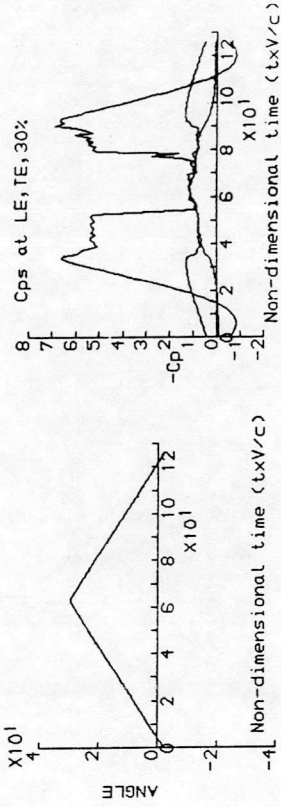
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 5351
 REYNOLDS NUMBER = 1002922.
 DYNAMIC PRESSURE = 459.54 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: STATIC
 DATE OF TEST: 12/12/88
 MACH NUMBER = 0.080
 AIR TEMPERATURE = 27.2°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



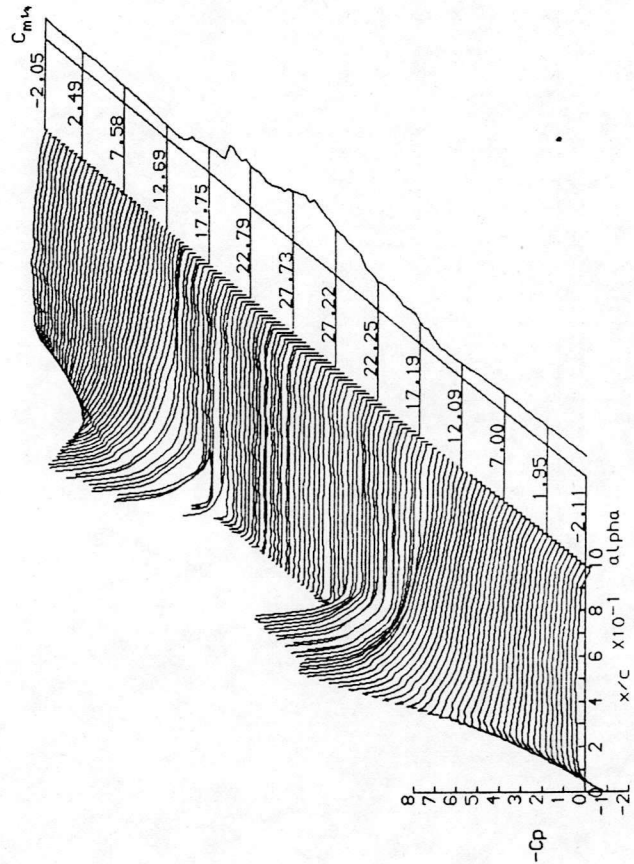
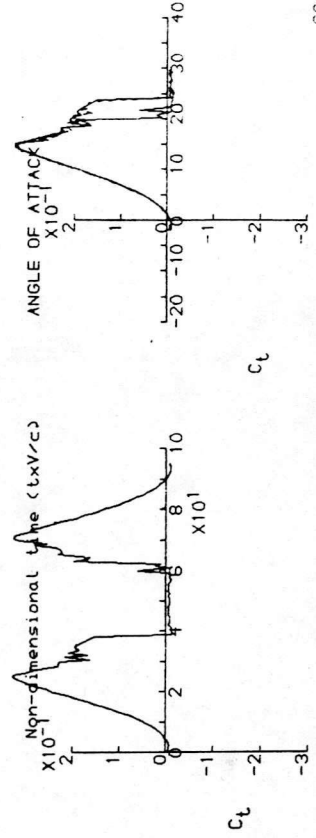
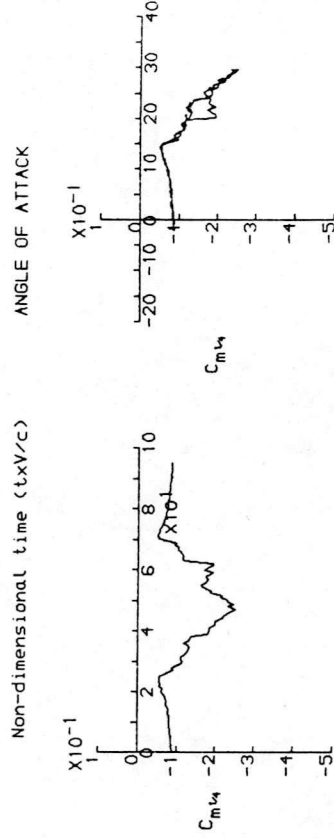
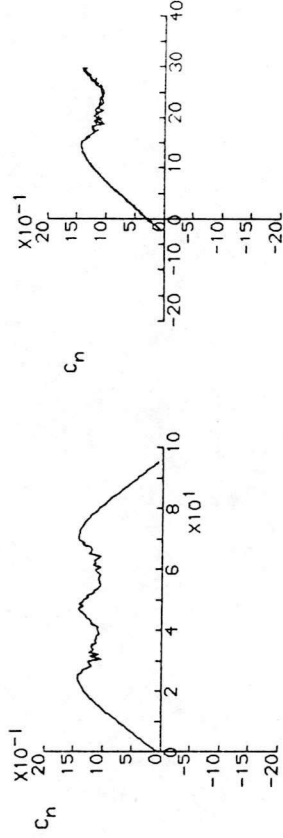
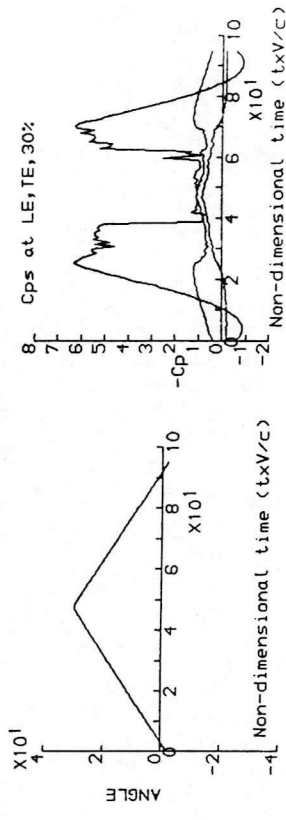
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 5361
 REYNOLDS NUMBER = 1970141.
 DYNAMIC PRESSURE = 1770.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: STATIC
 DATE OF TEST: 12/12/88
 MACH NUMBER = 0.157
 AIR TEMPERATURE = 27.0°C
 SAMPLING FREQUENCY = 100.00 HZ.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

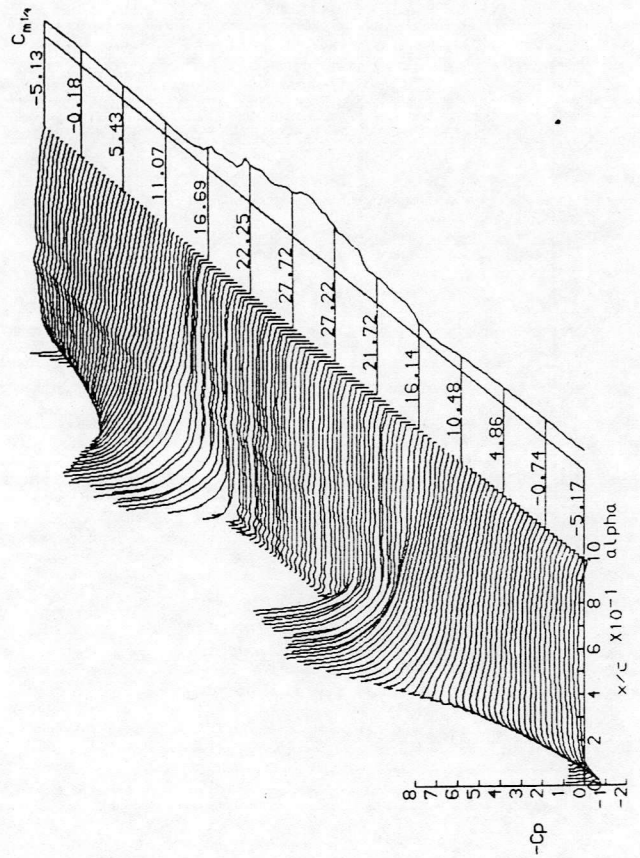
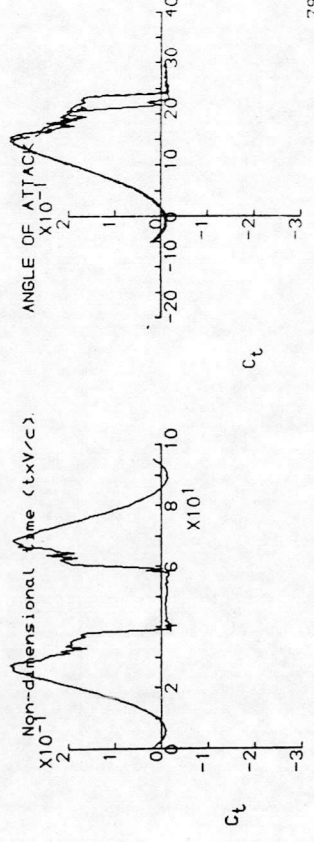
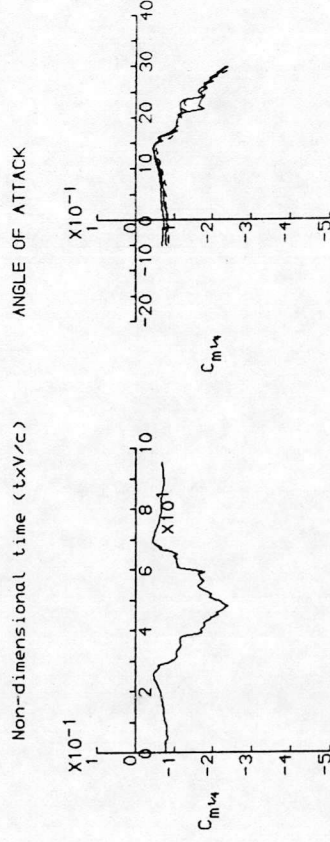
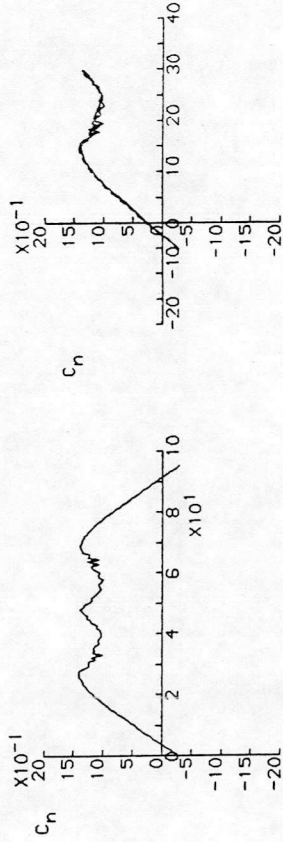
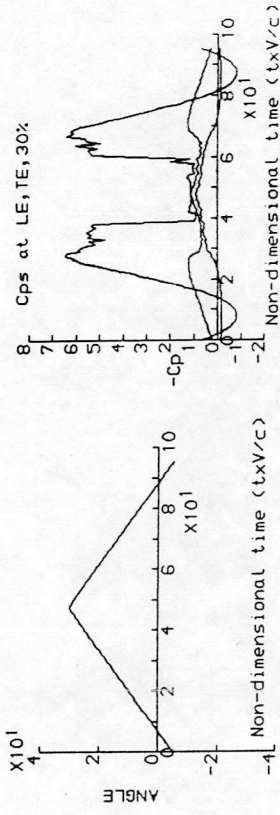
RUN REFERENCE NUMBER: 6611
 REYNOLDS NUMBER = 1505114.
 DYNAMIC PRESSURE = 1016.76 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 25.3°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 7911
 RETNOLDS NUMBER = 1517269.
 DYNAMIC PRESSURE = 1026.61 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: STATIC

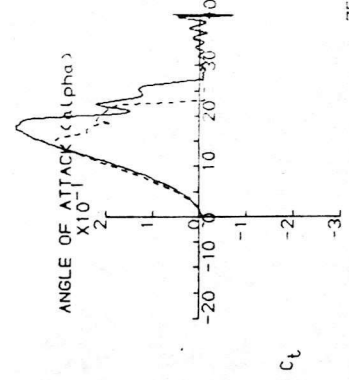
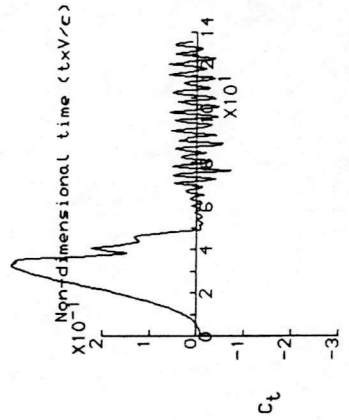
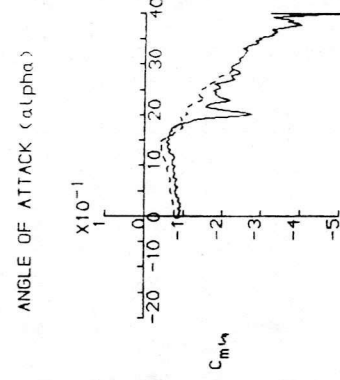
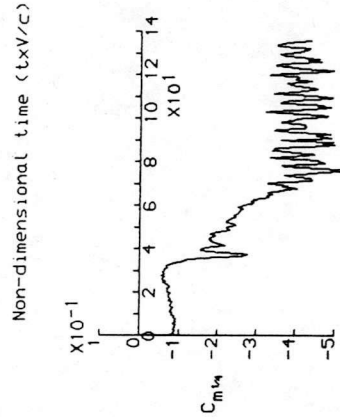
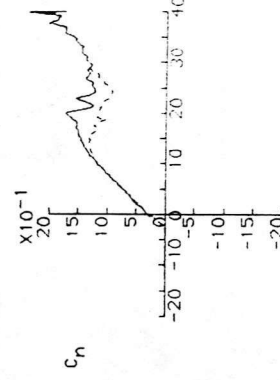
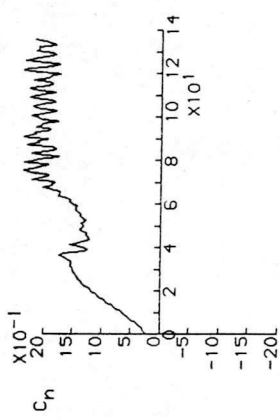
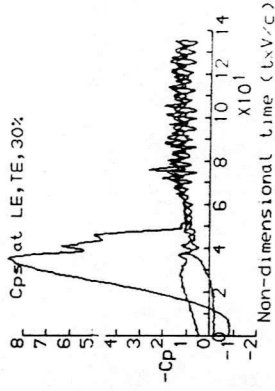
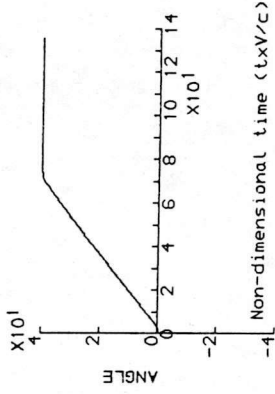
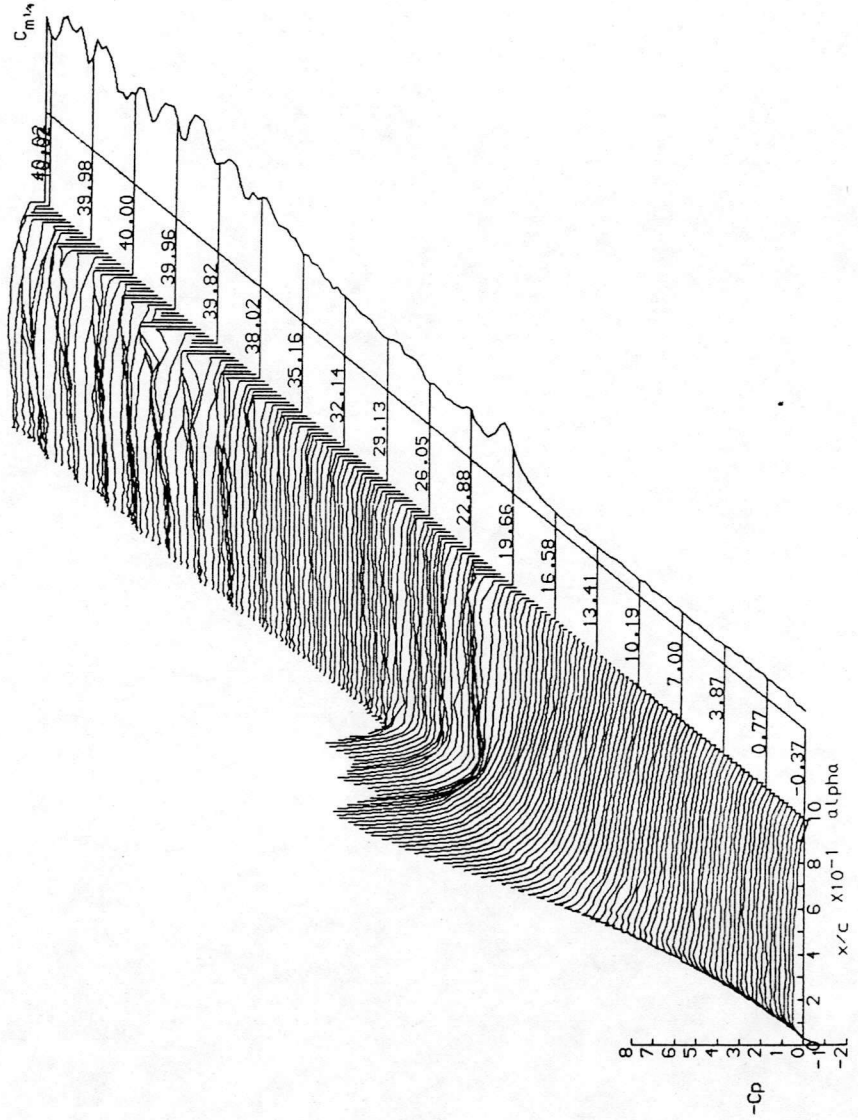
DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 25.0°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27531
 REYNOLDS NUMBER = 998881.
 DYNAMIC PRESSURE = 450.71 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.079
 AIR TEMPERATURE = 26.1°C
 SAMPLING FREQUENCY = 93.70 Hz.
 REDUCED PITCH RATE = 0.00517
 LINEAR PITCH RATE = 29.51°s⁻¹

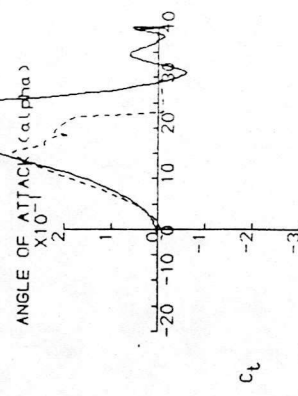
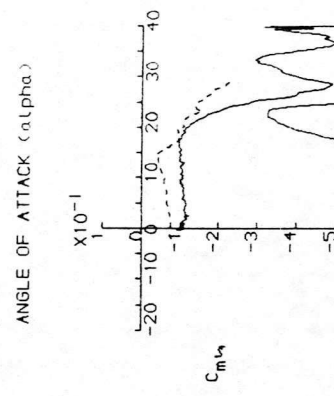
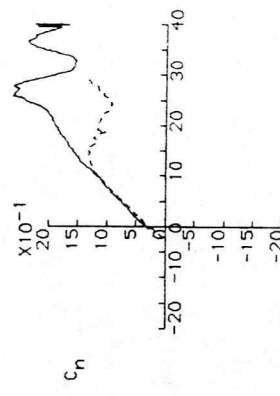
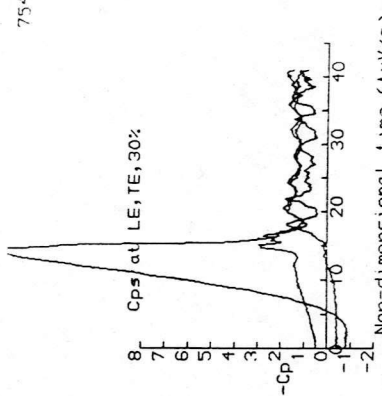
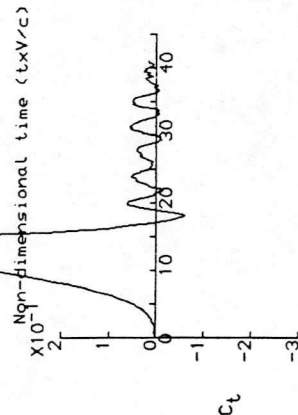
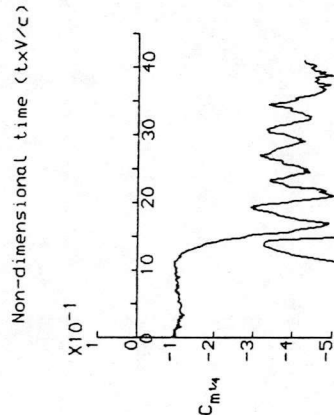
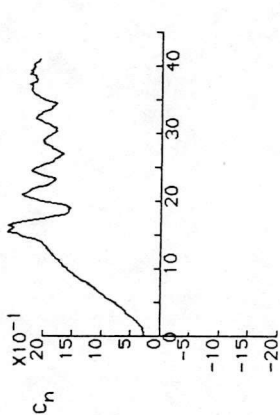
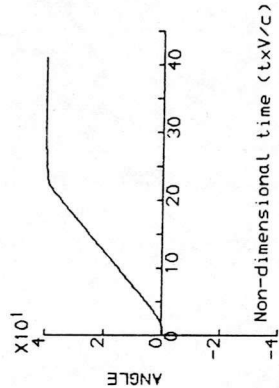
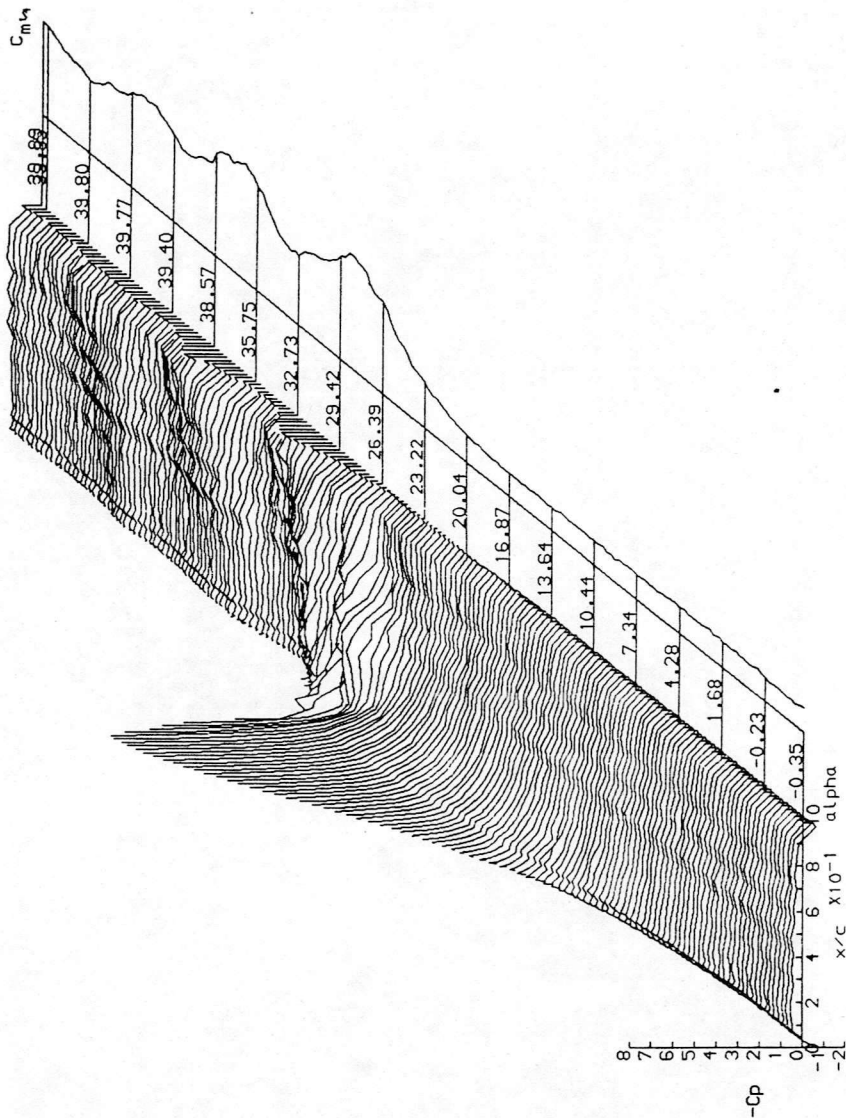
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

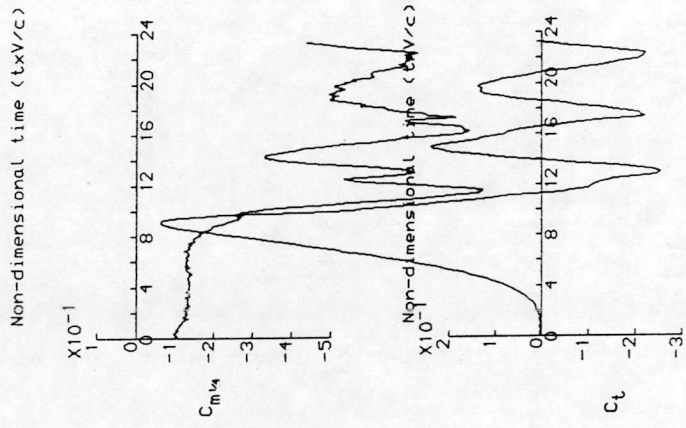
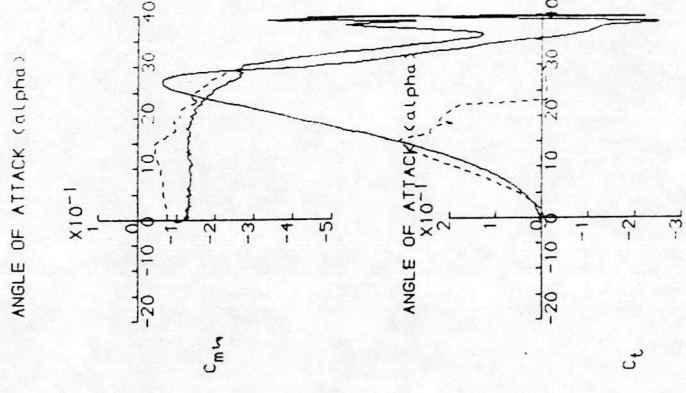
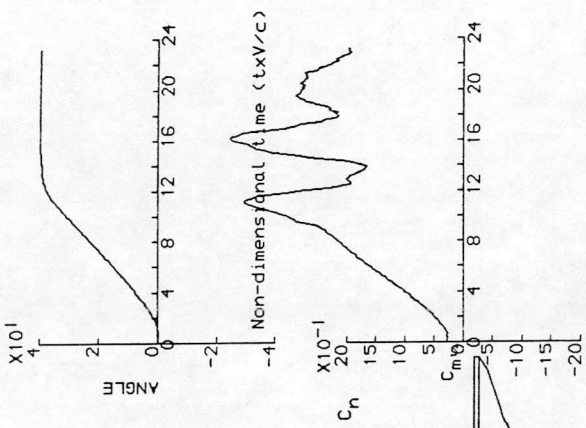
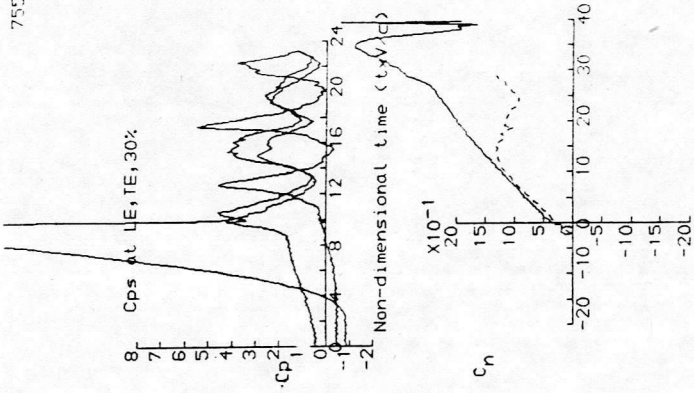
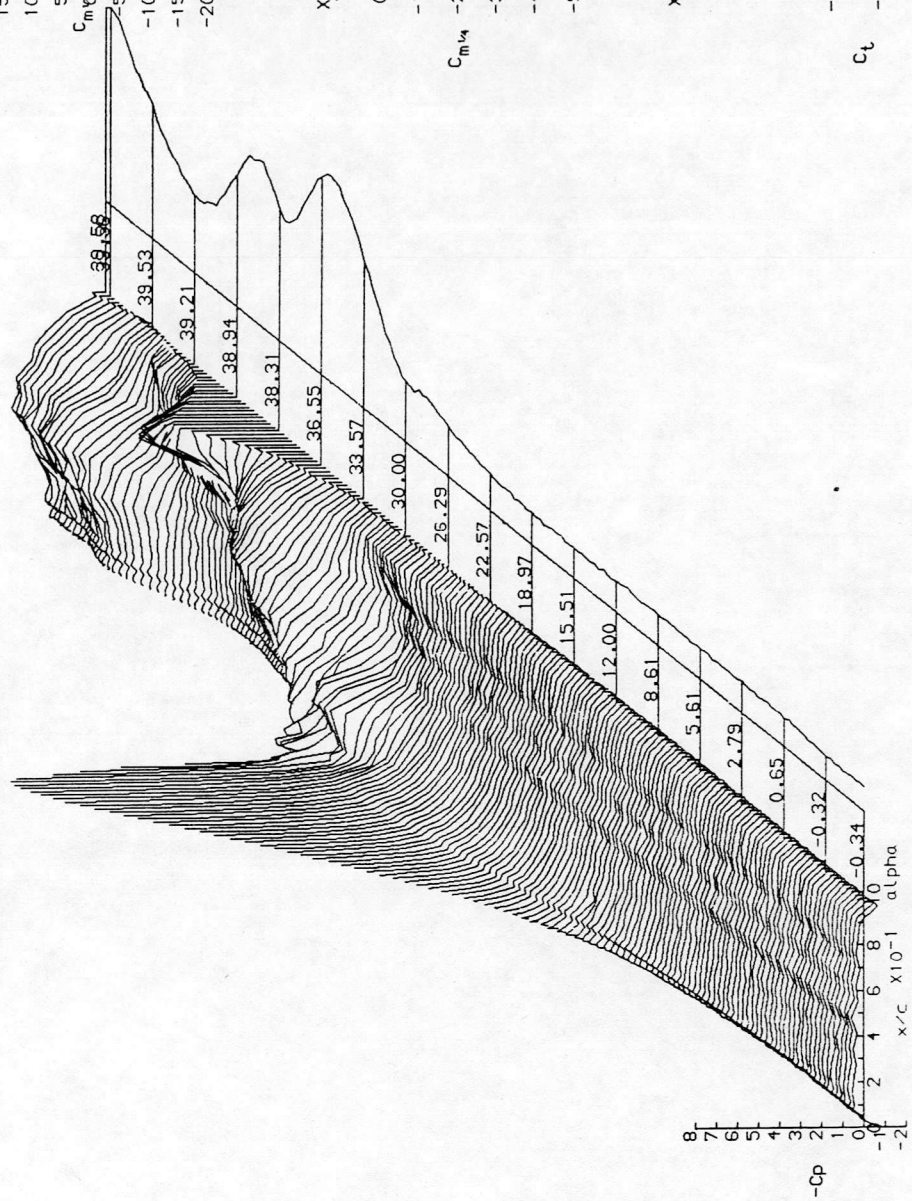
RUN REFERENCE NUMBER: 27541
 RETNOLDS NUMBER = 1002402.
 DYNAMIC PRESSURE = 455.45 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.079
 AIR TEMPERATURE = 26.5°C
 SAMPLING FREQUENCY = 312.01 Hz.
 REDUCED PITCH RATE = 0.01734
 LINEAR PITCH RATE = 99.64°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

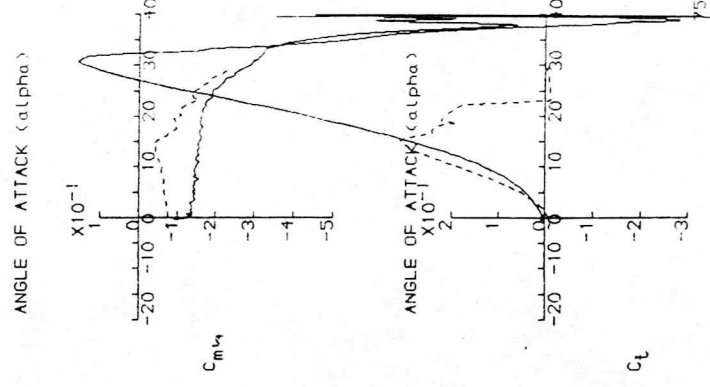
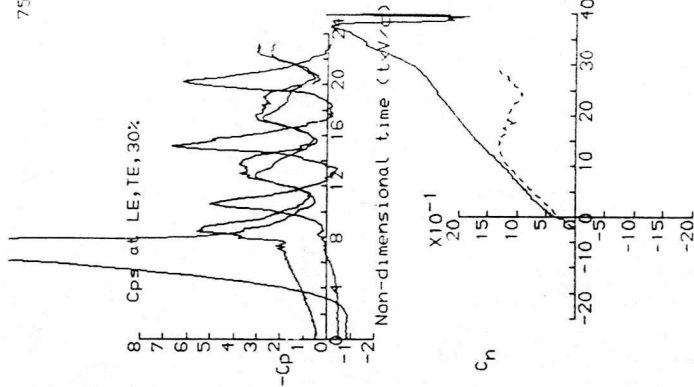
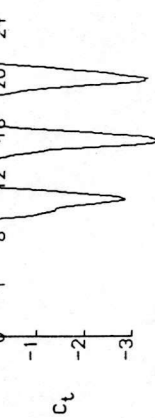
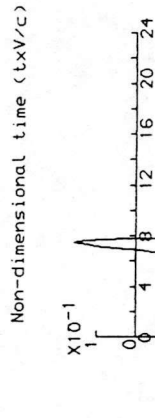
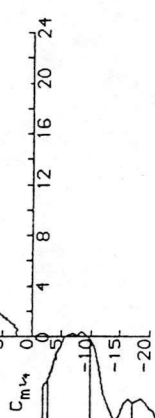
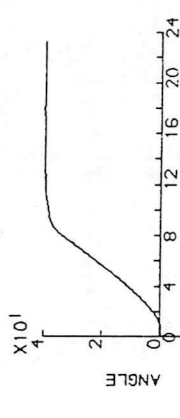
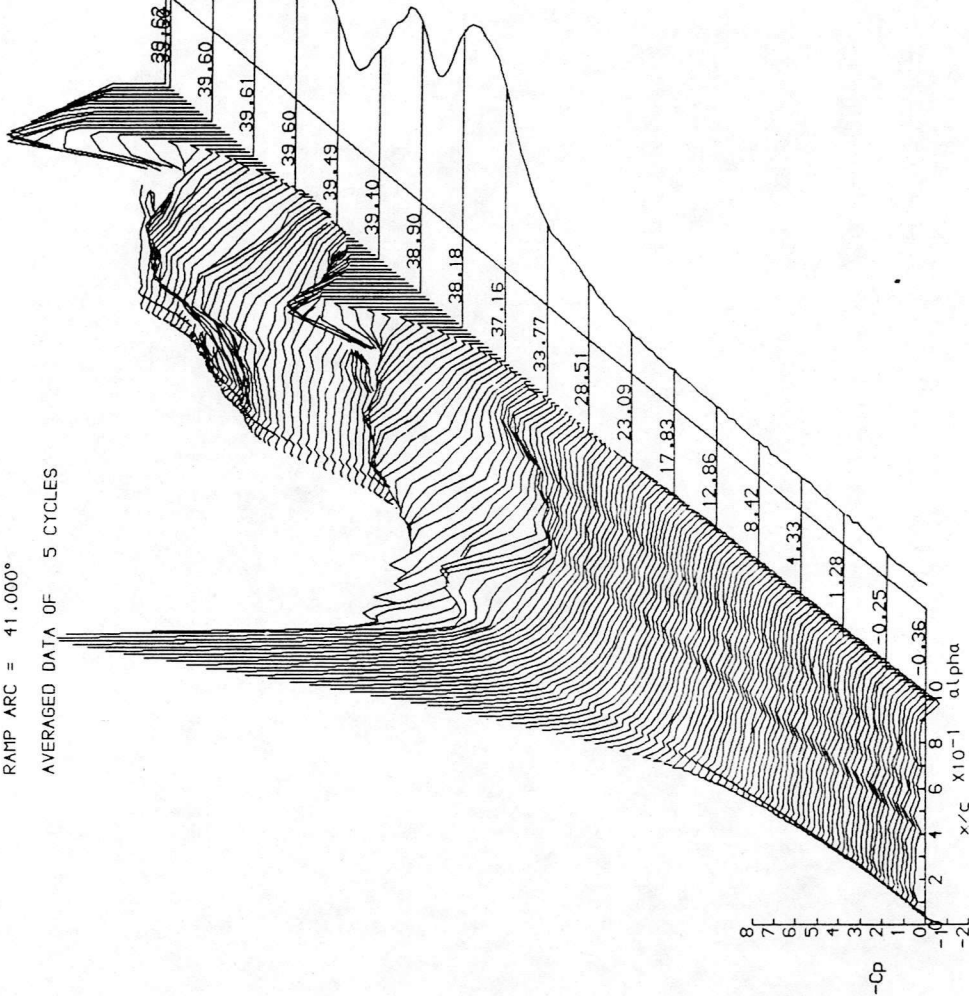
RUN REFERENCE NUMBER: 27551
 REYNOLDS NUMBER = 1002402.
 DYNAMIC PRESSURE = 455.45 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.079
 AIR TEMPERATURE = 26.5°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.03313
 LINEAR PITCH RATE = 190.33°S⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

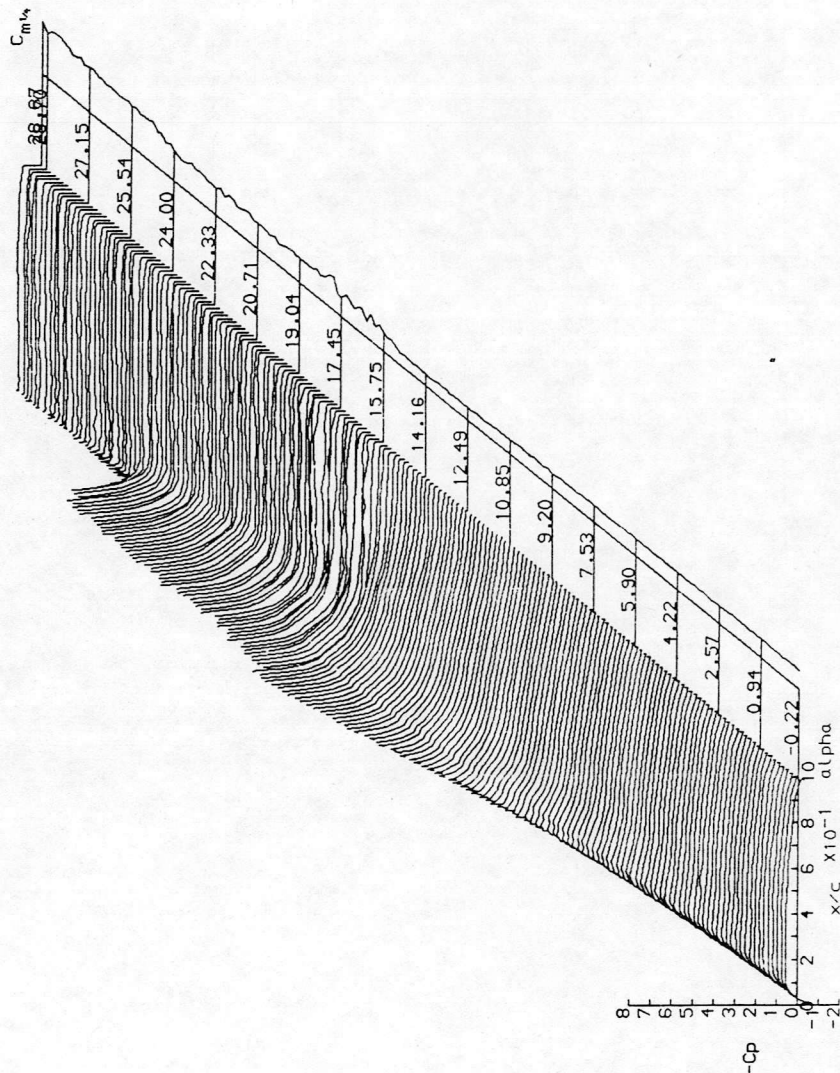
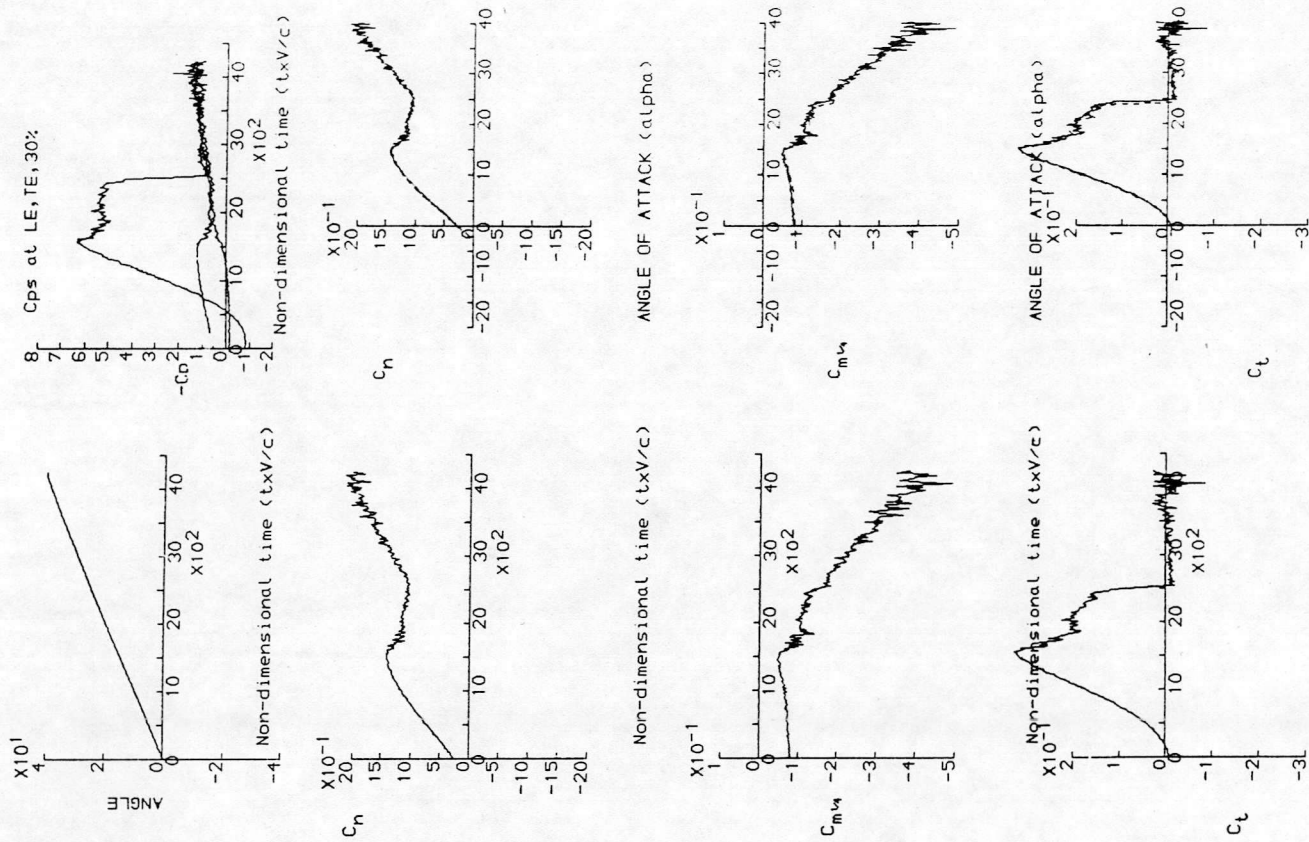
RUN REFERENCE NUMBER = 27561
 RETNOLDS NUMBER = 1002402.
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.079
 AIR TEMPERATURE = 26.5°C
 SAMPLING FREQUENCY = 550.05 Hz.
 DYNAMIC PRESSURE = 455.45 Nm⁻²
 REDUCED PITCH RATE = 0.04732
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 LINEAR PITCH RATE = 271.86°S⁻¹
 START ANGLE = -1.00°
 RAMP ARC = 41.000°

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

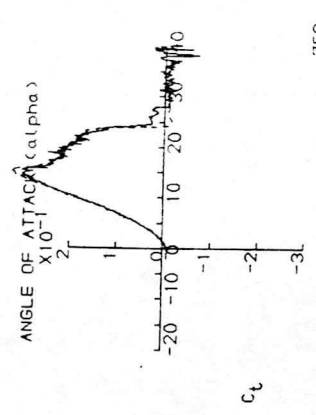
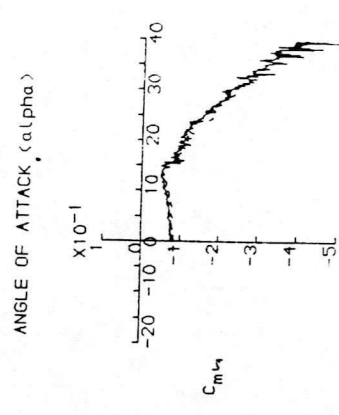
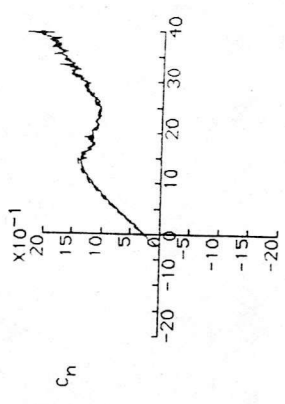
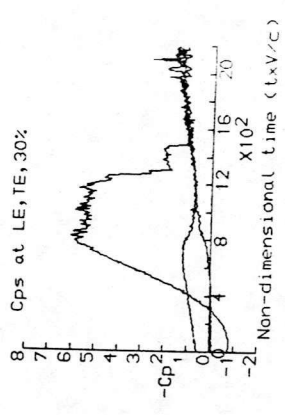
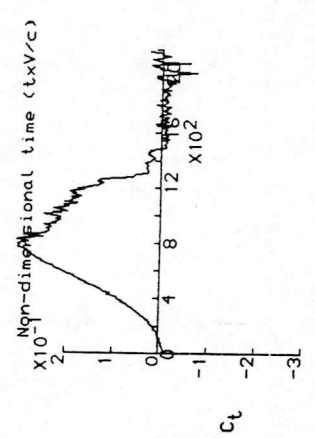
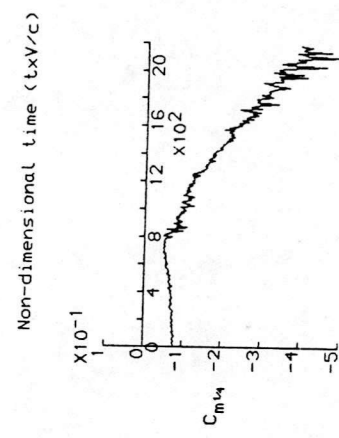
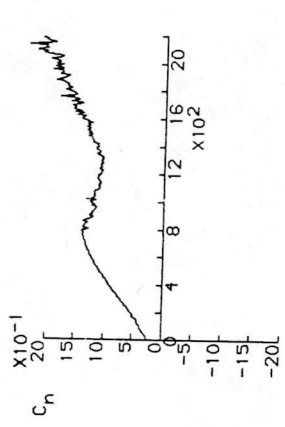
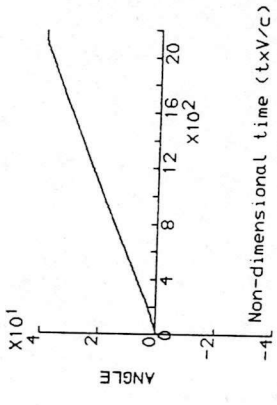
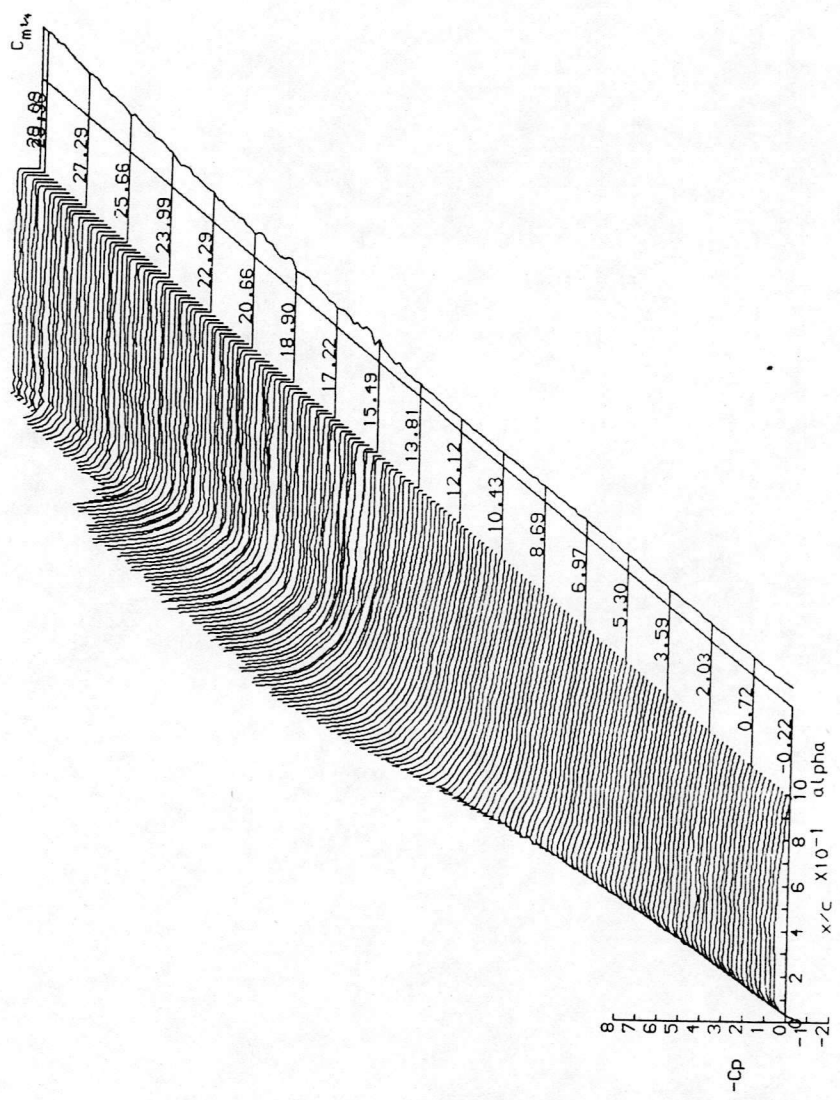
RUN REFERENCE NUMBER: 27571
 RETNOLDS NUMBER = 1495638.
 DYNAMIC PRESSURE = 1013.93 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 26.5°C
 SAMPLING FREQUENCY = 4.50 Hz.
 REDUCED PITCH RATE = 0.00009
 LINEAR PITCH RATE = 0.74°S⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

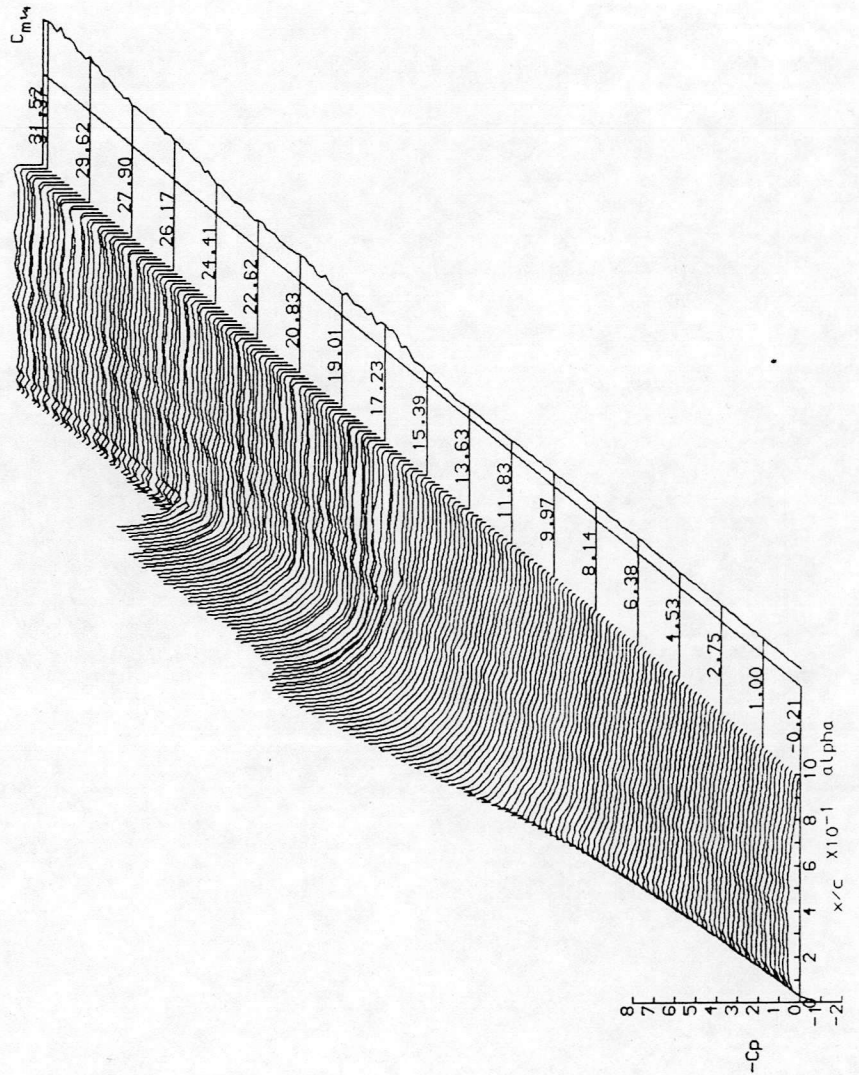
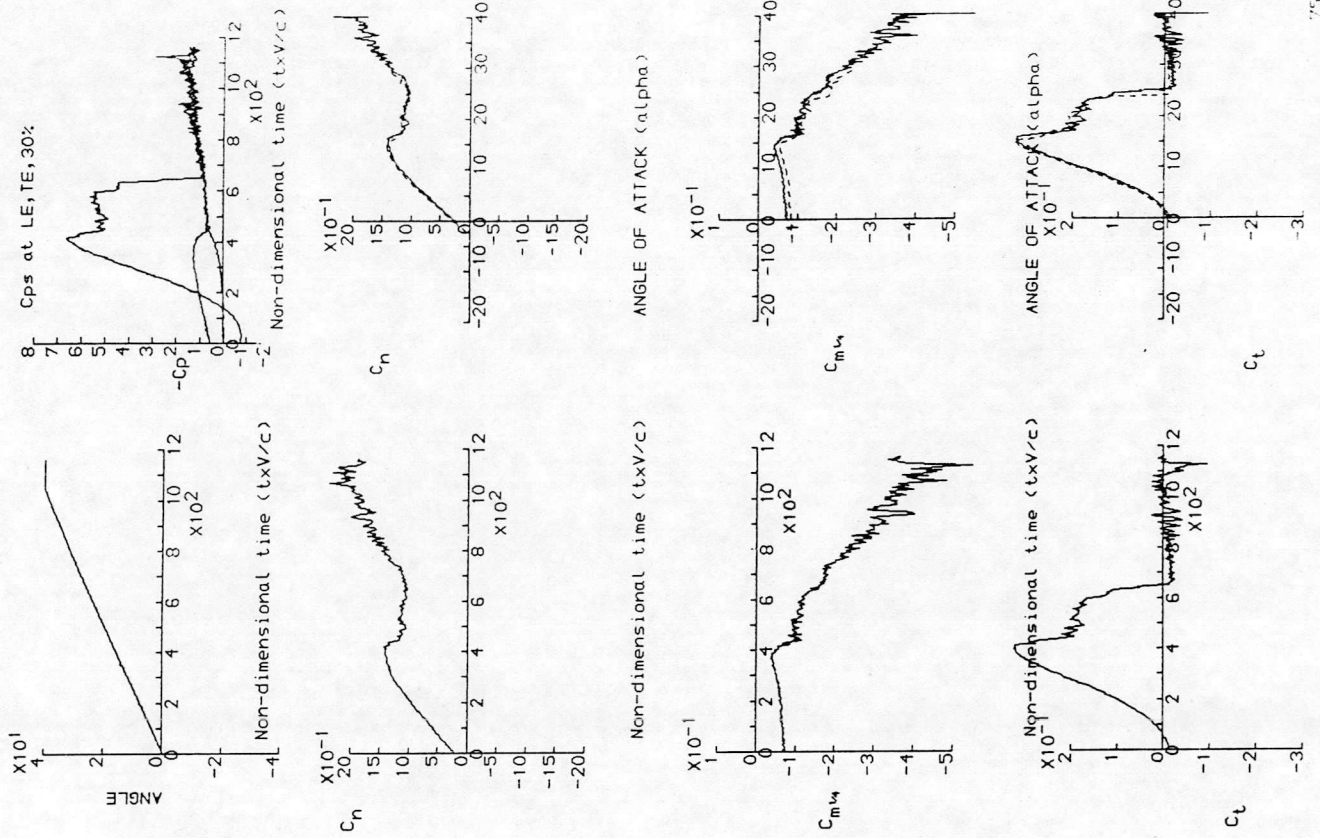
RUN REFERENCE NUMBER: 27581
 REYNOLDS NUMBER = 1478325.
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1005.90 Nm⁻²
 AIR TEMPERATURE = 28.3°C
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 SAMPLING FREQUENCY = 8.70 Hz.
 START ANGLE = -1.00°
 REDUCED PITCH RATE = 0.00017
 RAMP ARC = 41.000°
 LINEAR PITCH RATE = 1.47°S⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

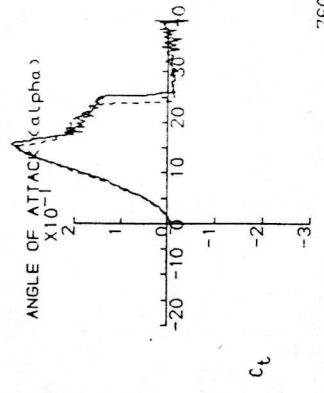
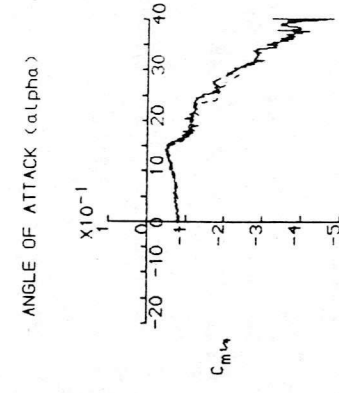
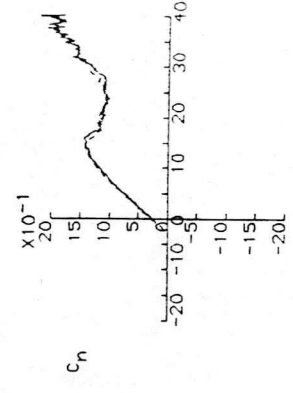
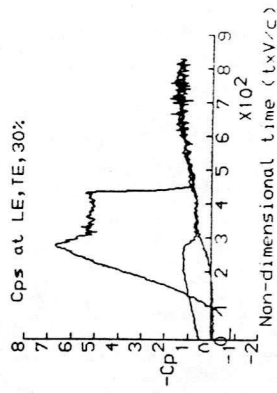
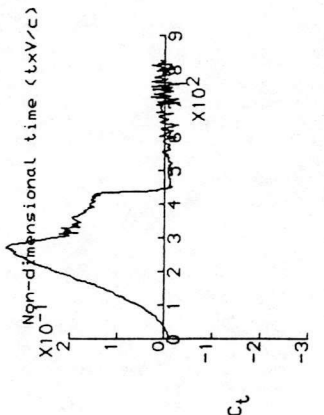
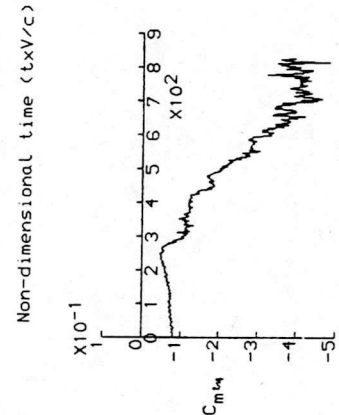
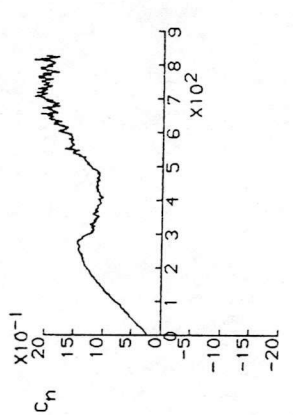
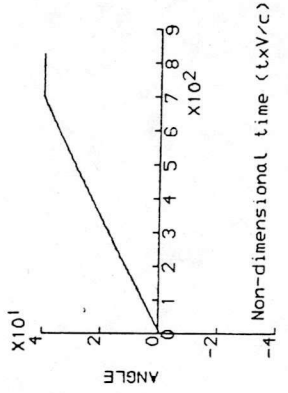
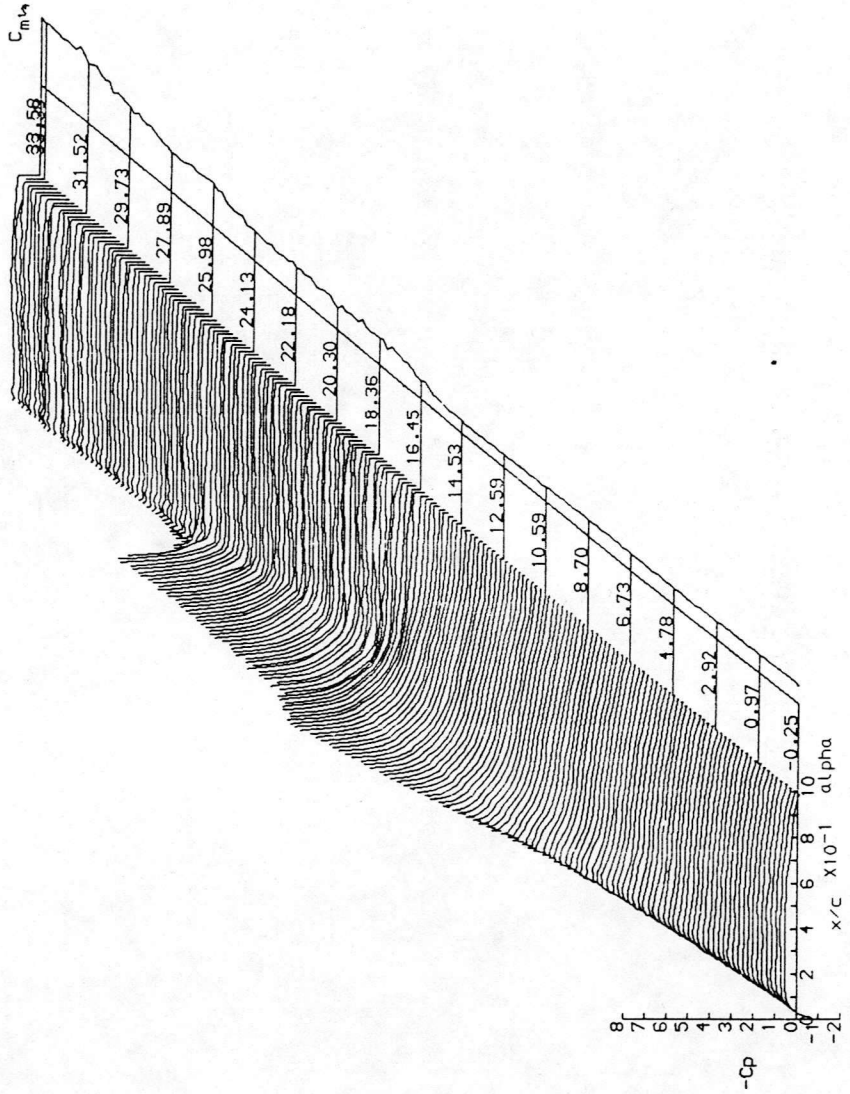
RUN REFERENCE NUMBER: 27591
 RETNOLDS NUMBER = 1470832.
 DYNAMIC PRESSURE = 1005.90 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.5°C
 SAMPLING FREQUENCY = 16.40 Hz.
 REDUCED PITCH RATE = 0.00035
 LINEAR PITCH RATE = 2.97°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

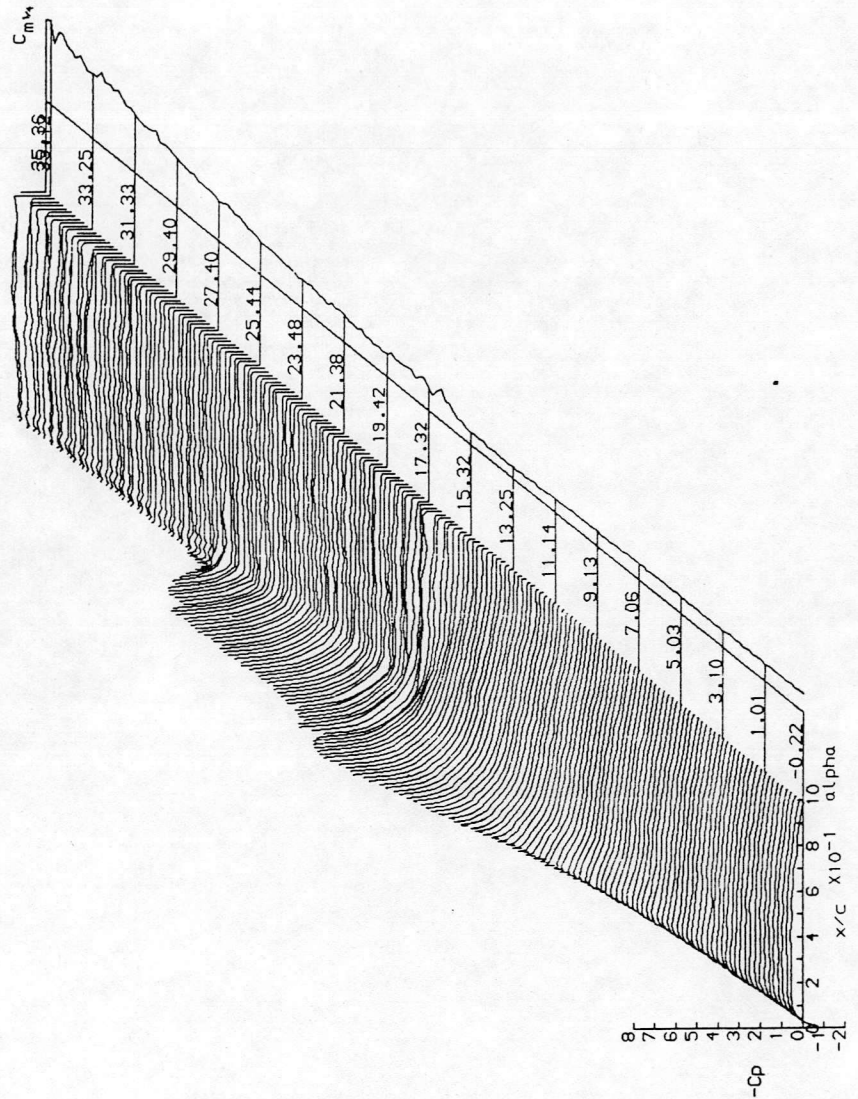
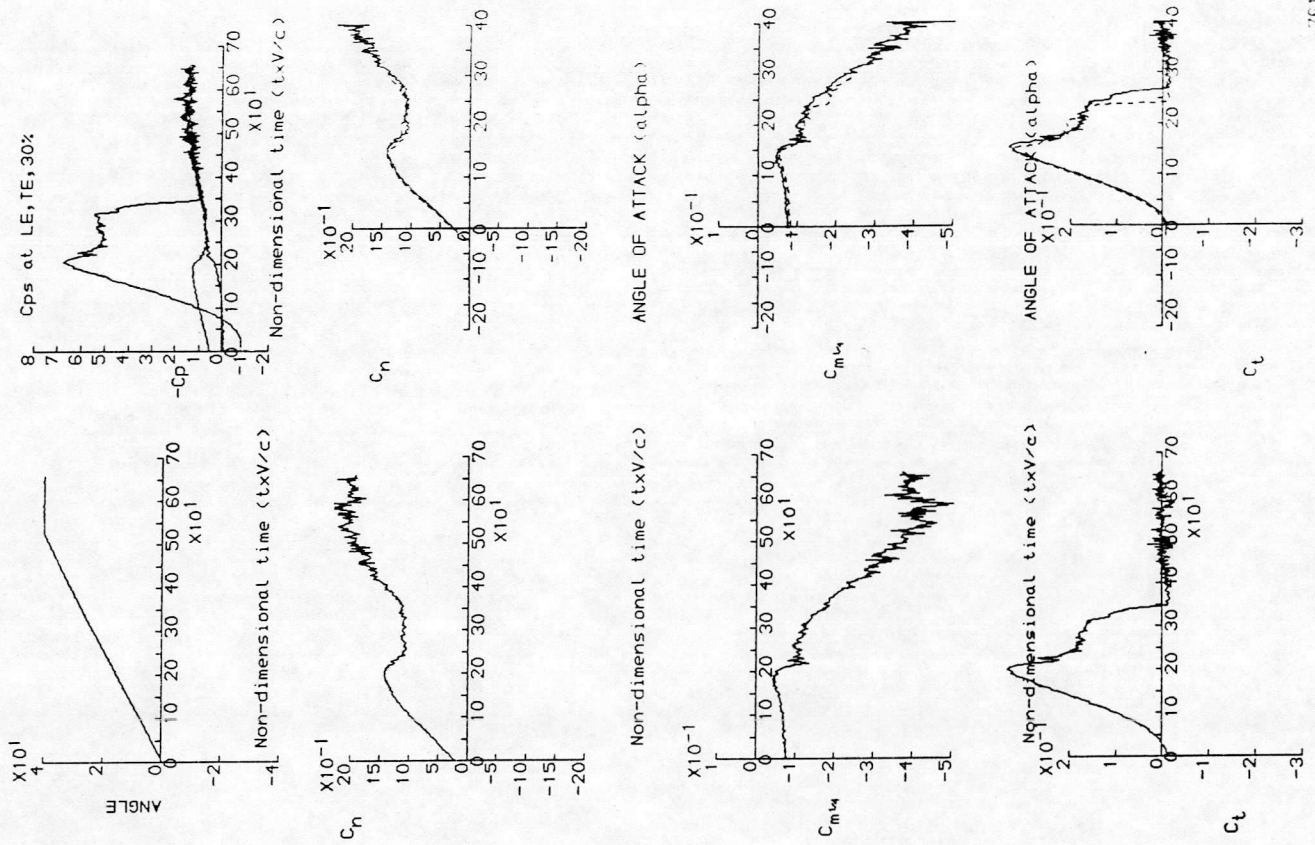
RUN REFERENCE NUMBER: 27601
 RETNOLDS NUMBER = 1467342.
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1000.28 Nm⁻²
 AIR TEMPERATURE = 29.4°C
 NUMBER OF CYCLES = 5
 SAMPLING FREQUENCY = 23.00 Hz.
 MOTION TYPE: RAMP UP
 REDUCED PITCH RATE = 0.00052
 START ANGLE = -1.00°
 LINEAR PITCH RATE = 4.41°s⁻¹
 RAMP ARC = 41.000°

AVERAGED DATA OF 5 CYCLES



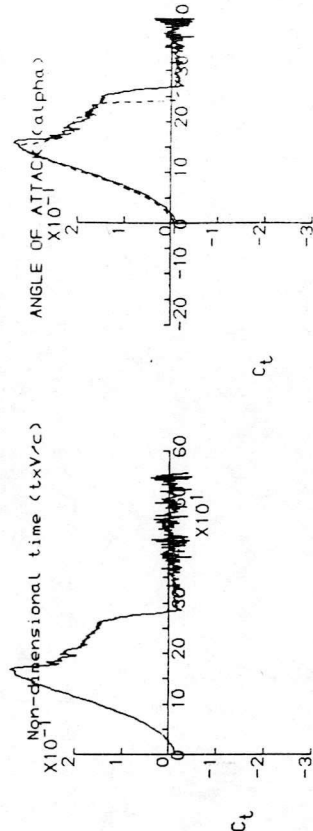
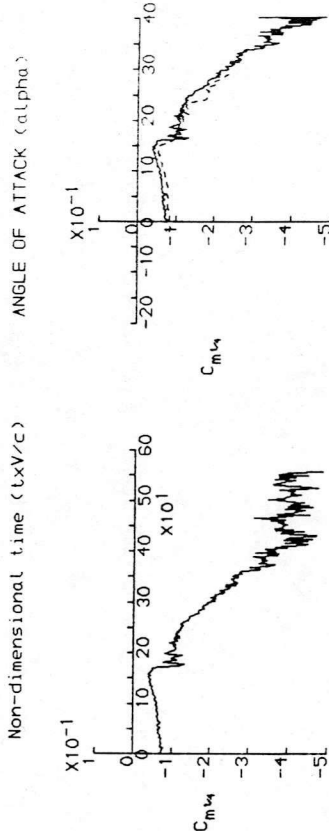
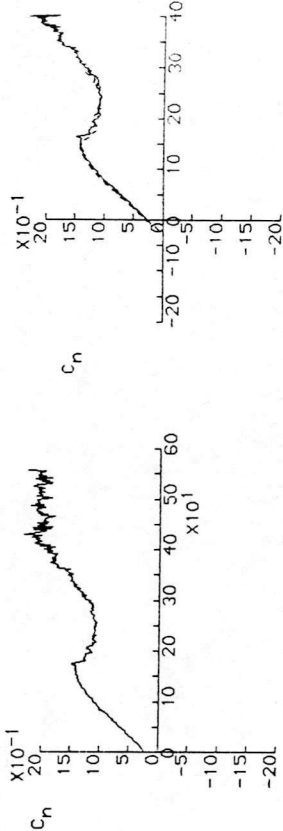
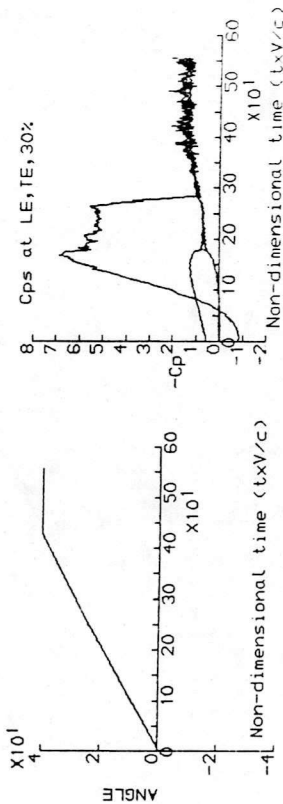
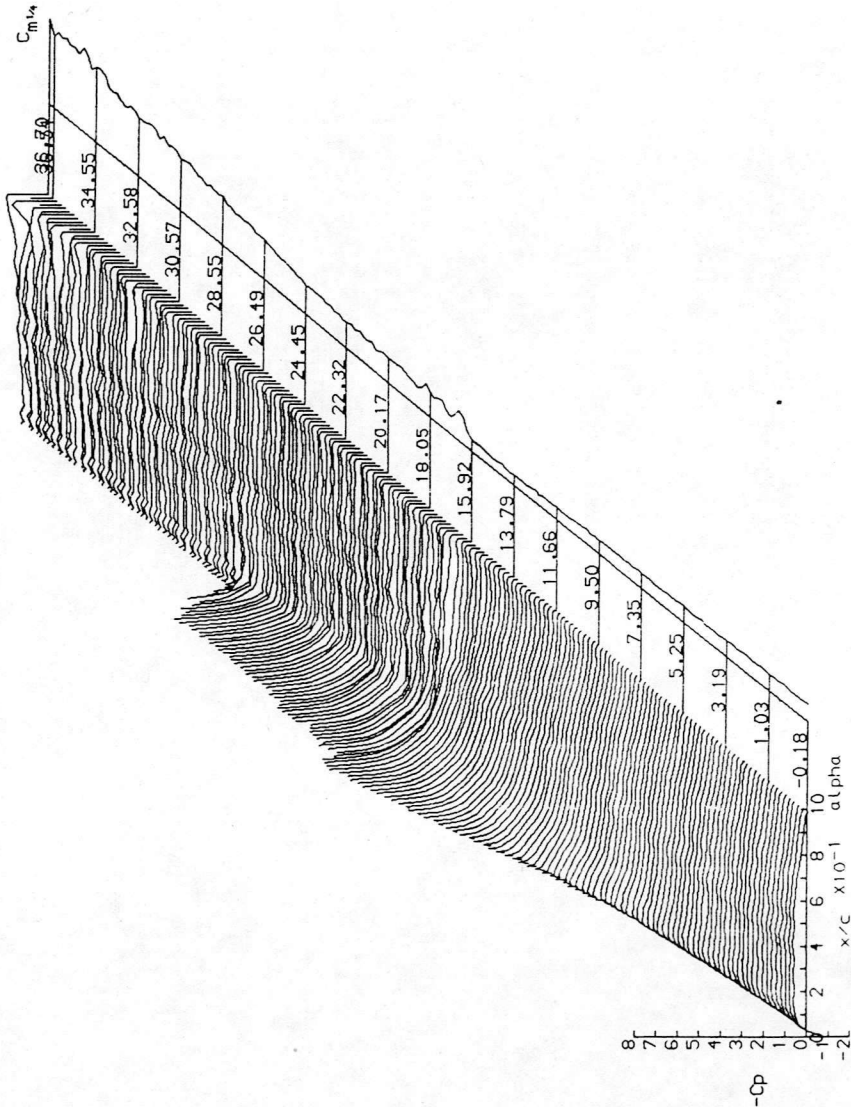
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27611
 REYNOLDS NUMBER = 1462396.
 DYNAMIC PRESSURE = 1000.28 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.2°C
 SAMPLING FREQUENCY = 29.00 Hz.
 REDUCED PITCH RATE = 0.00070
 LINEAR PITCH RATE = 5.97°s⁻¹



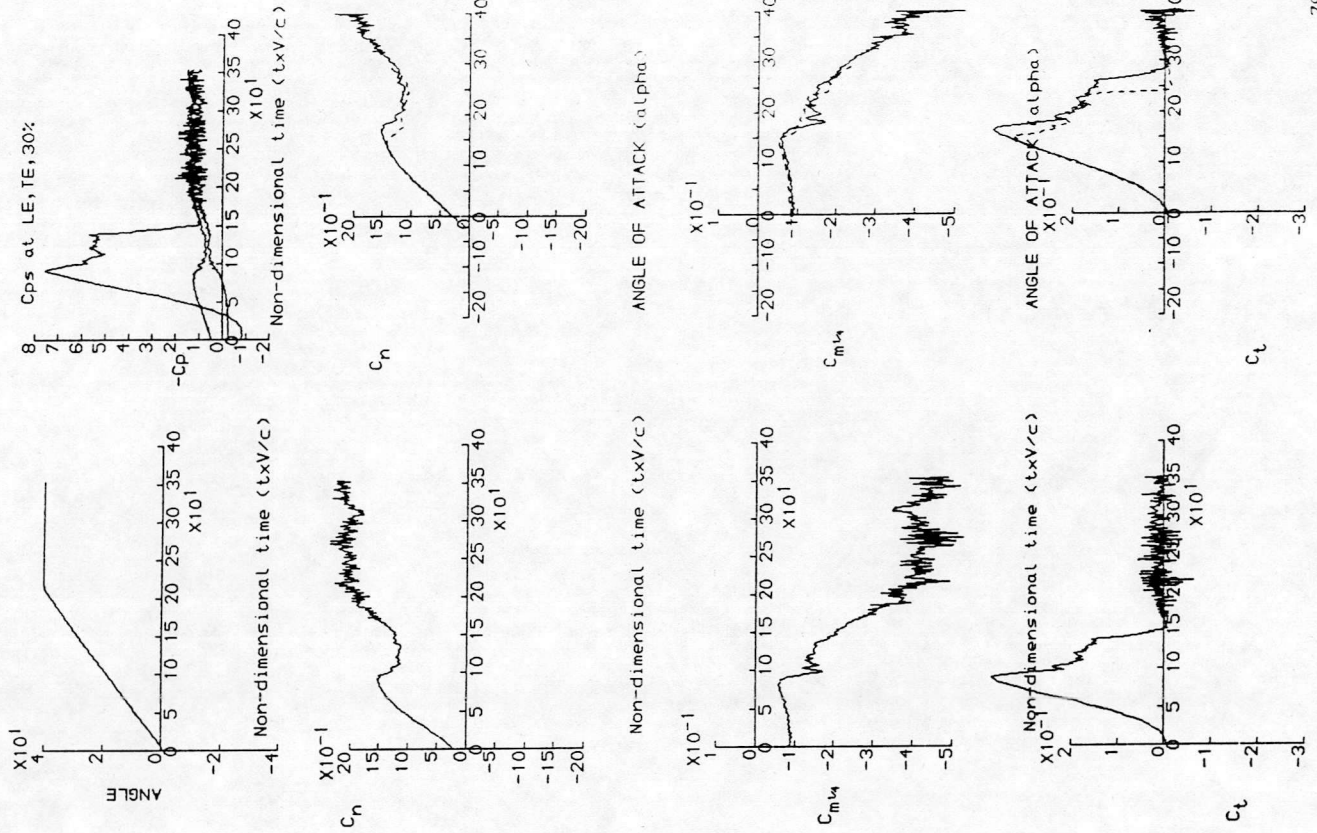
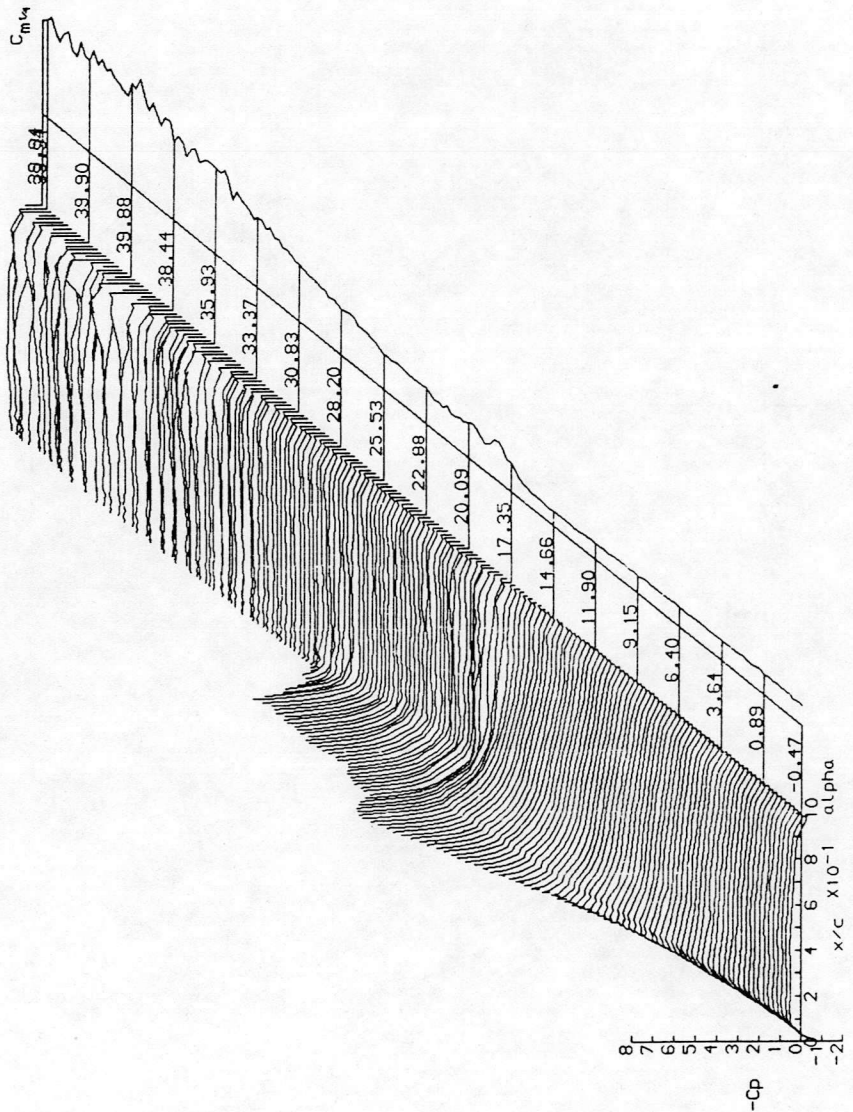
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27621
 RETNOLDS NUMBER = 1461164.
 DYNAMIC PRESSURE = 1000.28 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.4°C
 SAMPLING FREQUENCY = 34.30 Hz.
 REDUCED PITCH RATE = 0.00085
 LINEAR PITCH RATE = 7.28°s⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

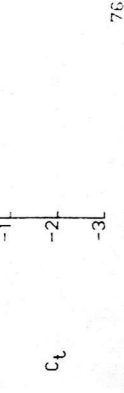
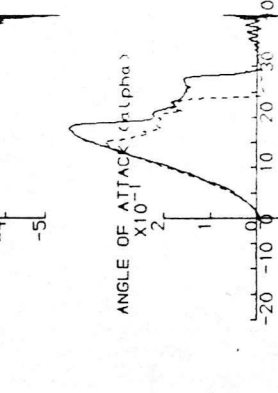
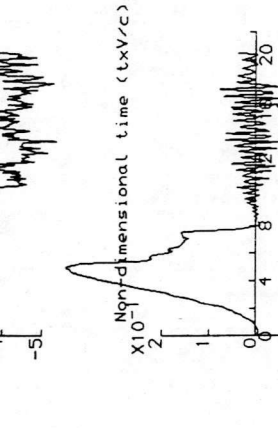
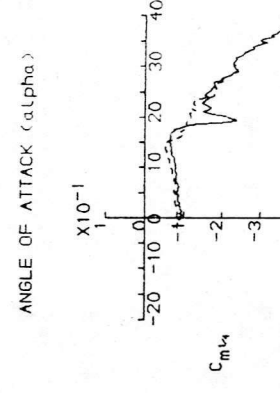
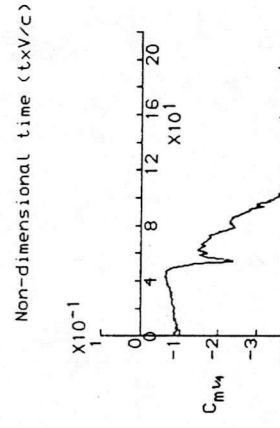
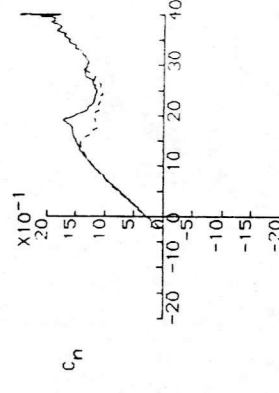
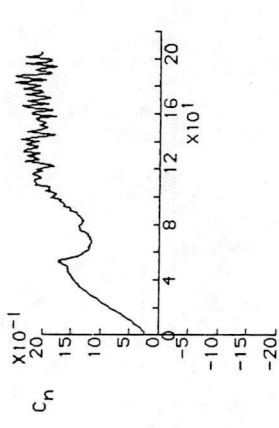
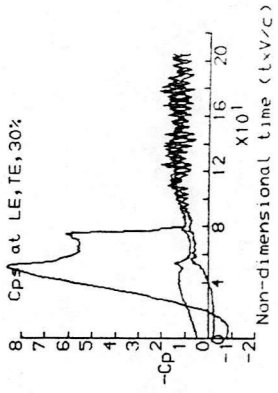
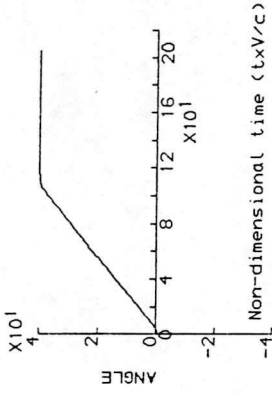
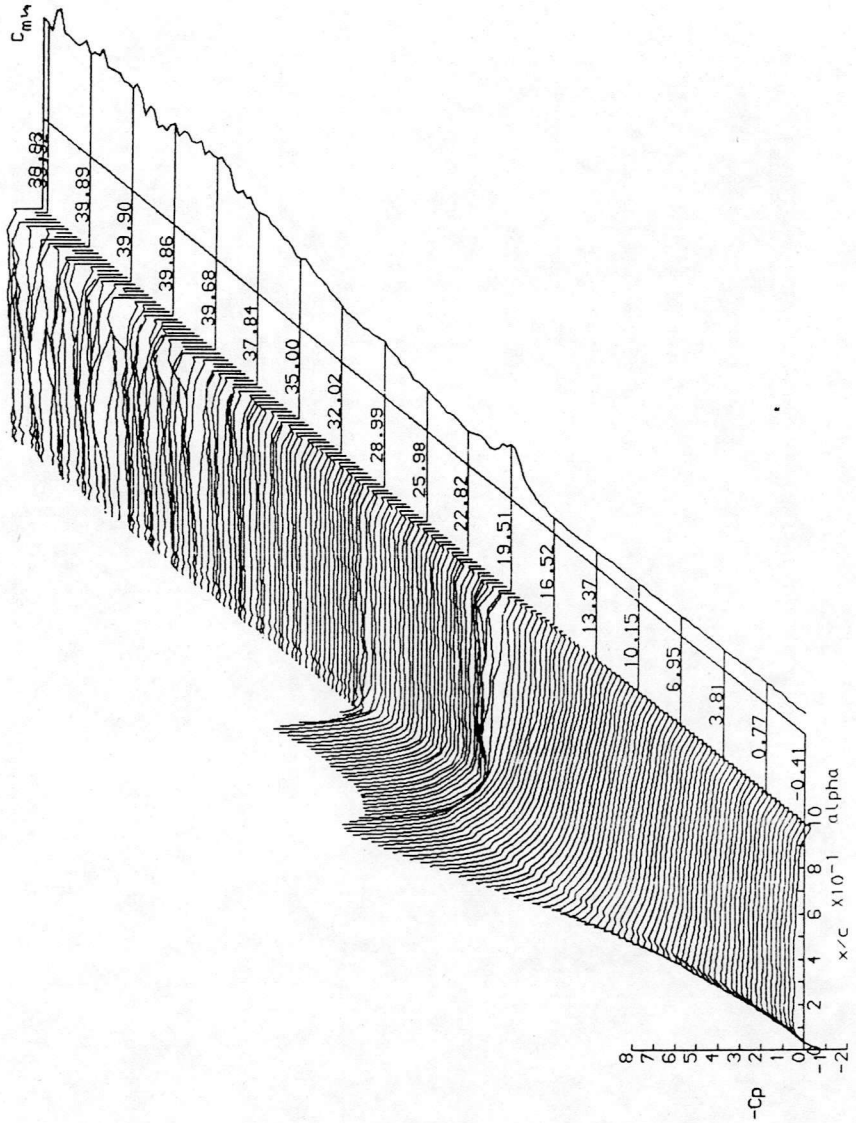
RUN REFERENCE NUMBER: 27631
 RETNOLDS NUMBER = 1481220.
 DYNAMIC PRESSURE = 1013.27 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 28.7°C
 SAMPLING FREQUENCY = 54.10 Hz.
 REDUCED PITCH RATE = 0.00172
 LINEAR PITCH RATE = 14.80°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

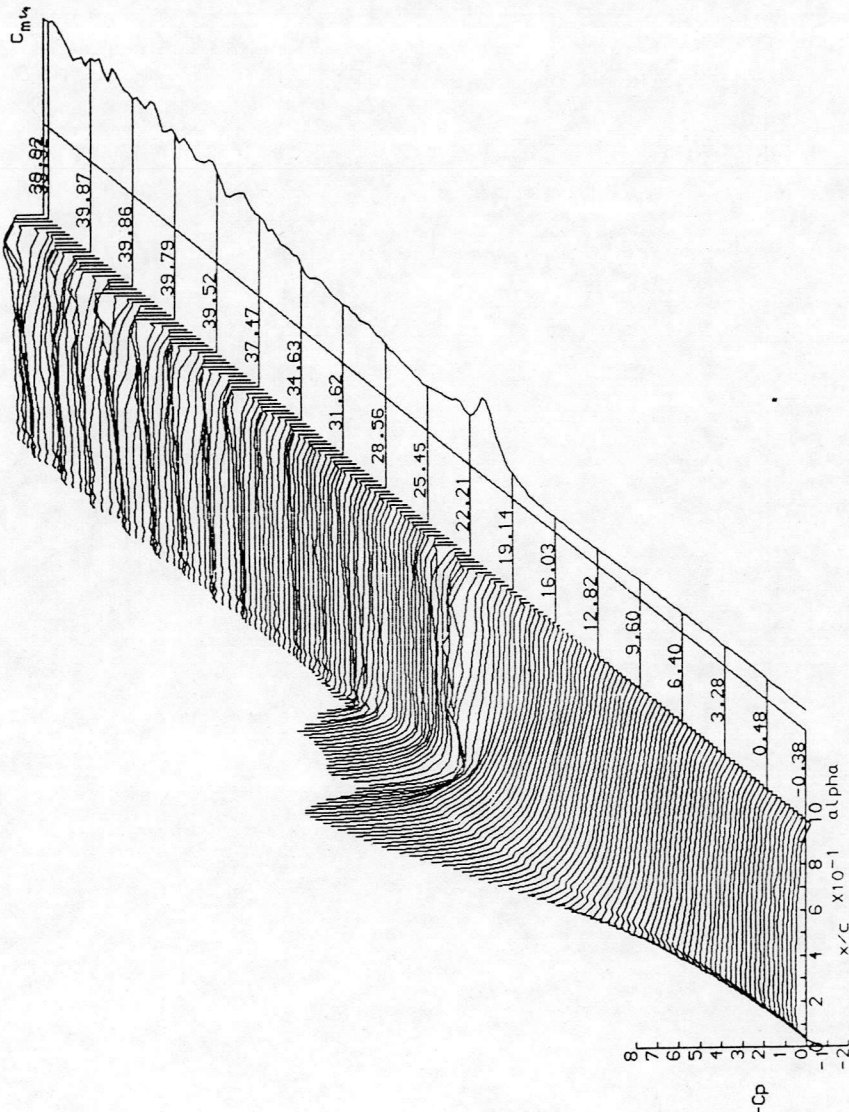
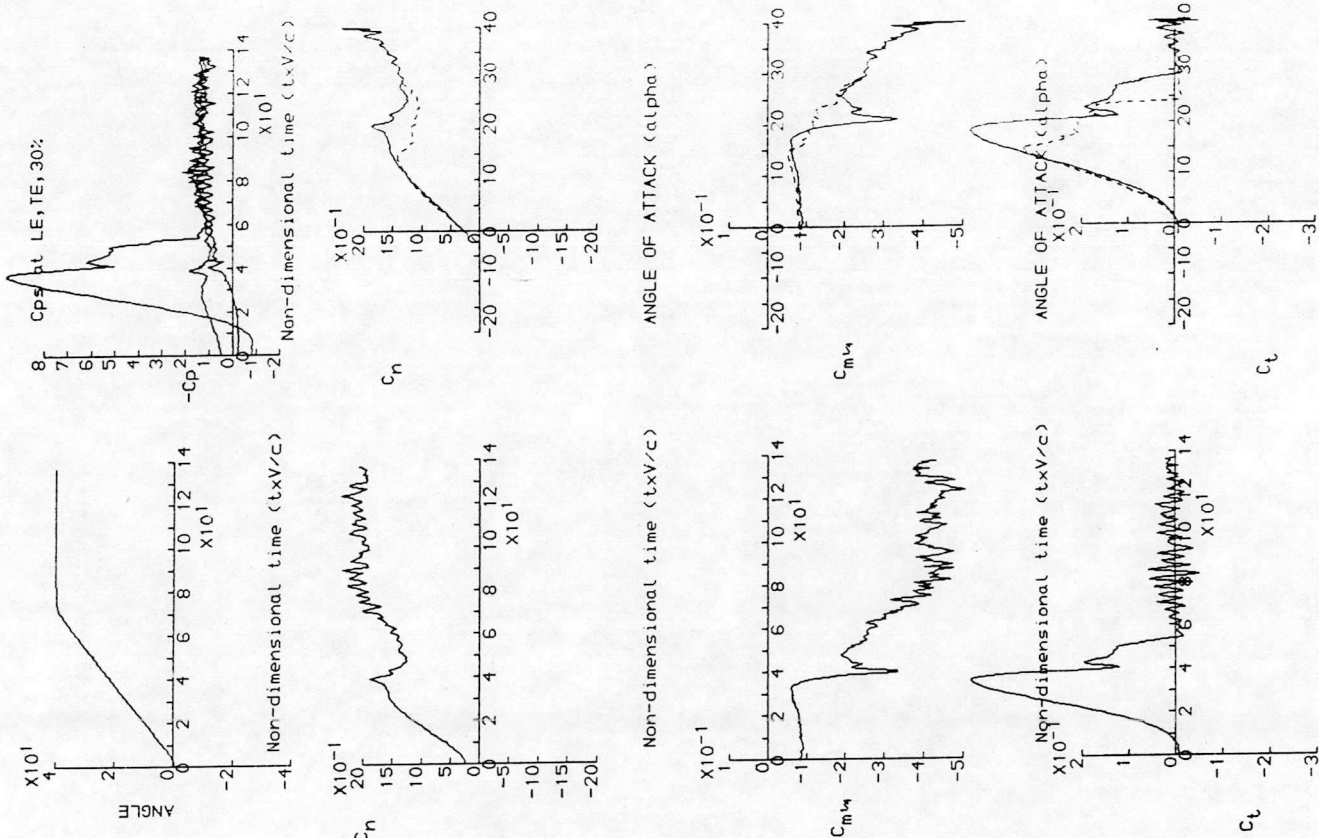
RUN REFERENCE NUMBER: 27641
 REYNOLDS NUMBER = 1473724.
 DYNAMIC PRESSURE = 1013.27 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13-12-88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 29.9°C
 SAMPLING FREQUENCY = 93.70 Hz.
 REDUCED PITCH RATE = 0.00341
 LINEAR PITCH RATE = 29.42°S⁻¹

AVERAGED DATA OF 5 CYCLES



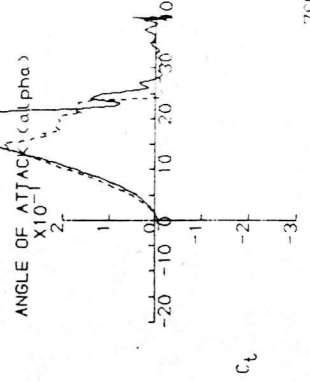
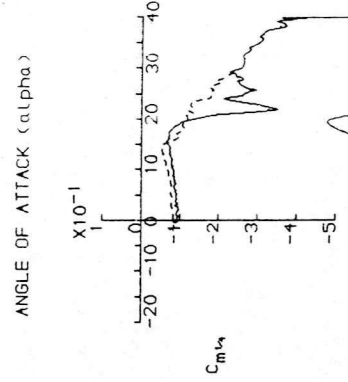
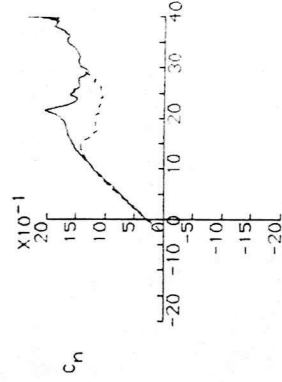
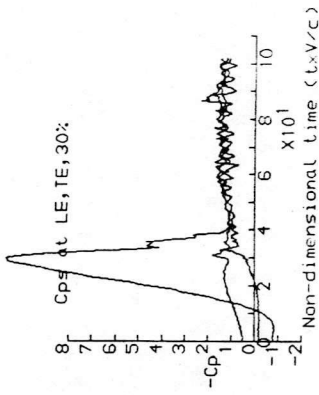
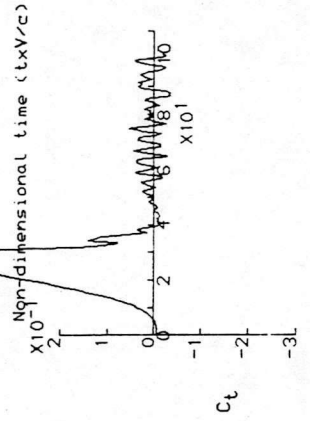
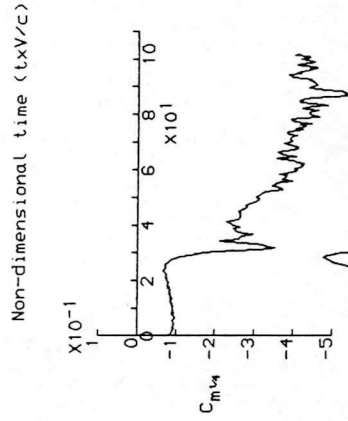
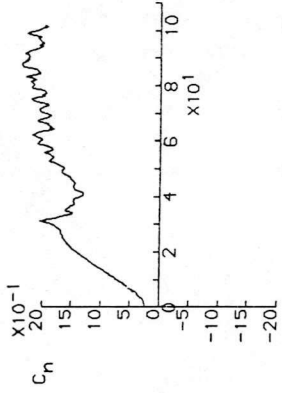
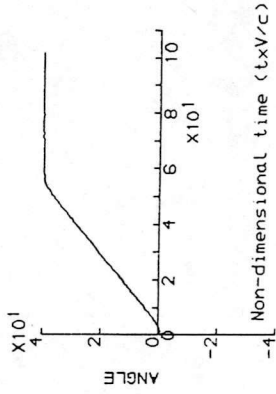
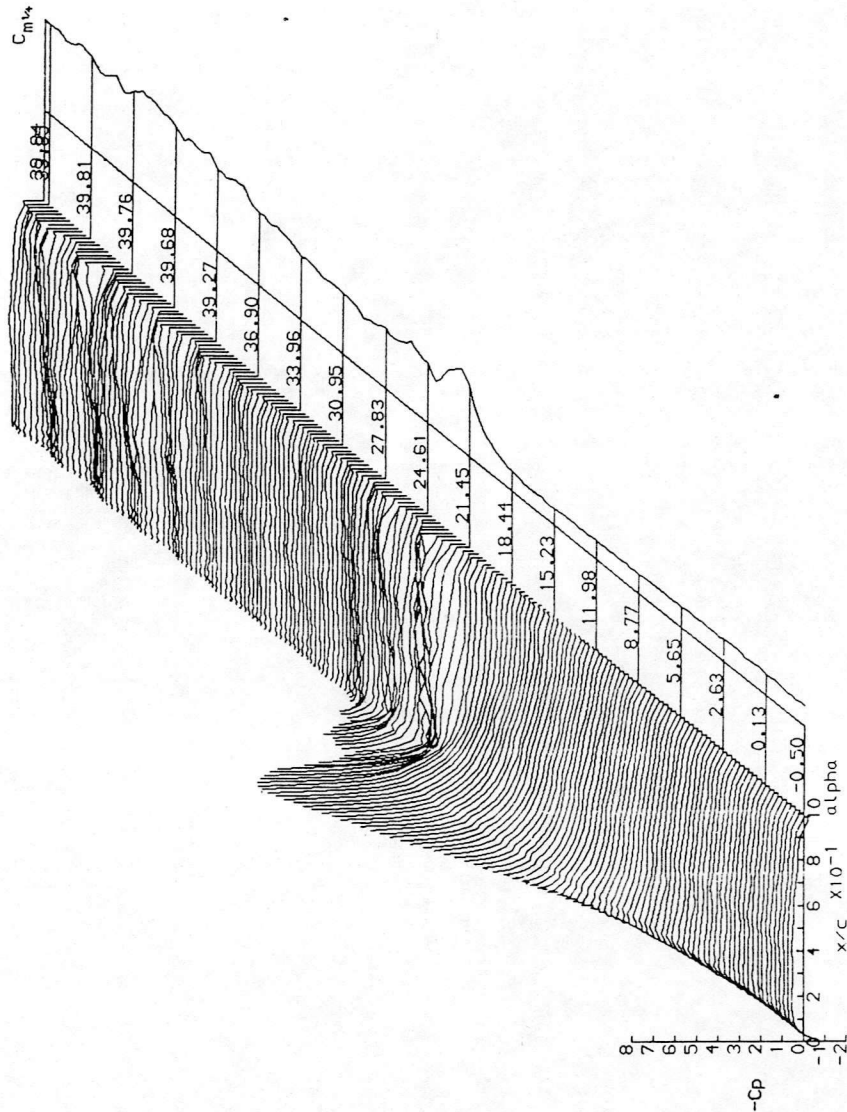
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27651
 REYNOLDS NUMBER = 1471241.
 DYNAMIC PRESSURE = 1013.27 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 30.3°C
 SAMPLING FREQUENCY = 140.00 Hz.
 REDUCED PITCH RATE = 0.00513
 LINEAR PITCH RATE = 44.28°S⁻¹



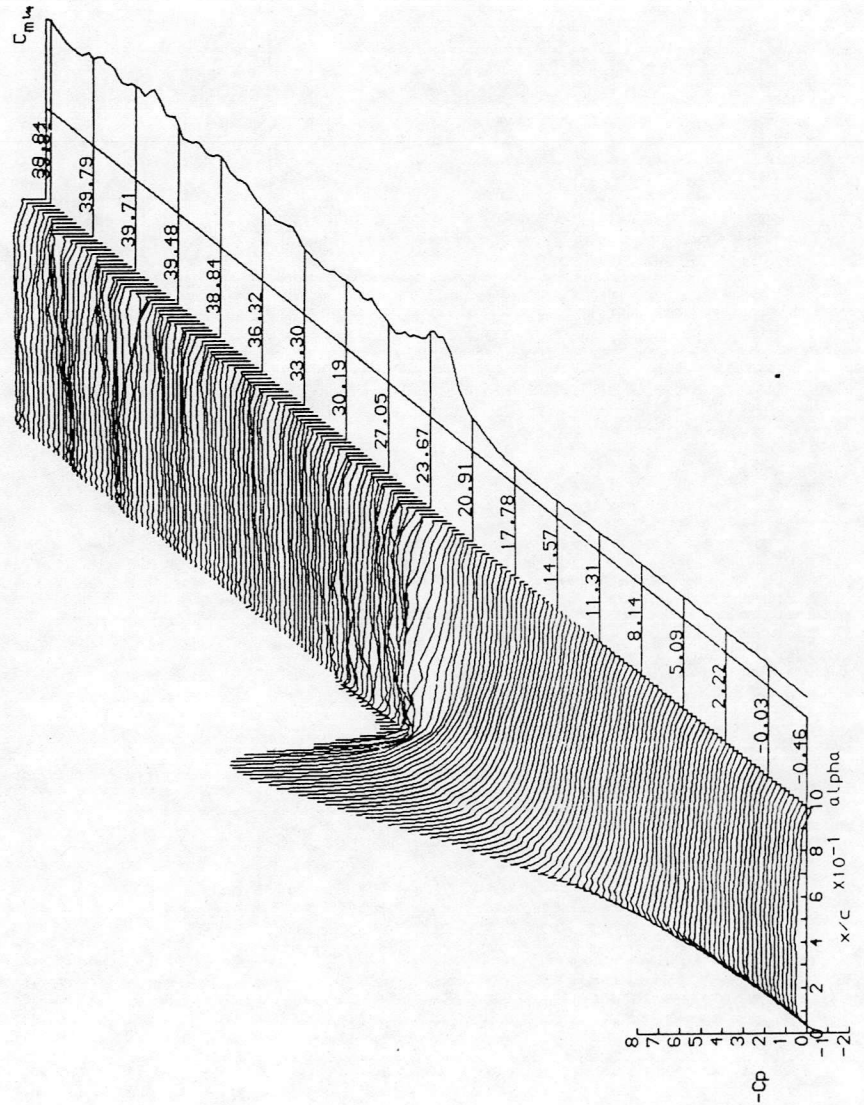
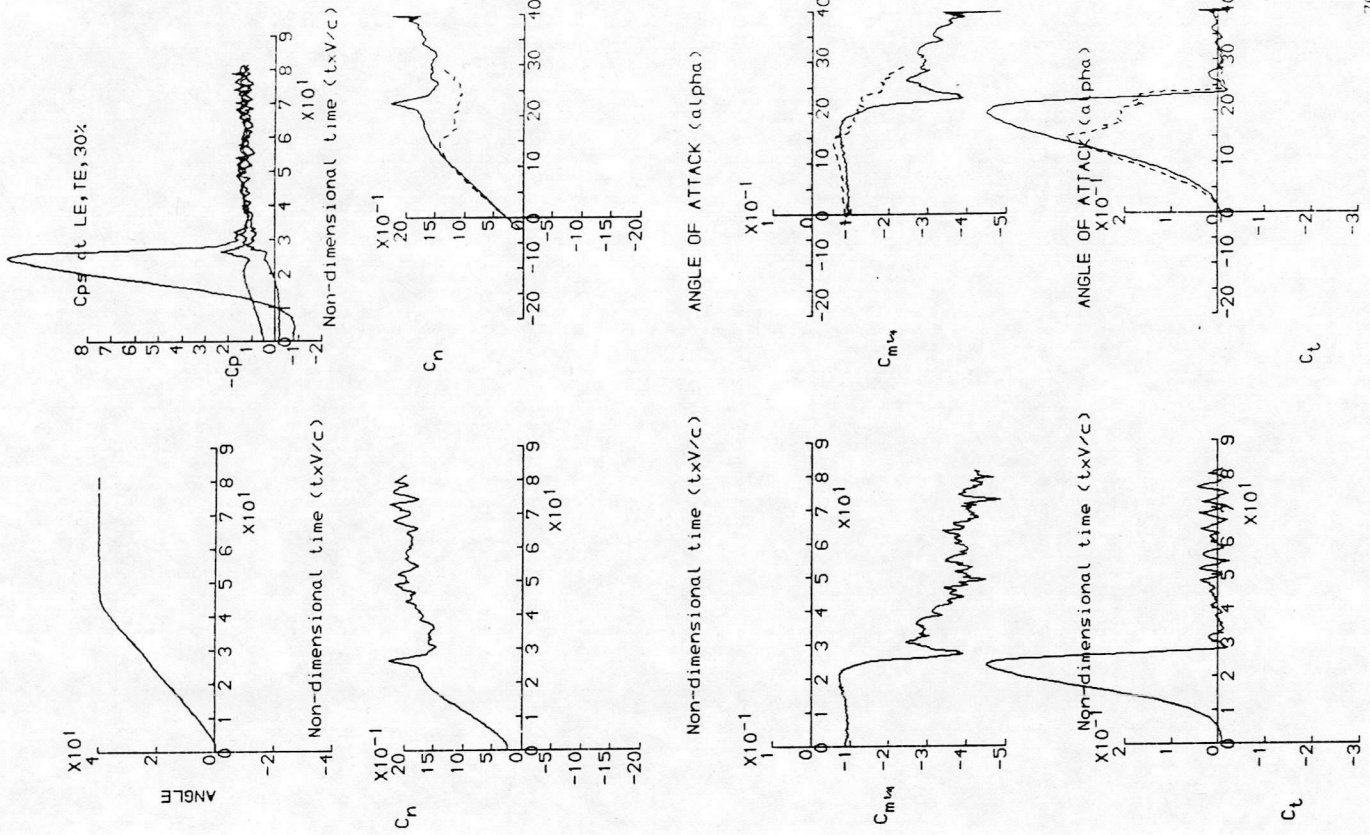
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER = 27661
 REYNOLDS NUMBER = 1462696.
 DYNAMIC PRESSURE = 999.01 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.0°C
 SAMPLING FREQUENCY = 186.99 Hz.
 REDUCED PITCH RATE = 0.00696
 LINEAR PITCH RATE = 59.54°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

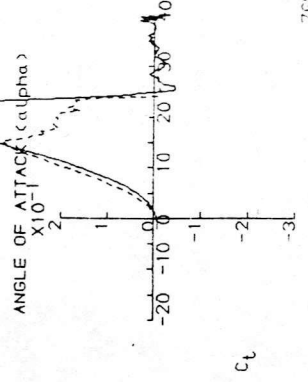
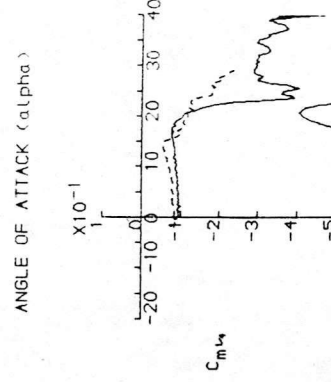
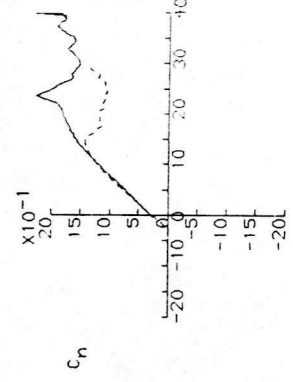
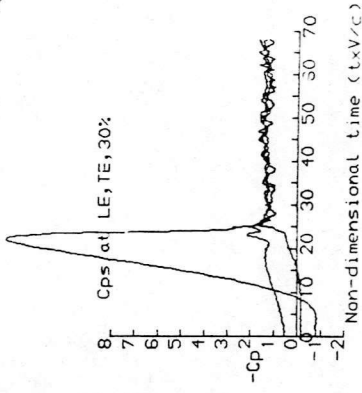
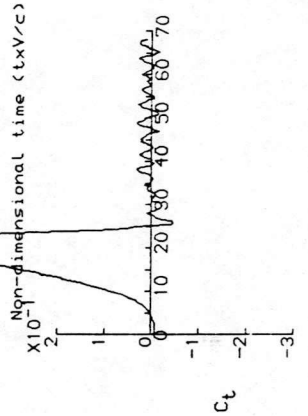
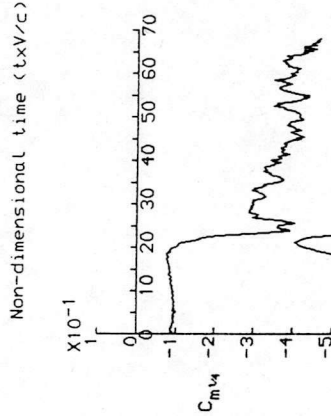
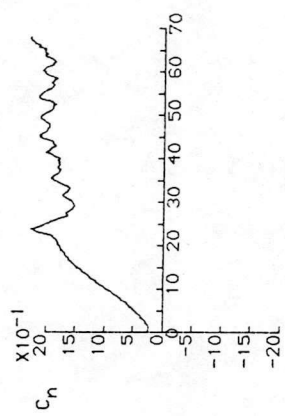
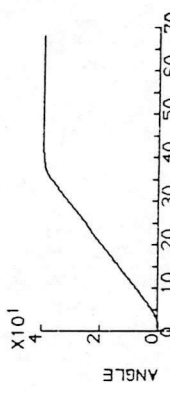
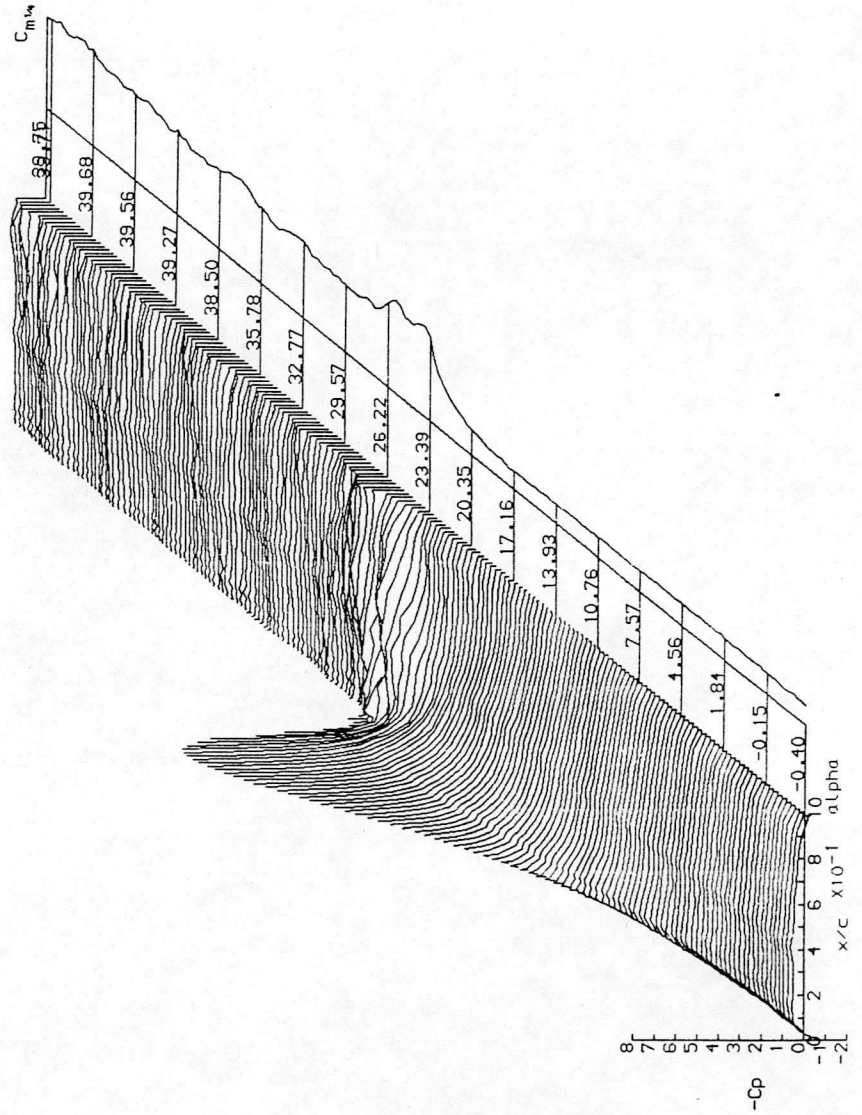
RUN REFERENCE NUMBER: 27671
 RETNOLDS NUMBER = 1460847.
 DYNAMIC PRESSURE = 999.01 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.3°C
 SAMPLING FREQUENCY = 233.97 Hz.
 REDUCED PITCH RATE = 0.00869
 LINEAR PITCH RATE = 74.36°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

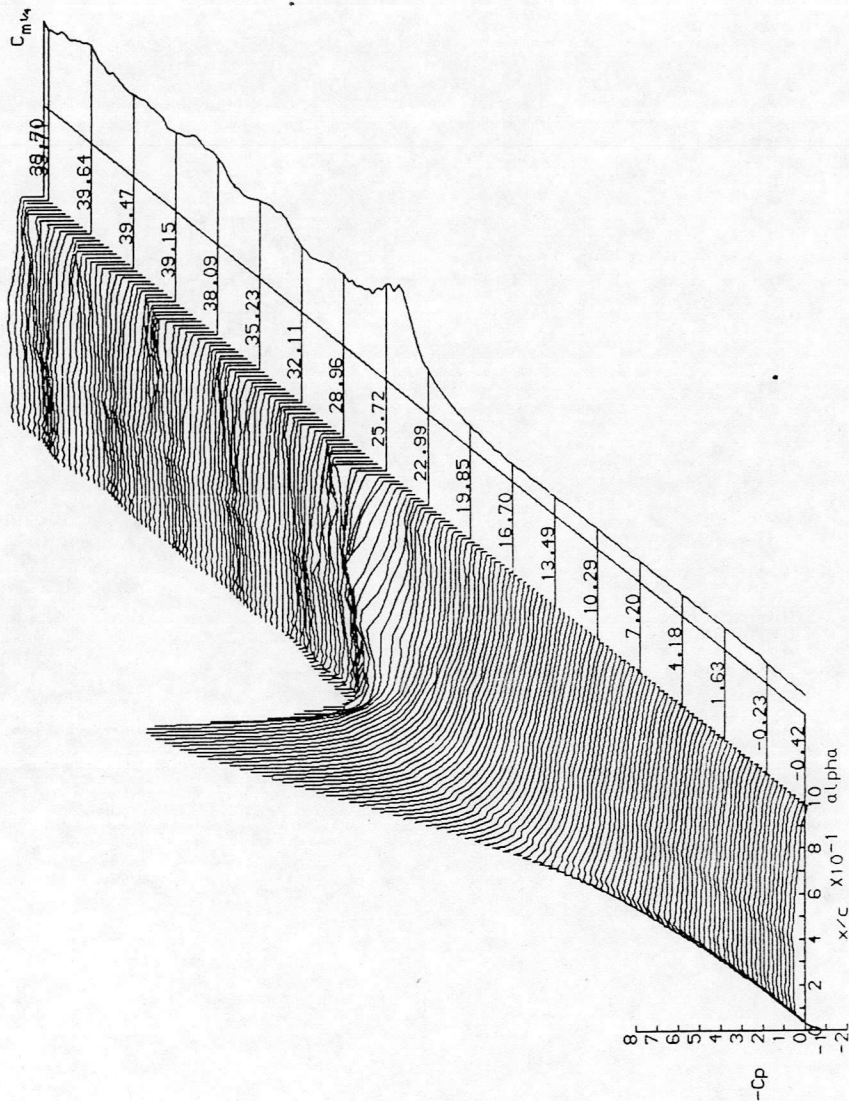
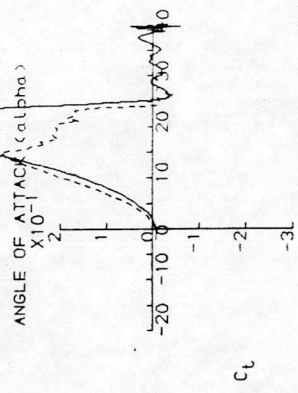
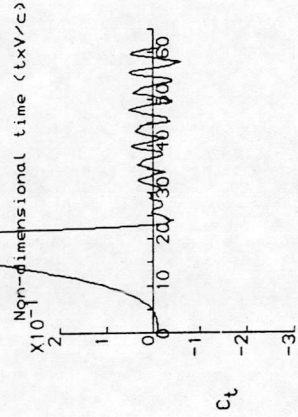
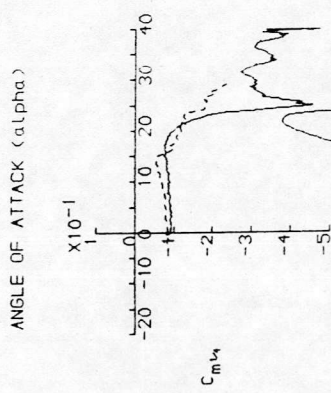
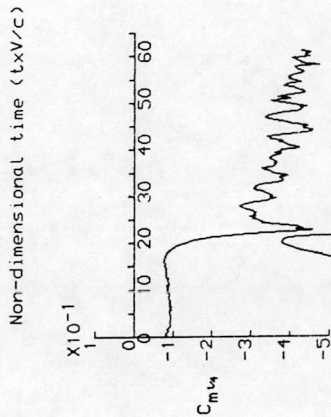
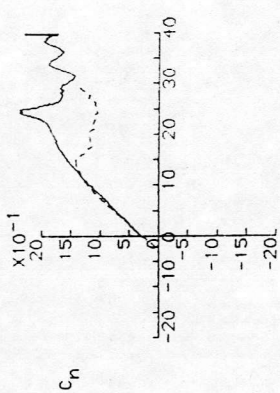
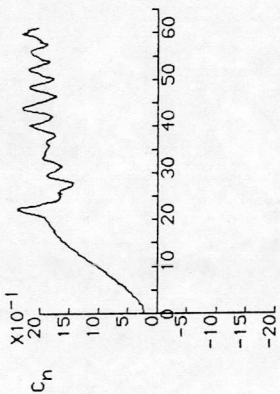
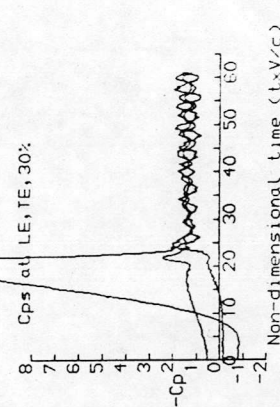
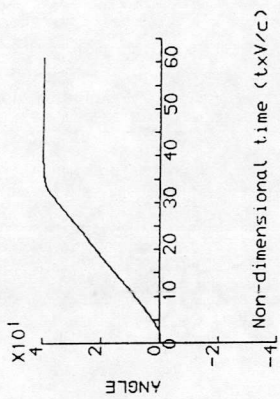
RUN REFERENCE NUMBER: 27681
 REYNOLDS NUMBER = 1439003.
 DYNAMIC PRESSURE = 999.01 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.6°C
 SAMPLING FREQUENCY = 280.03 Hz.
 REDUCED PITCH RATE = 0.01047
 LINEAR PITCH RATE = 89.70°S⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL01

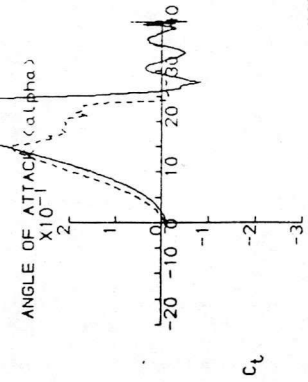
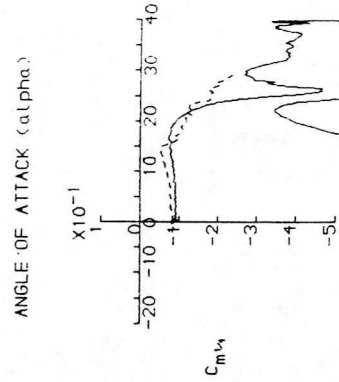
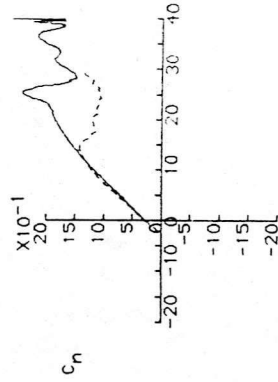
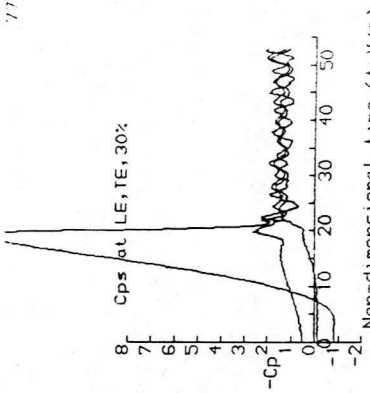
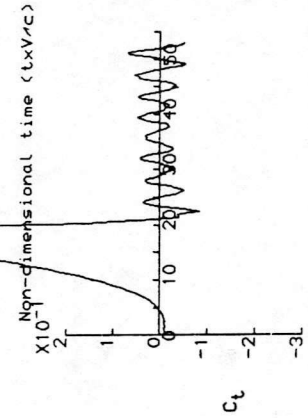
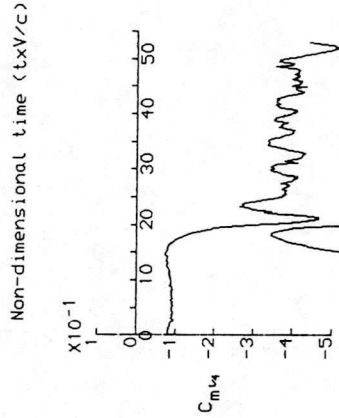
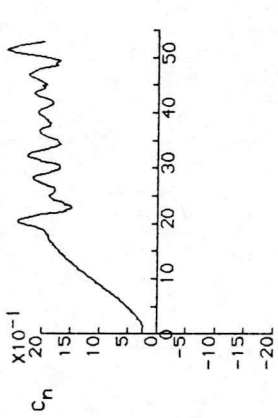
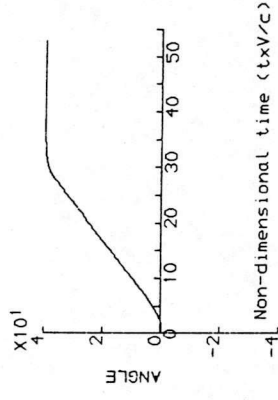
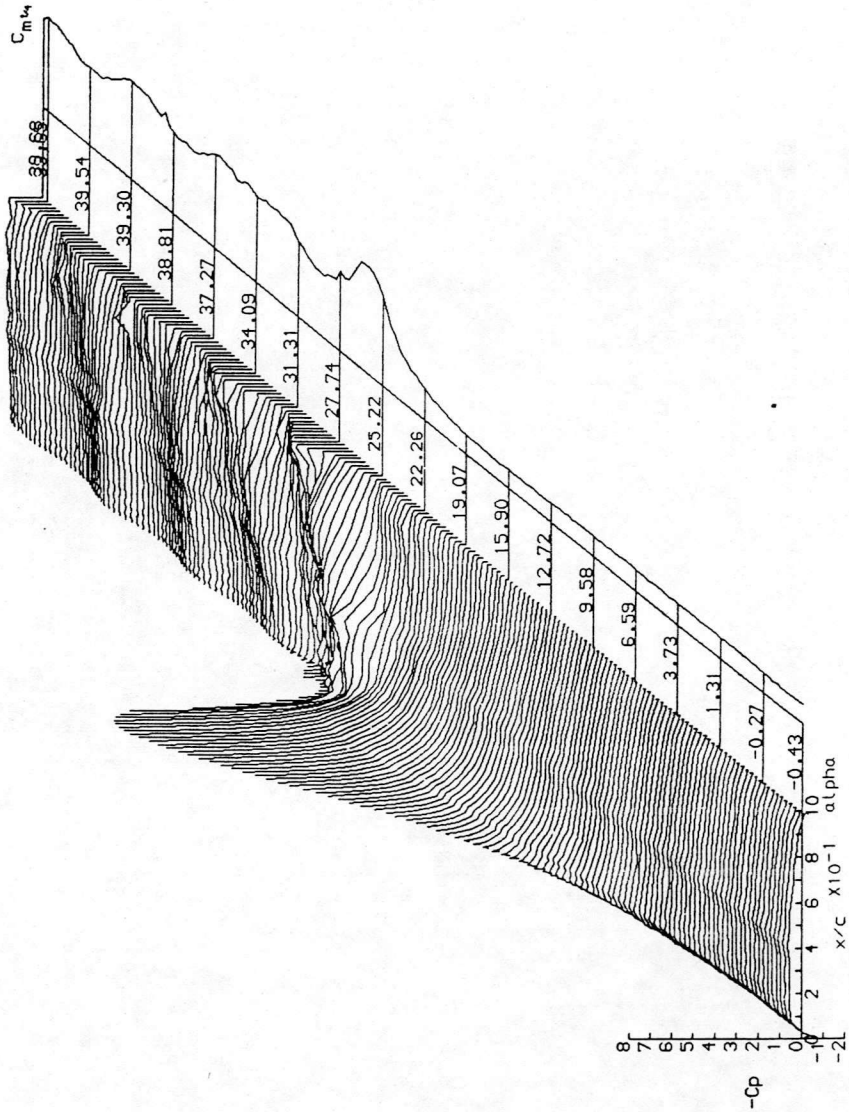
RUN REFERENCE NUMBER: 27691
 REYNOLDS NUMBER = 1457777.
 DYNAMIC PRESSURE = 999.01 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.8°C
 SAMPLING FREQUENCY = 312.01 Hz.
 REDUCED PITCH RATE = 0.01165
 LINEAR PITCH RATE = 99.82°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27701
 REYNOLDS NUMBER = 1456552.
 DYNAMIC PRESSURE = 999.01 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 31.0°C
 SAMPLING FREQUENCY = 359.97 Hz.
 REDUCED PITCH RATE = 0.01321
 LINEAR PITCH RATE = 113.24°s⁻¹

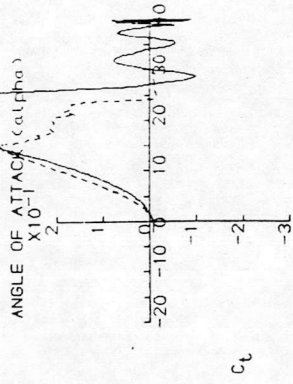
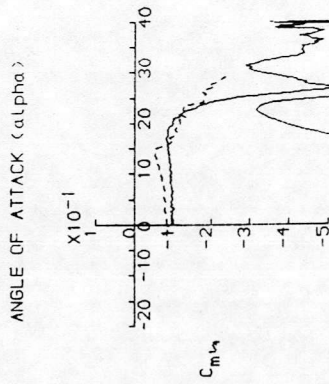
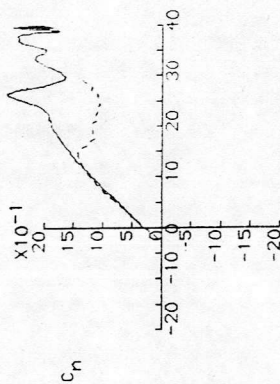
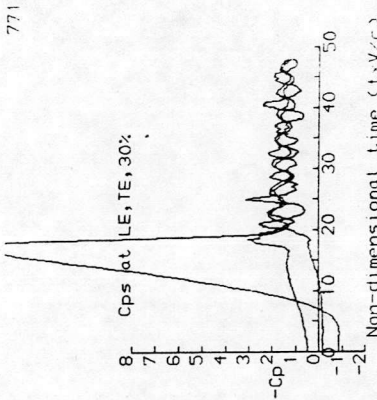
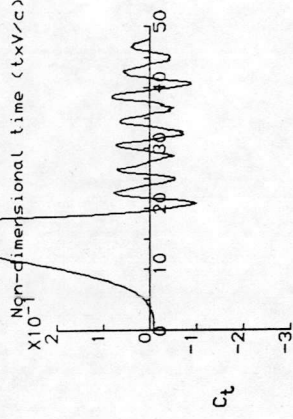
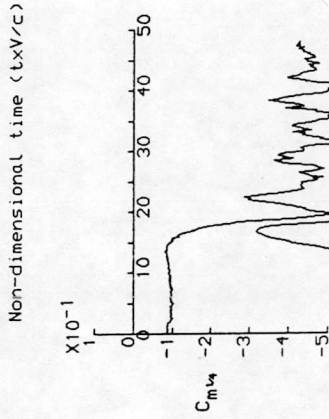
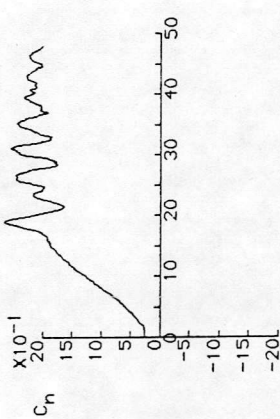
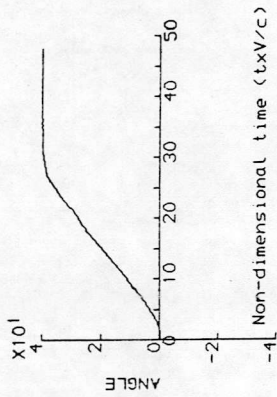
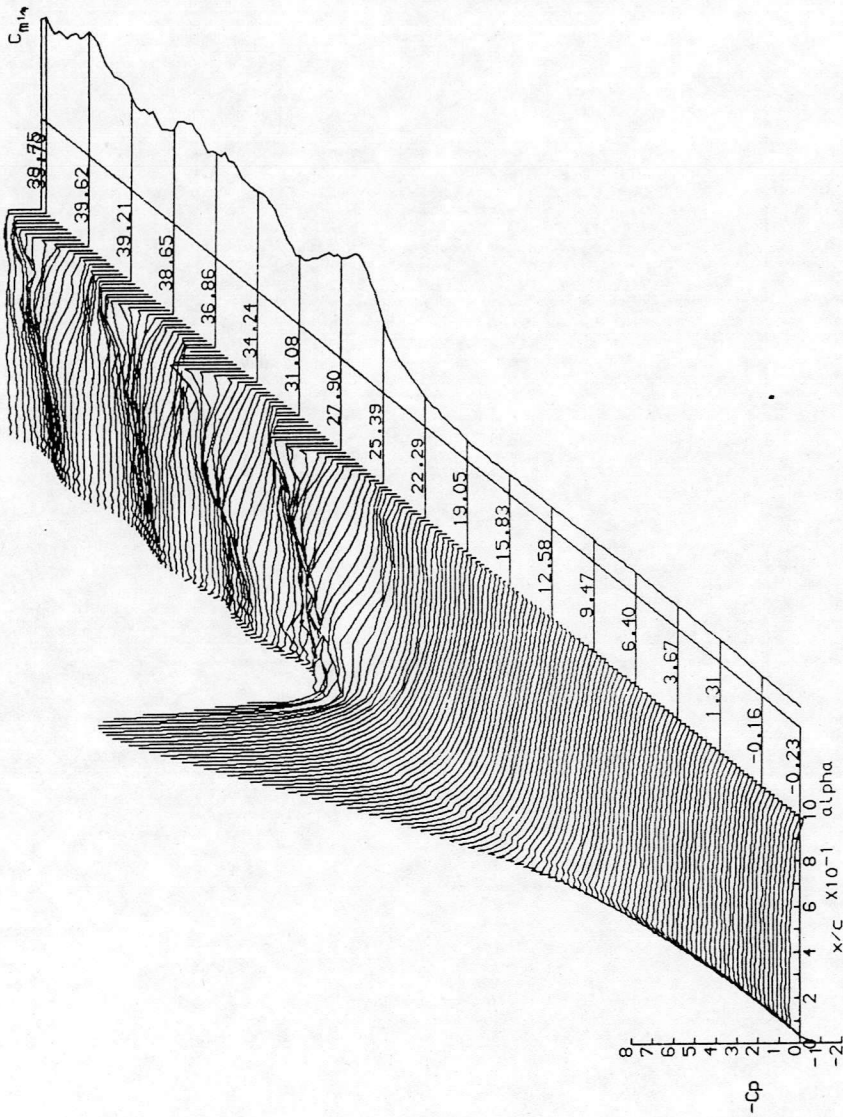
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

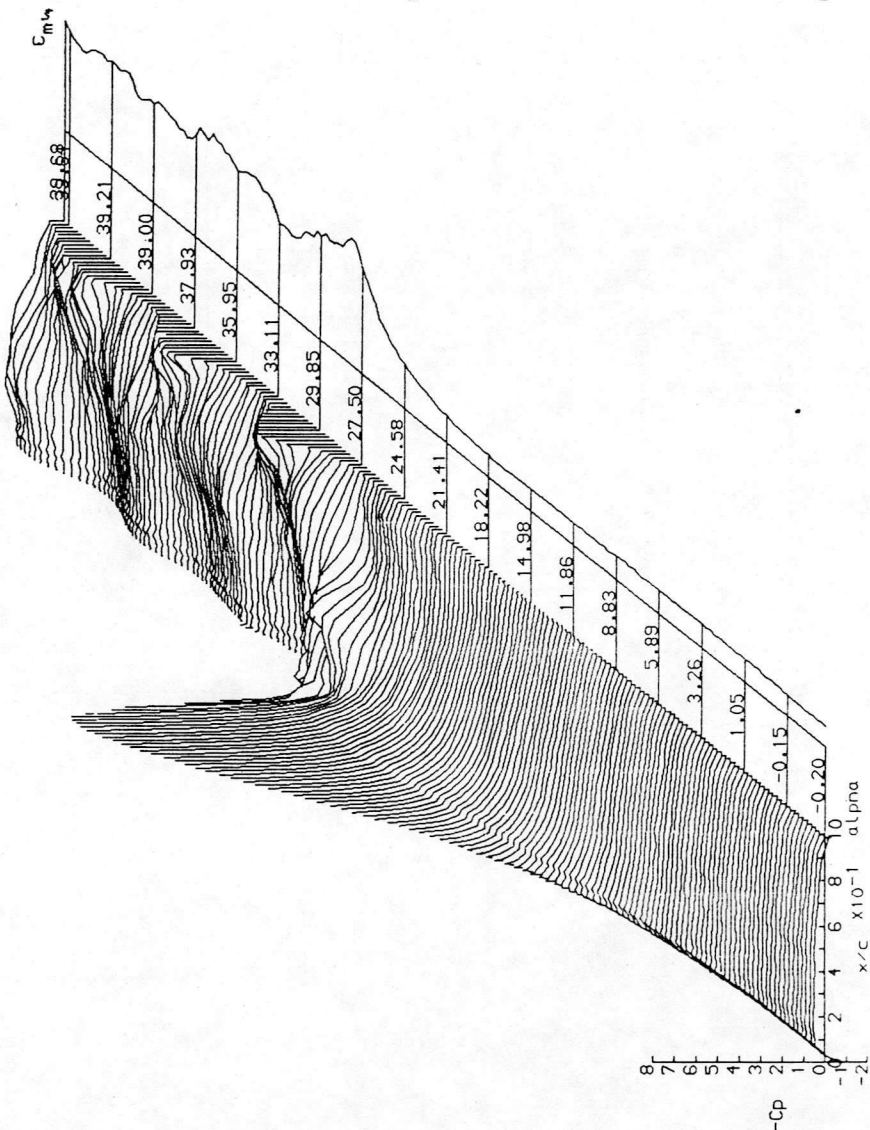
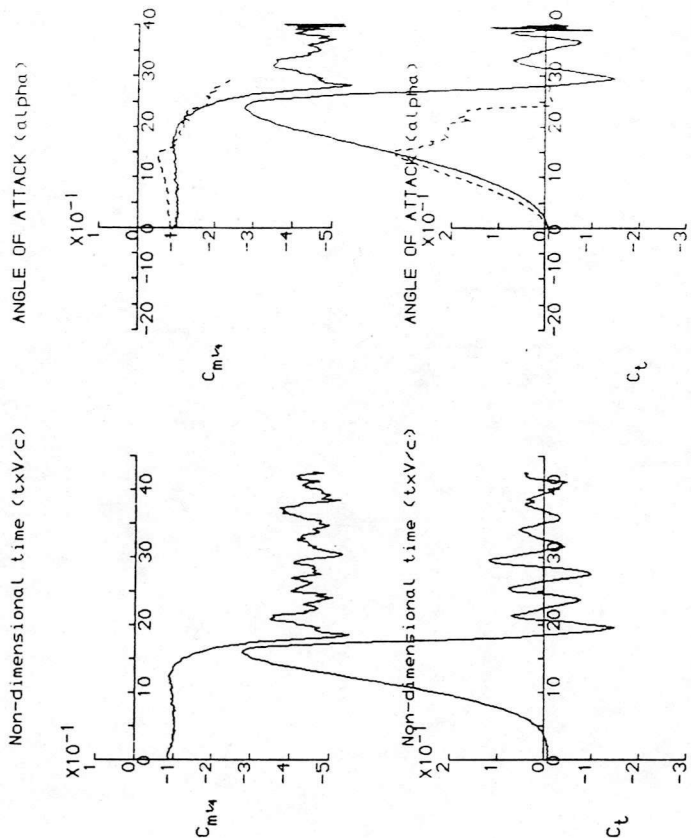
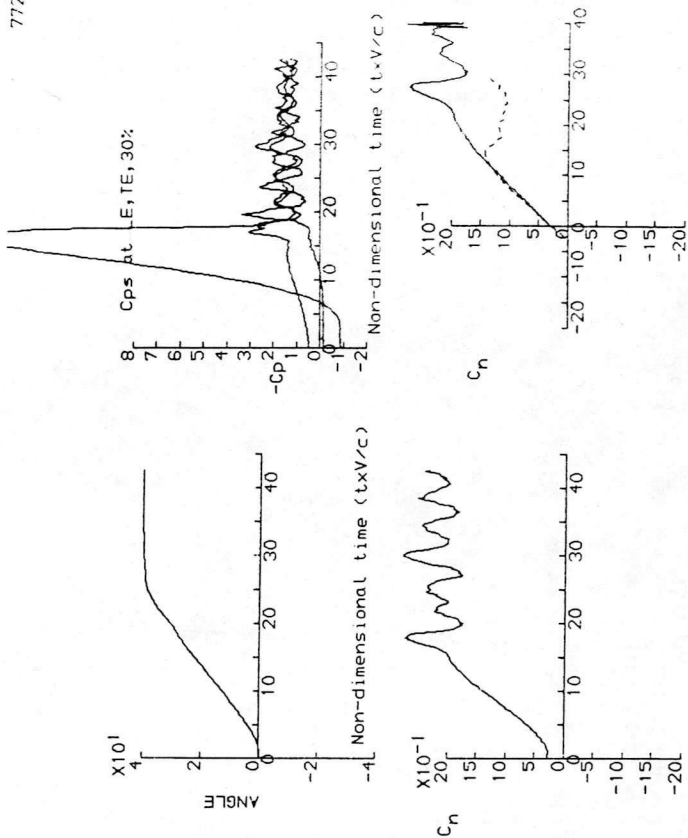
RUN REFERENCE NUMBER: 27711
 REYNOLDS NUMBER = 1478639.
 DYNAMIC PRESSURE = 1014.03 Nm²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 29.2°C
 SAMPLING FREQUENCY = 400.00 Hz.
 REDUCED PITCH RATE = 0.01493
 LINEAR PITCH RATE = 128.52°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

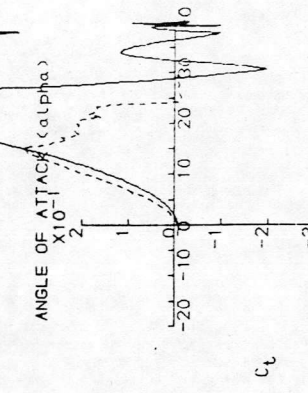
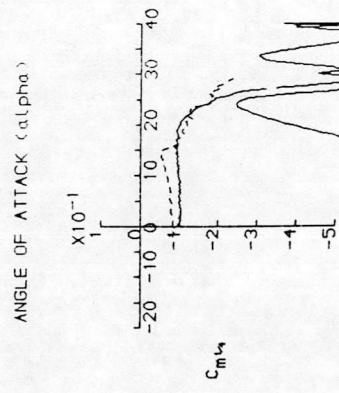
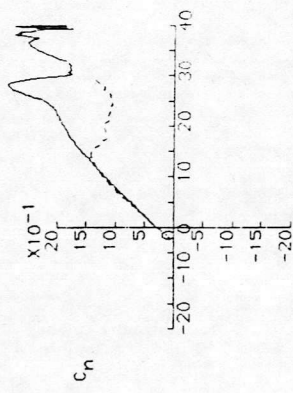
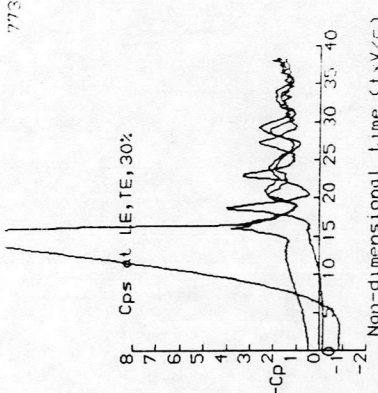
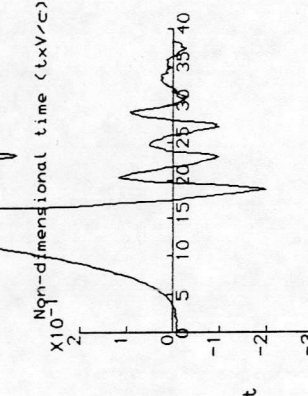
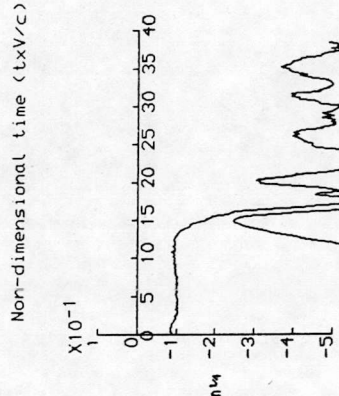
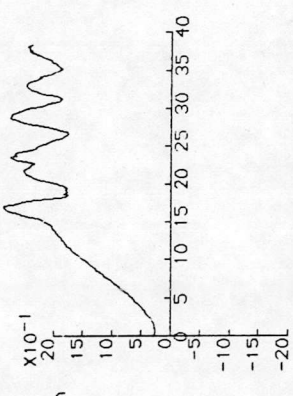
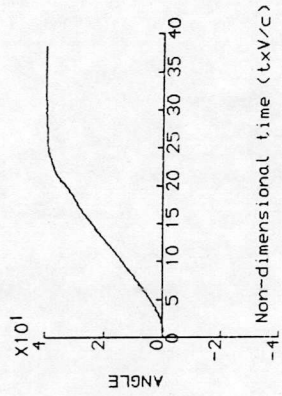
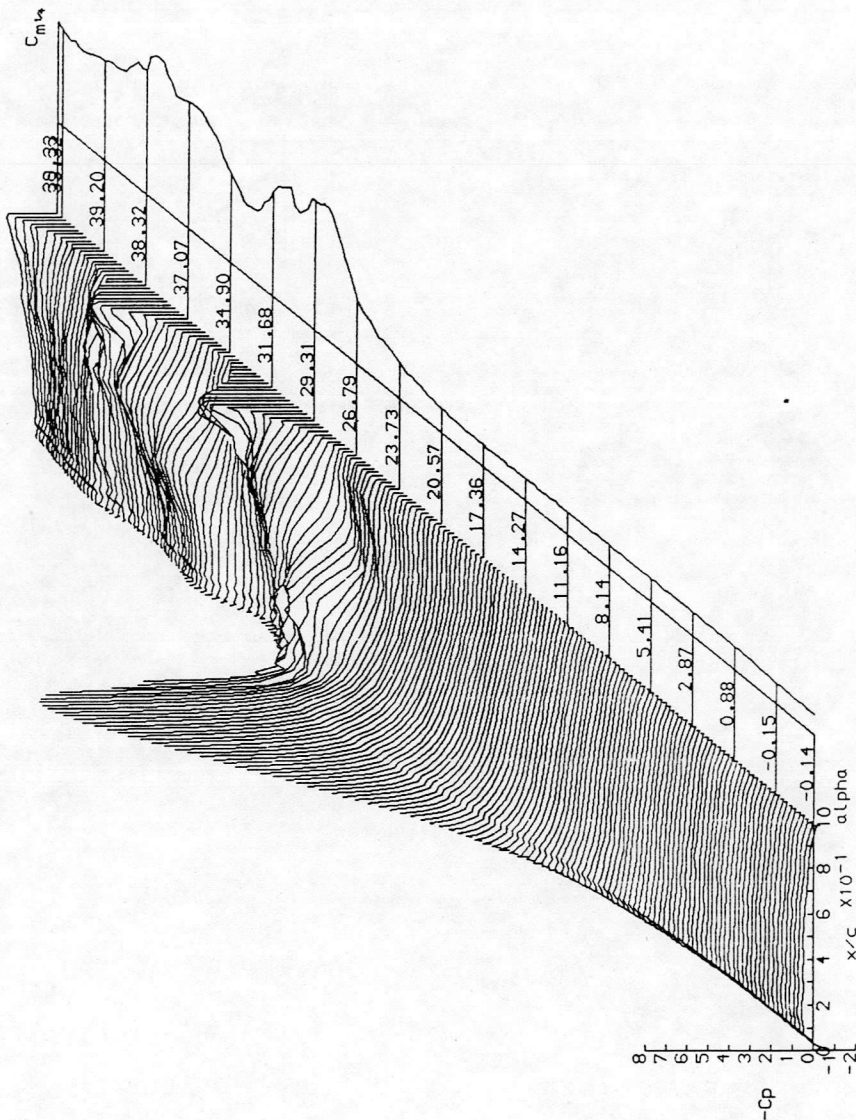
RUN REFERENCE NUMBER: 27721
 REYNOLDS NUMBER = 1473030.
 DYNAMIC PRESSURE = 1014.03 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 30.1°C
 SAMPLING FREQUENCY = 450.05 Hz.
 REDUCED PITCH RATE = 0.01644
 LINEAR PITCH RATE = 141.76°s⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27731
 RETNOLDS NUMBER = 1471169.
 DYNAMIC PRESSURE = 1014.03 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES

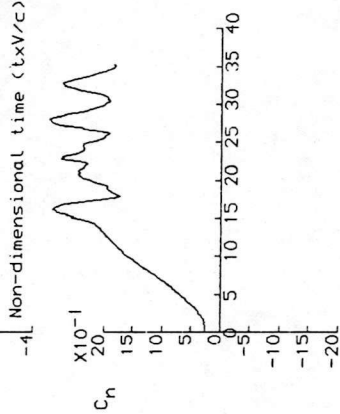
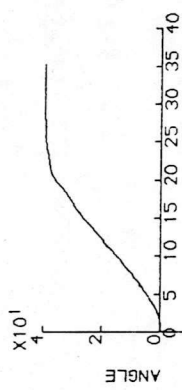
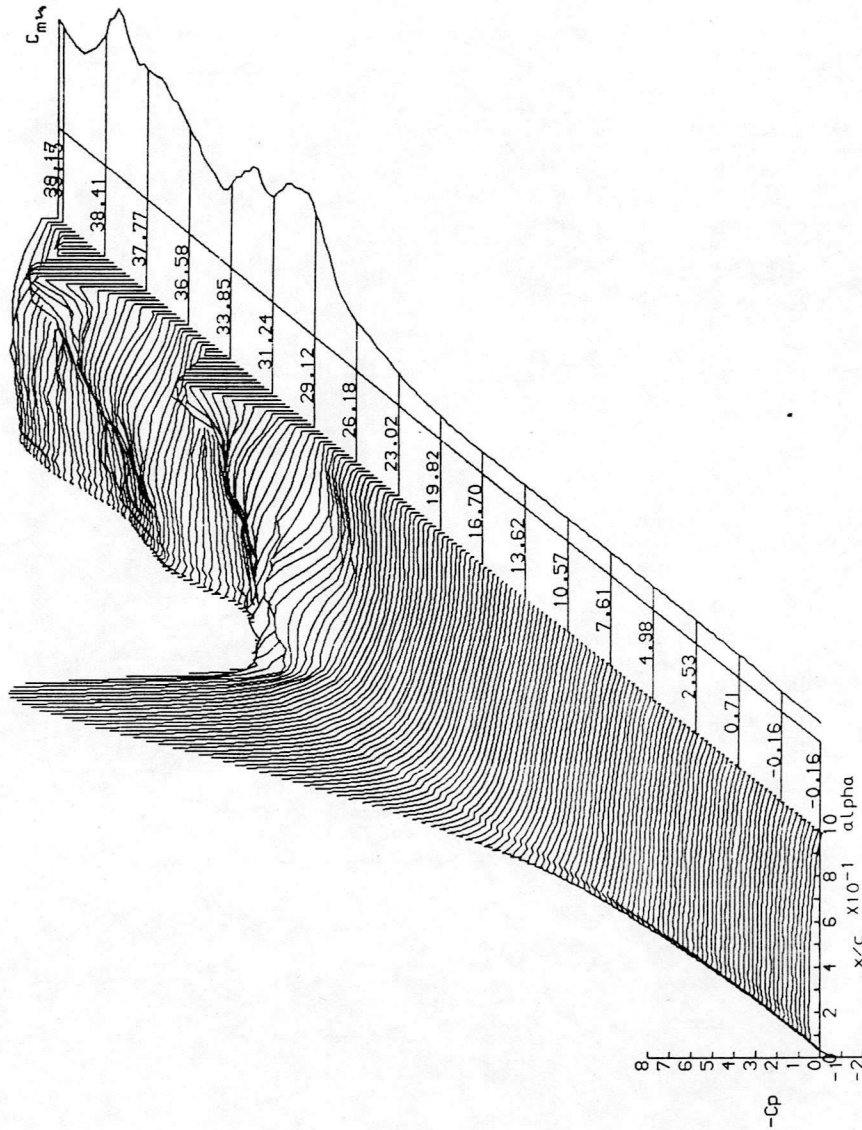
DATE OF TEST: 13/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 30.4°C
 SAMPLING FREQUENCY = 500.00 Hz.
 REDUCED PITCH RATE = 0.01814
 LINEAR PITCH RATE = 156.50°S⁻¹



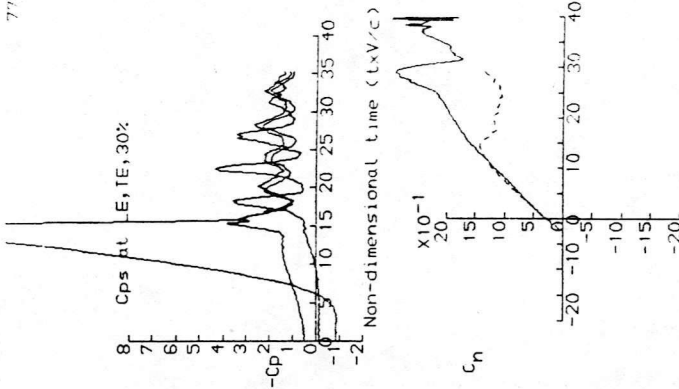
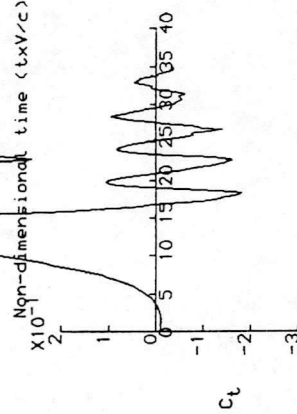
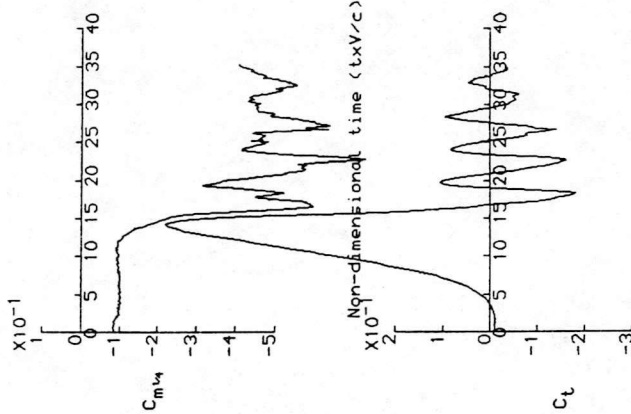
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27741
 REYNOLDS NUMBER = 1469313.
 DYNAMIC PRESSURE = 1014.03 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.1119
 AIR TEMPERATURE = 30.7°C
 SAMPLING FREQUENCY = 544.96 Hz.
 REDUCED PITCH RATE = 0.01936
 LINEAR PITCH RATE = 167.12°S⁻¹

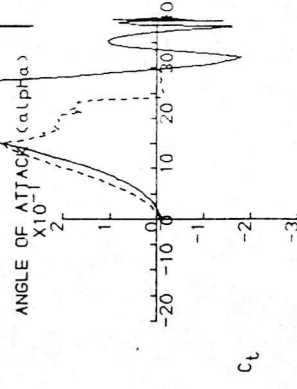
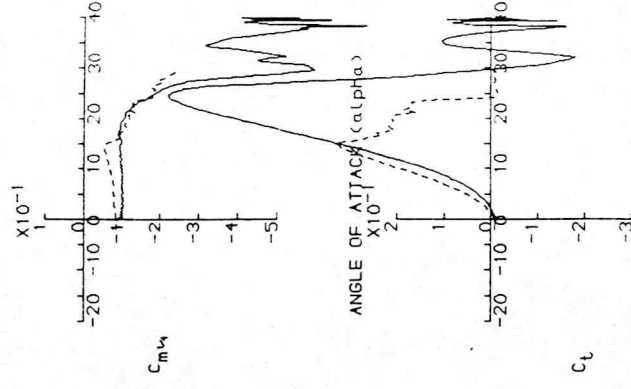
AVERAGED DATA OF 5 CYCLES



Non-dimensional time (txV/c)



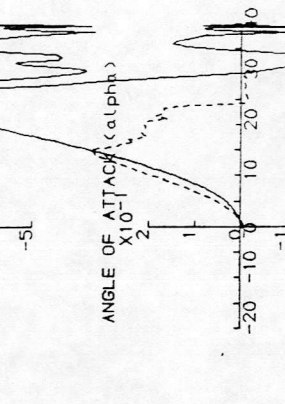
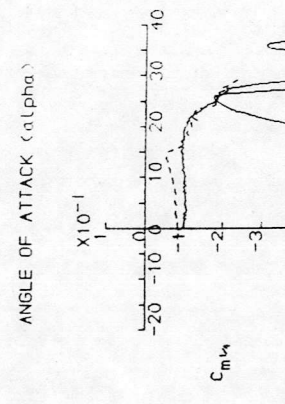
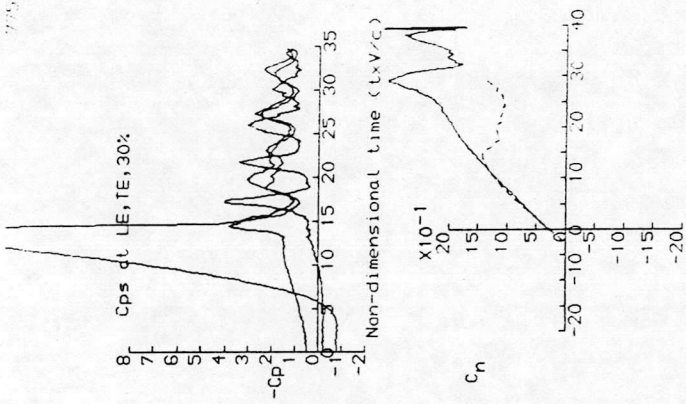
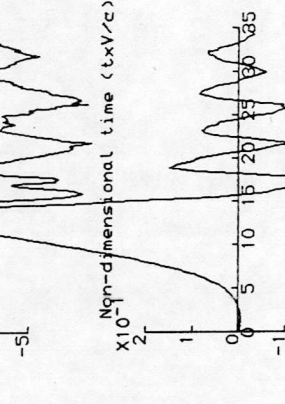
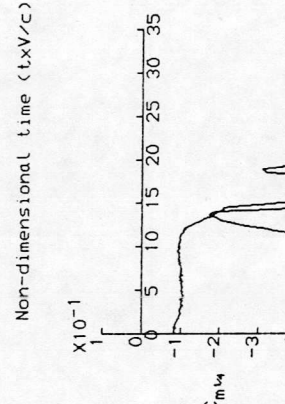
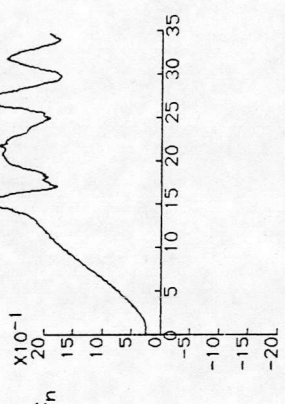
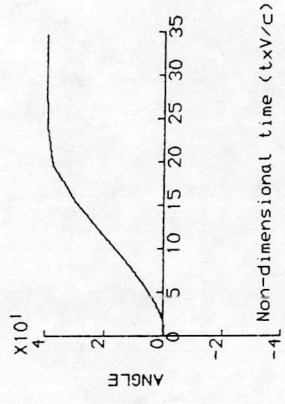
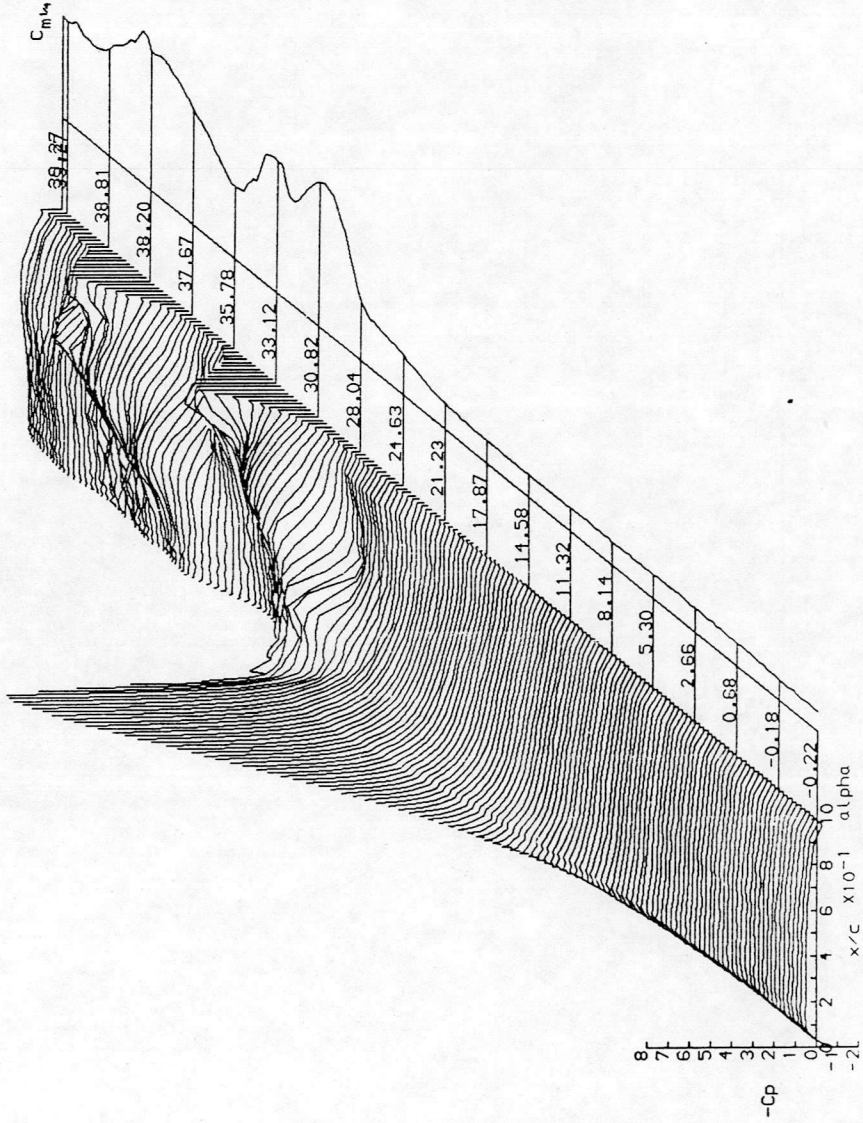
ANGLE OF ATTACK (alpha)



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27751
 REYNOLDS NUMBER = 1472688.
 DYNAMIC PRESSURE = 1005.88 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.2°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.02104
 LINEAR PITCH RATE = 180.42°S⁻¹

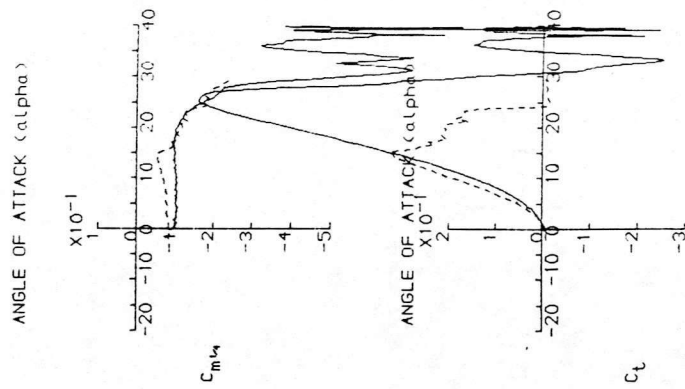
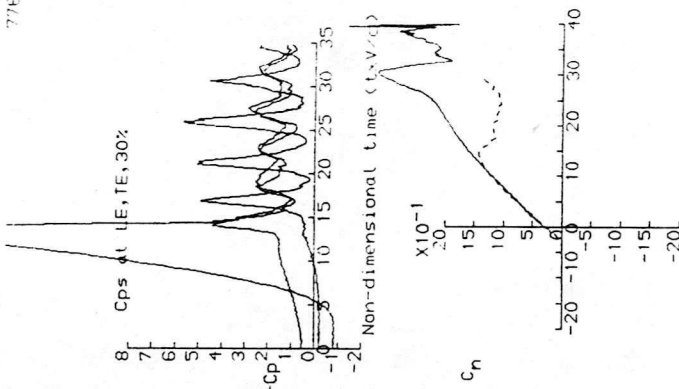
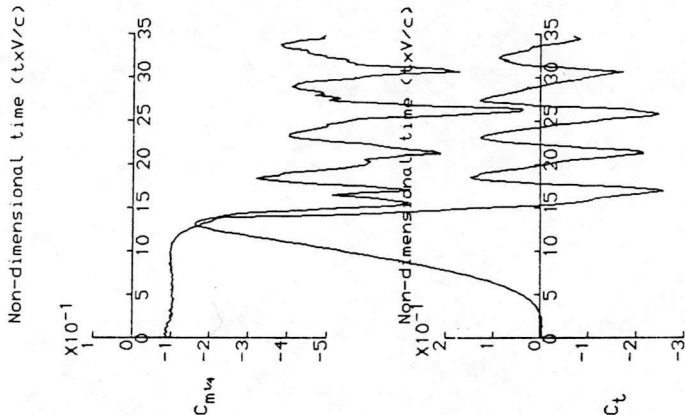
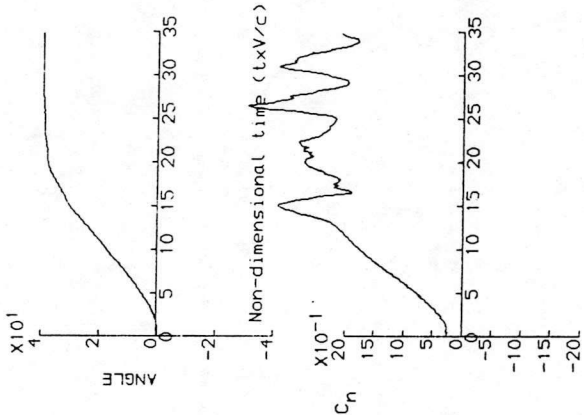
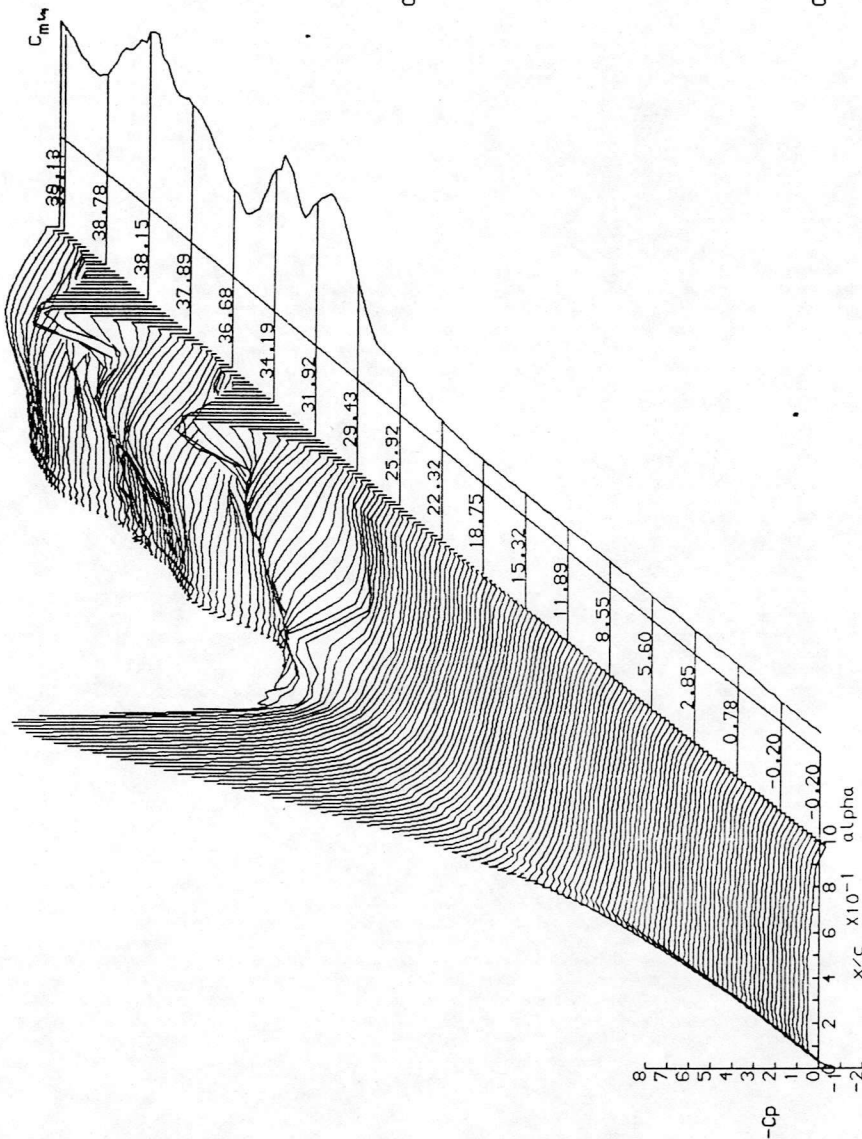
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

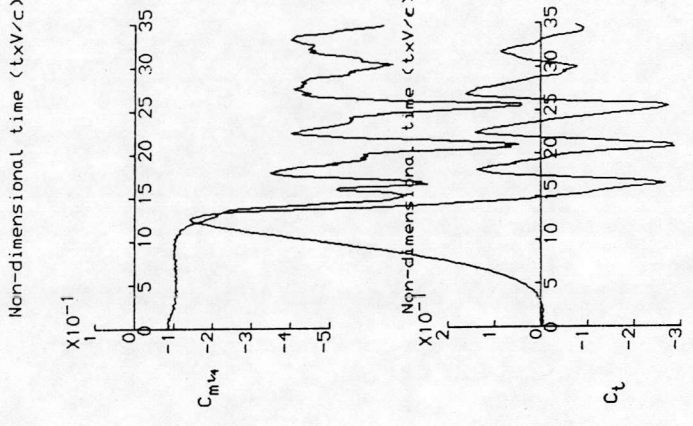
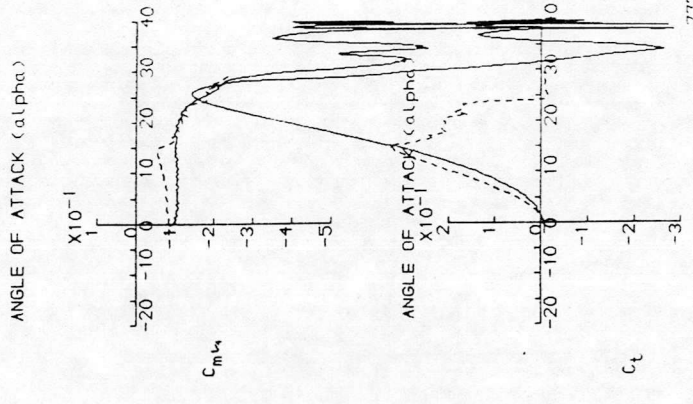
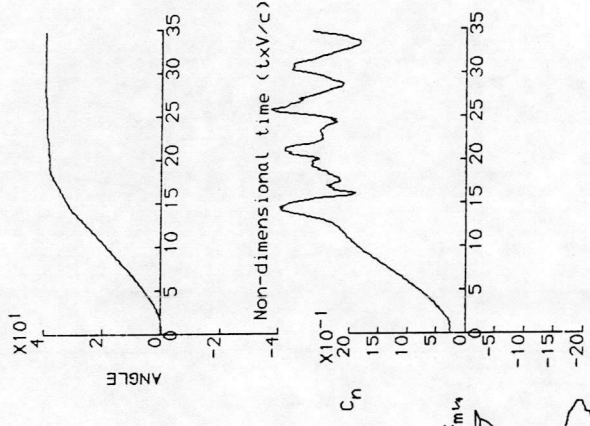
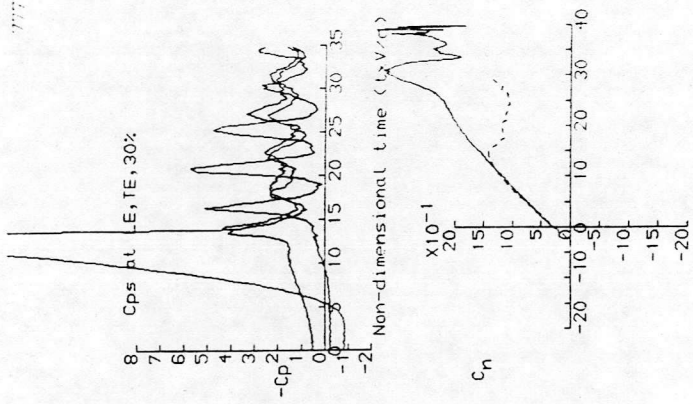
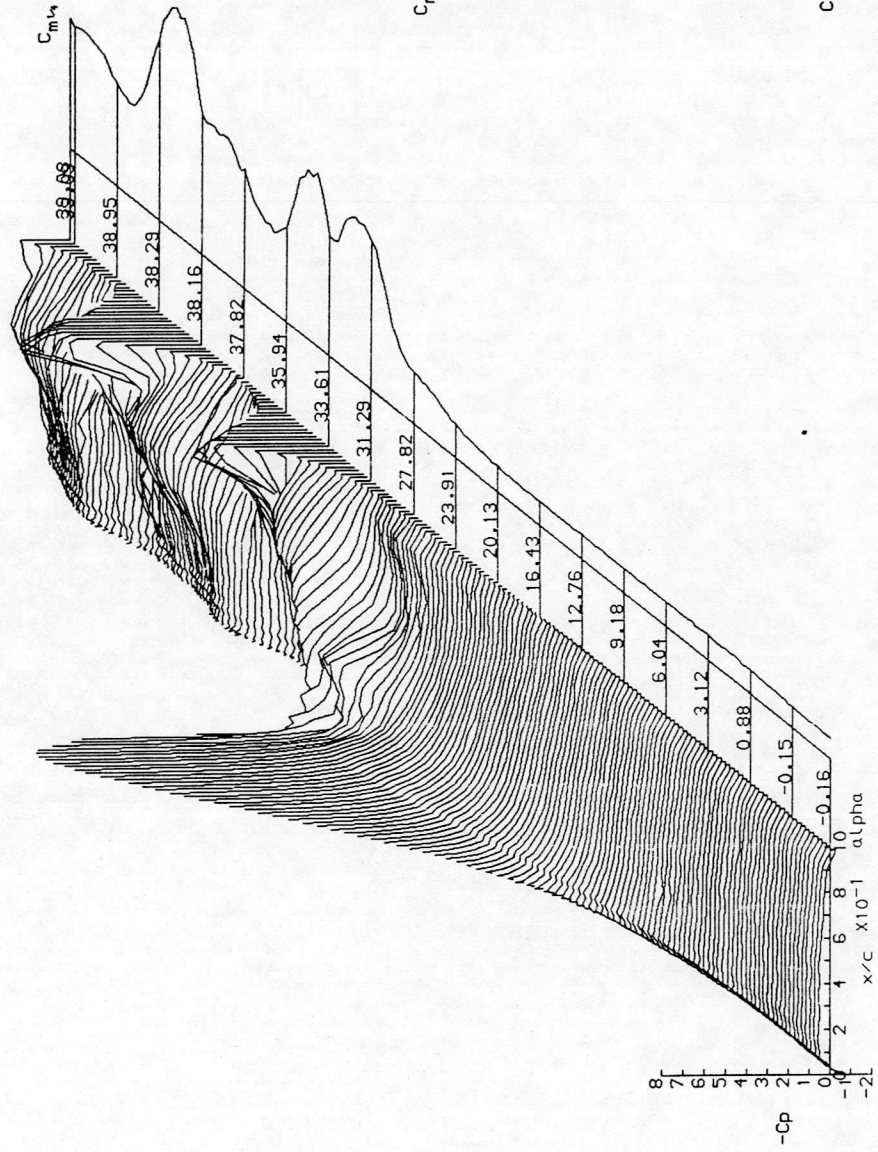
RUN REFERENCE NUMBER: 27761
 REYNOLDS NUMBER = 1466483.
 DYNAMIC PRESSURE = 1005.88 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.2°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.02201
 LINEAR PITCH RATE = 189.09°S⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

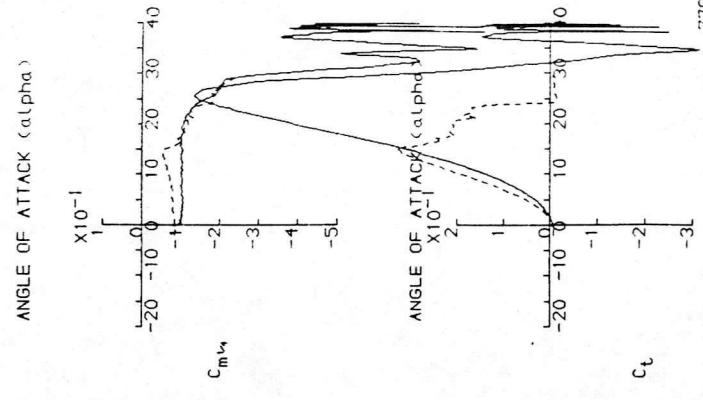
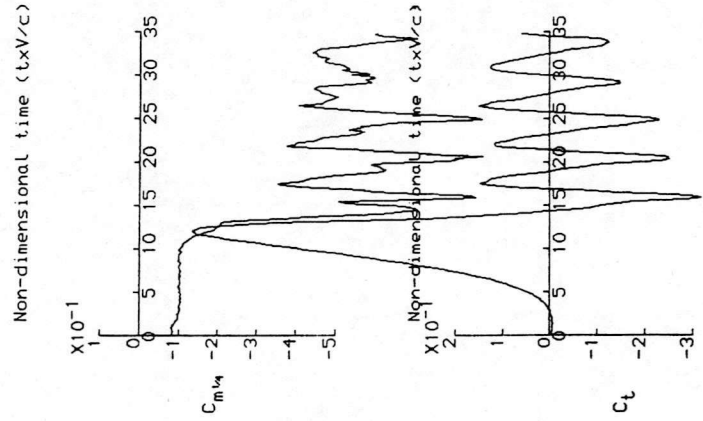
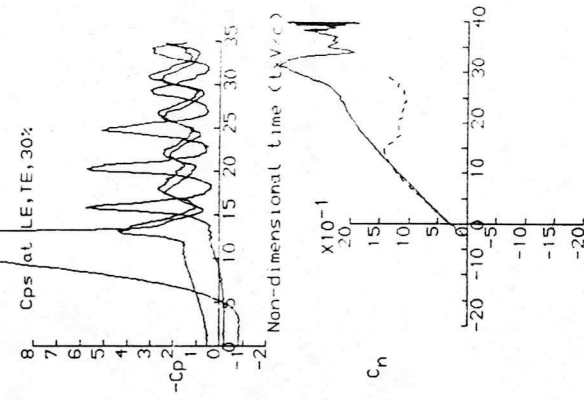
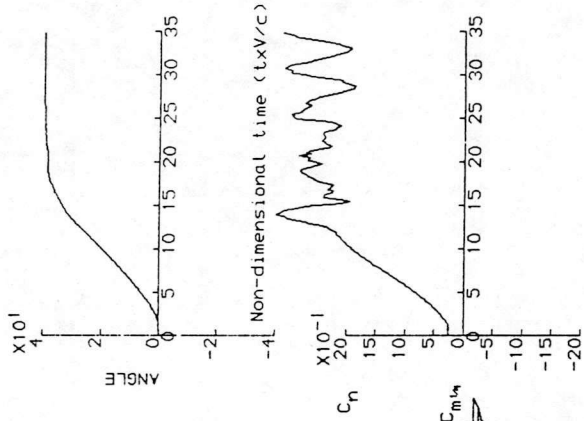
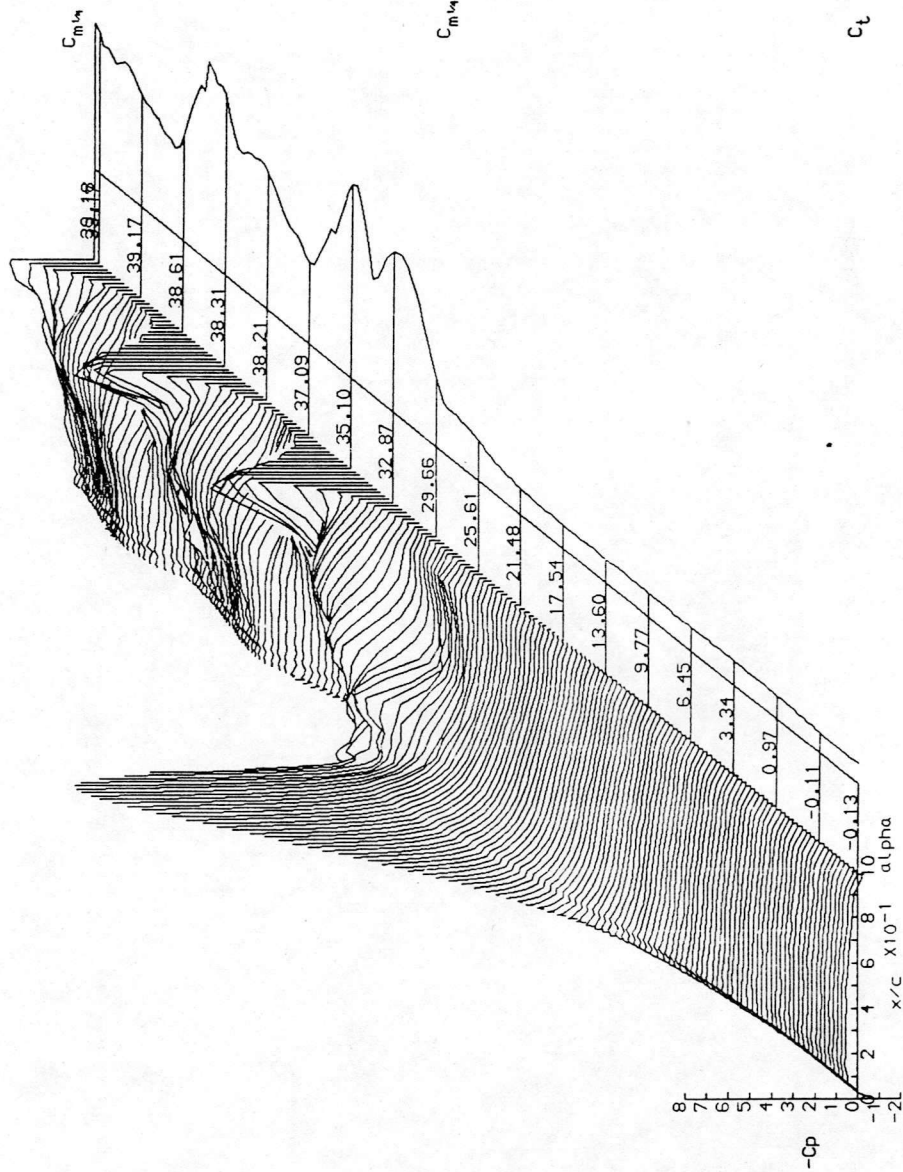
RUN REFERENCE NUMBER: 27771
 REYNOLDS NUMBER = 1465248.
 DYNAMIC PRESSURE = 1005.88 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.4°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.02365
 LINEAR PITCH RATE = 203.24°S⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

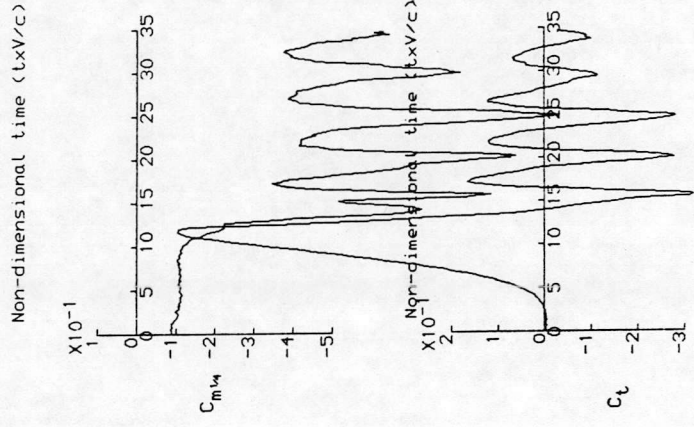
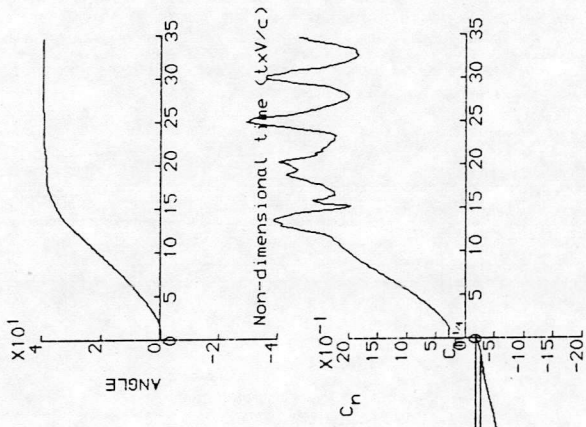
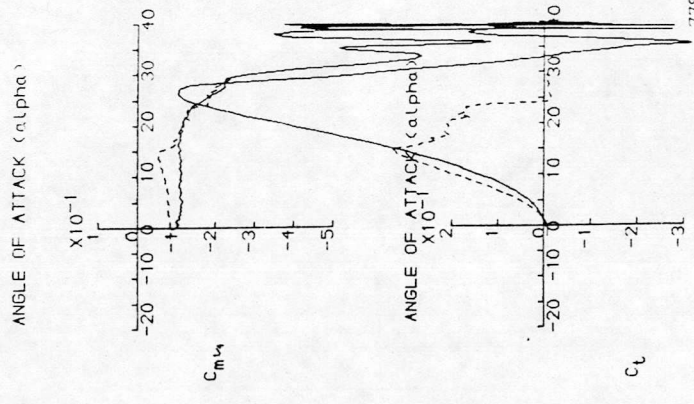
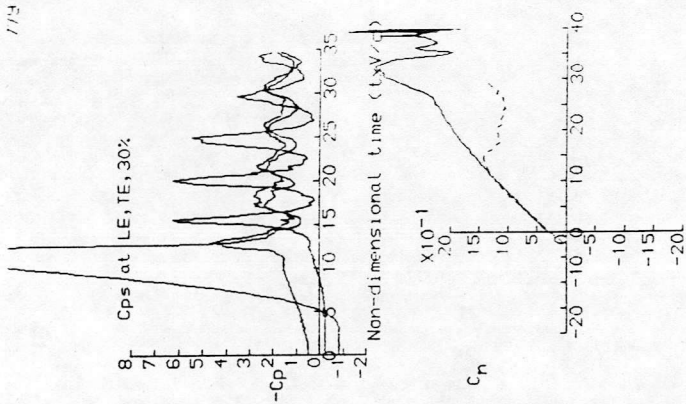
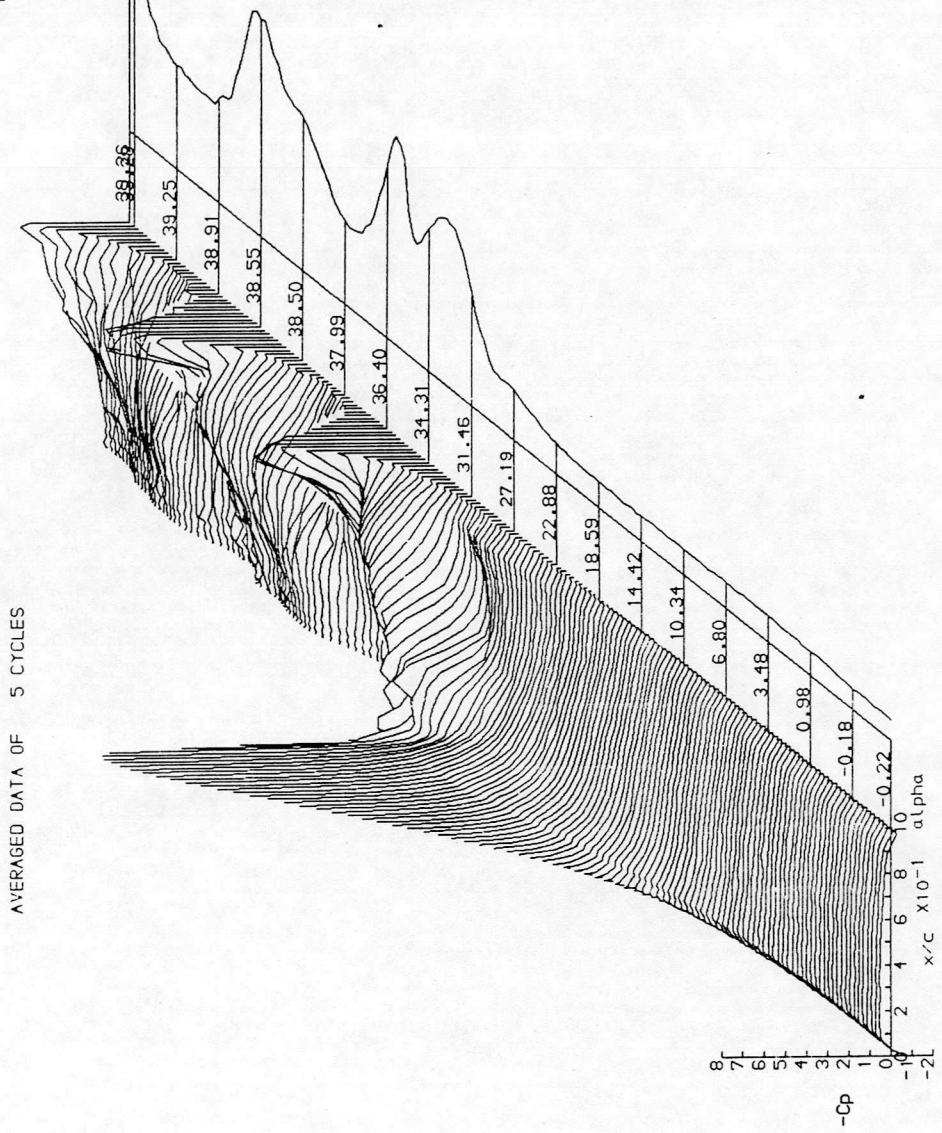
RUN REFERENCE NUMBER: 27781
 REYNOLDS NUMBER = 1464015.
 DYNAMIC PRESSURE = 1005.88 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.6°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.02498
 LINEAR PITCH RATE = 214.70°s⁻¹

AVERAGED DATA OF 5 CYCLES



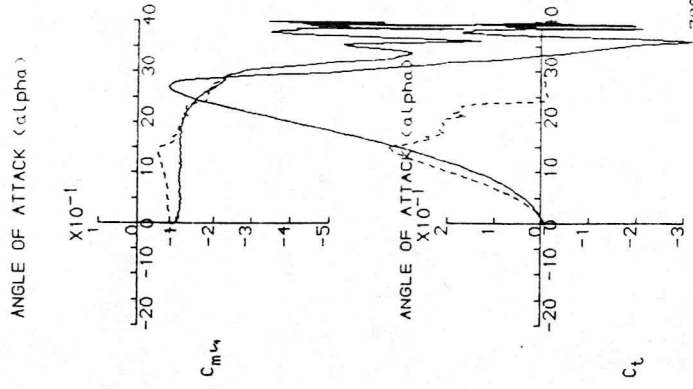
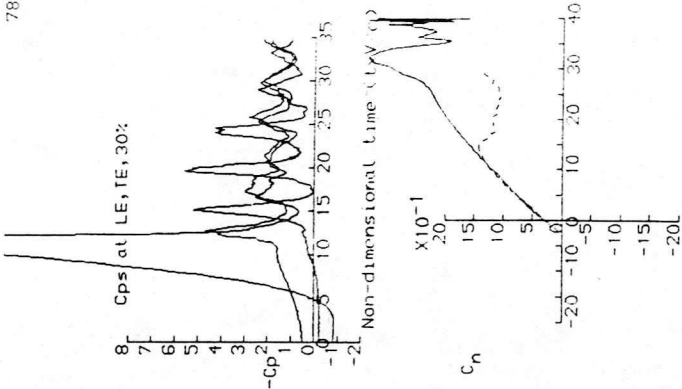
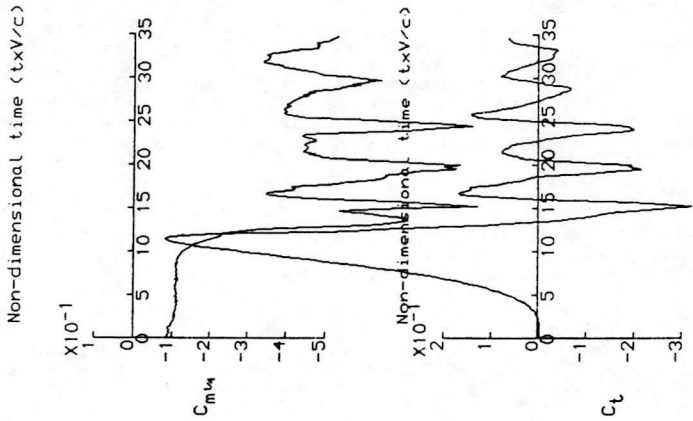
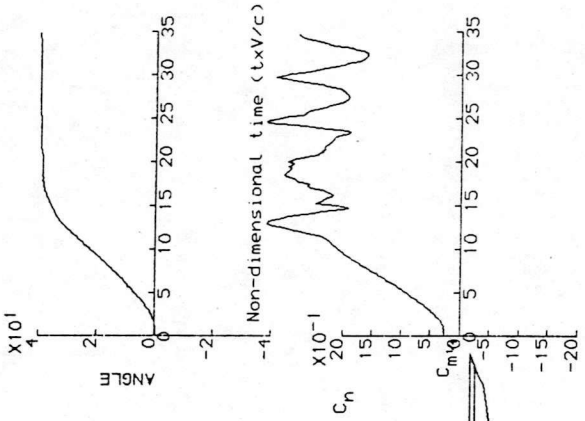
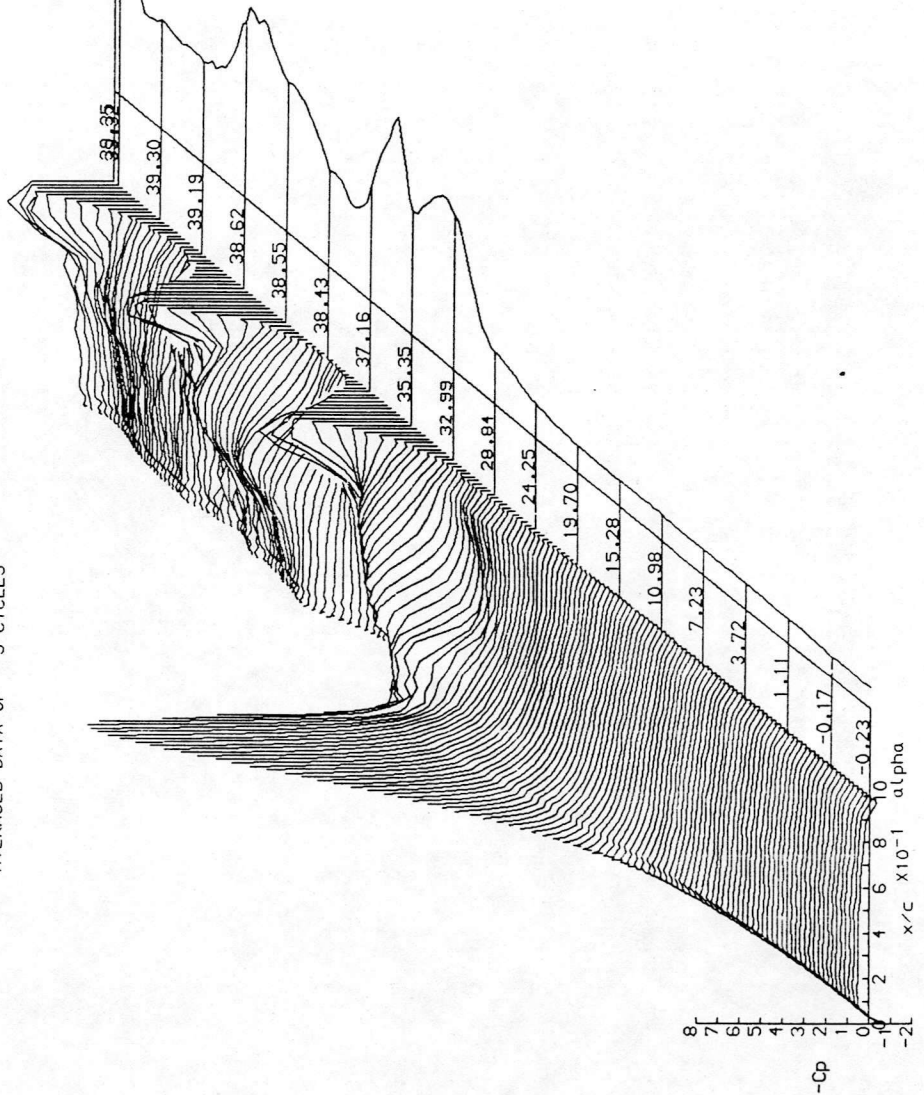
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27791
 REYNOLDS NUMBER = 1472895.
 DYNAMIC PRESSURE = 1005.31 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.1°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.02671
 LINEAR PITCH RATE = 228.98°s⁻¹



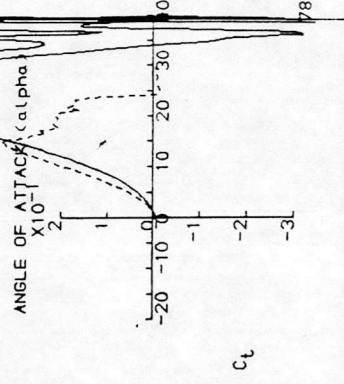
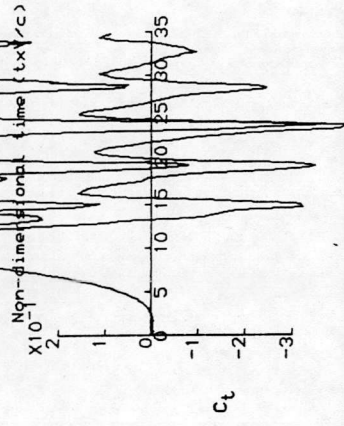
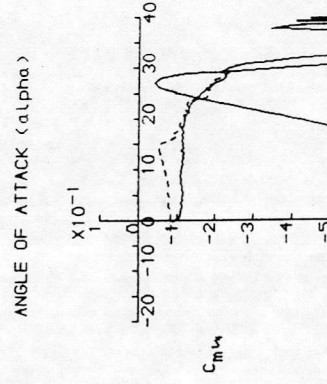
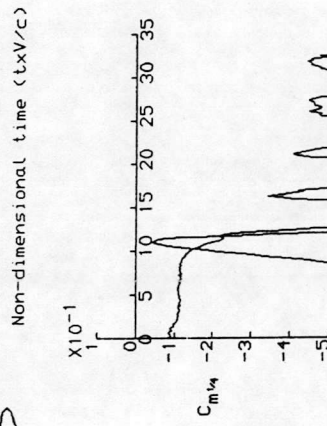
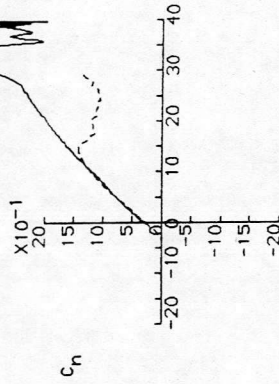
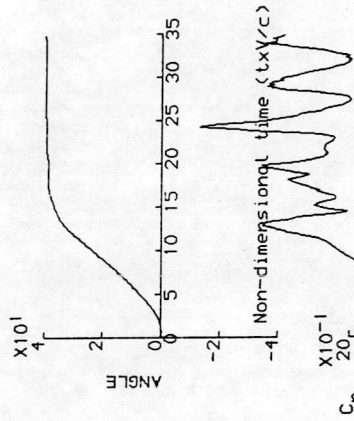
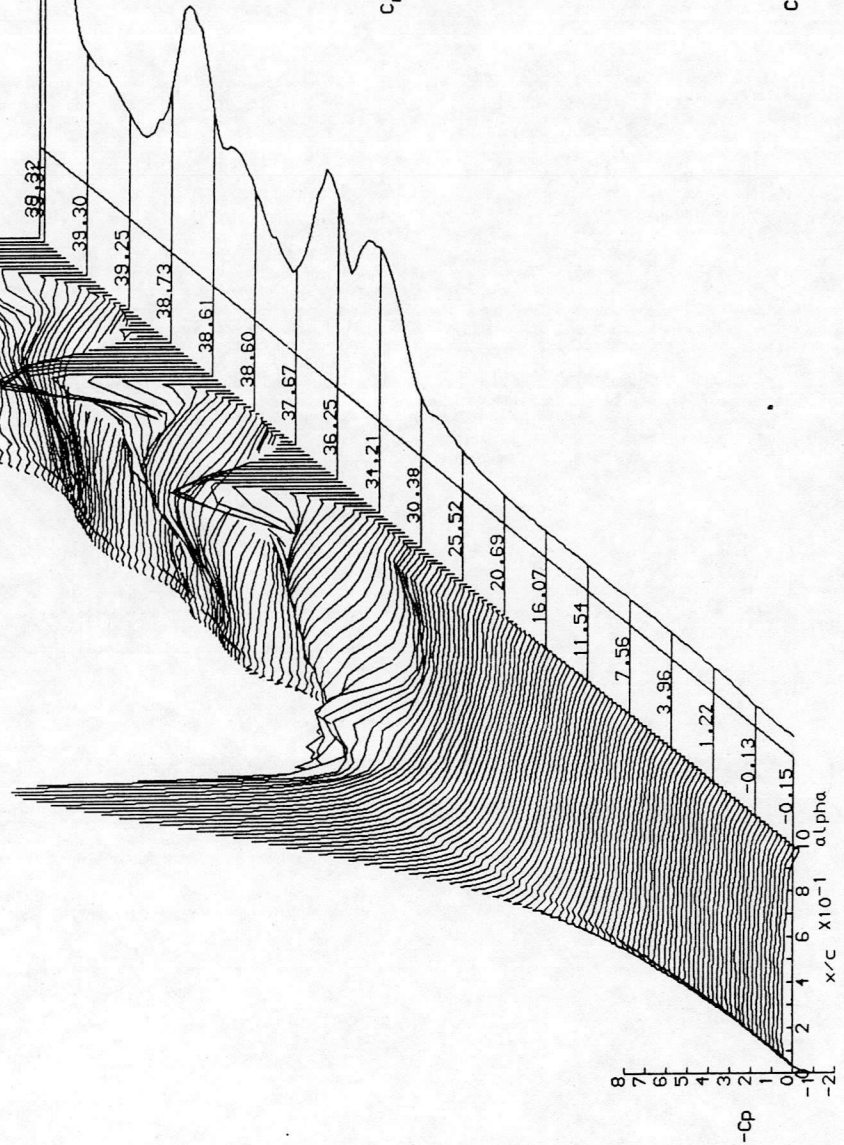
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27801
 RETNOLDS NUMBER = 1467924.
 DYNAMIC PRESSURE = 1005.31 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.9°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.02810
 LINEAR PITCH RATE = 241.15°S⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

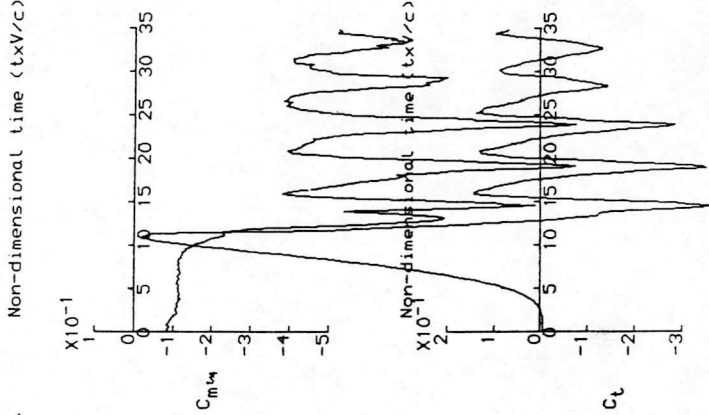
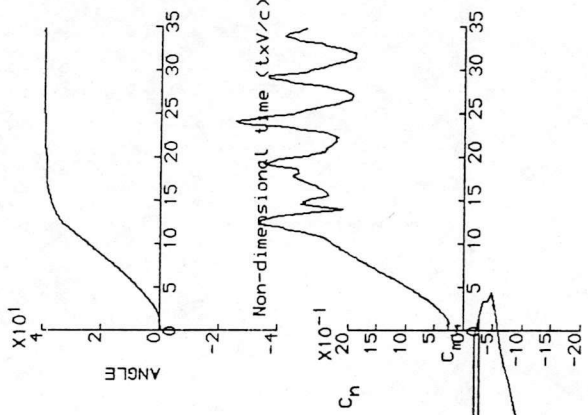
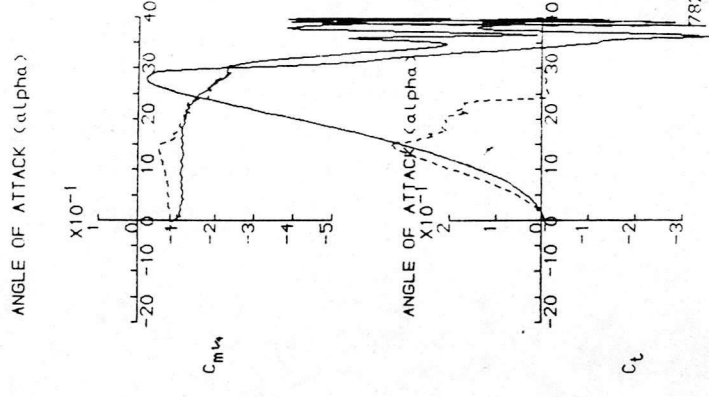
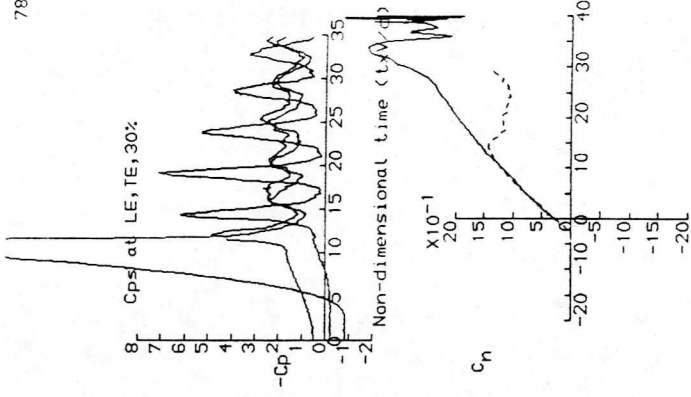
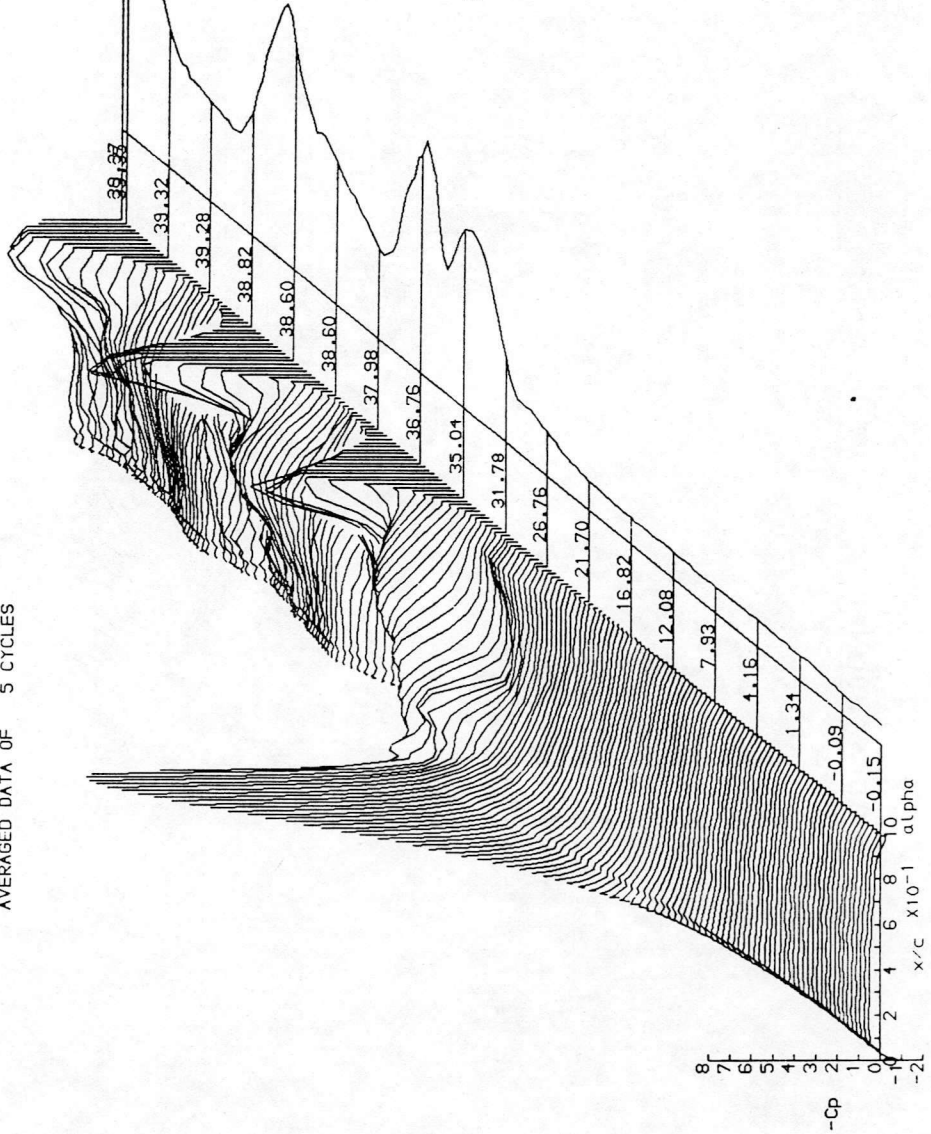
RUN REFERENCE NUMBER: 27811
 DATE OF TEST: 13/12/88
 REYNOLDS NUMBER = 1163451.
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1005.31 Nm⁻²
 AIR TEMPERATURE = 30.3°C
 NUMBER OF CYCLES = 5
 SAMPLING FREQUENCY = 550.05 Hz.
 MOTION TYPE: RAMP UP
 REDUCED PITCH RATE = 0.02885
 START ANGLE = -1.00°
 LINEAR PITCH RATE = 247.76°s⁻¹
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27821
 REYNOLDS NUMBER = 1461217.
 DYNAMIC PRESSURE = 1005.31 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.5°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.03030
 LINEAR PITCH RATE = 260.29°s⁻¹

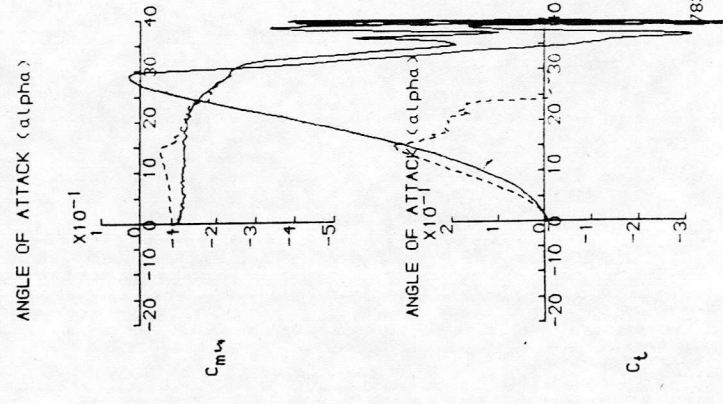
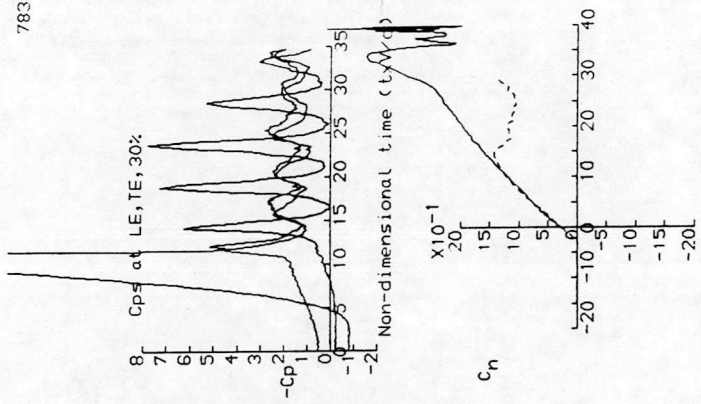
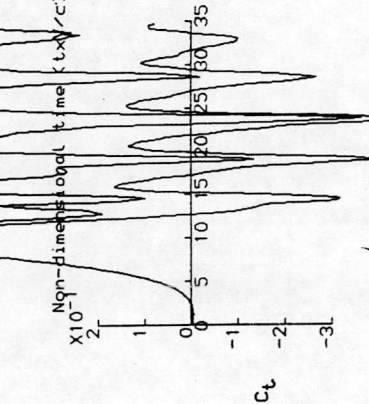
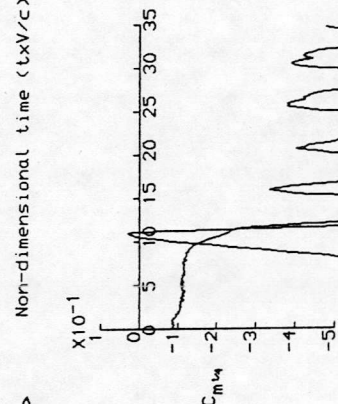
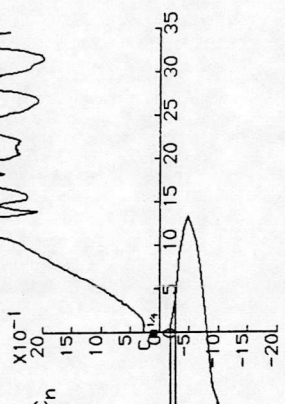
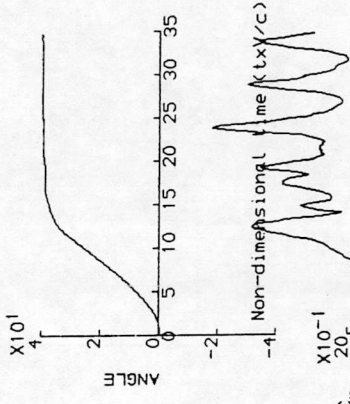
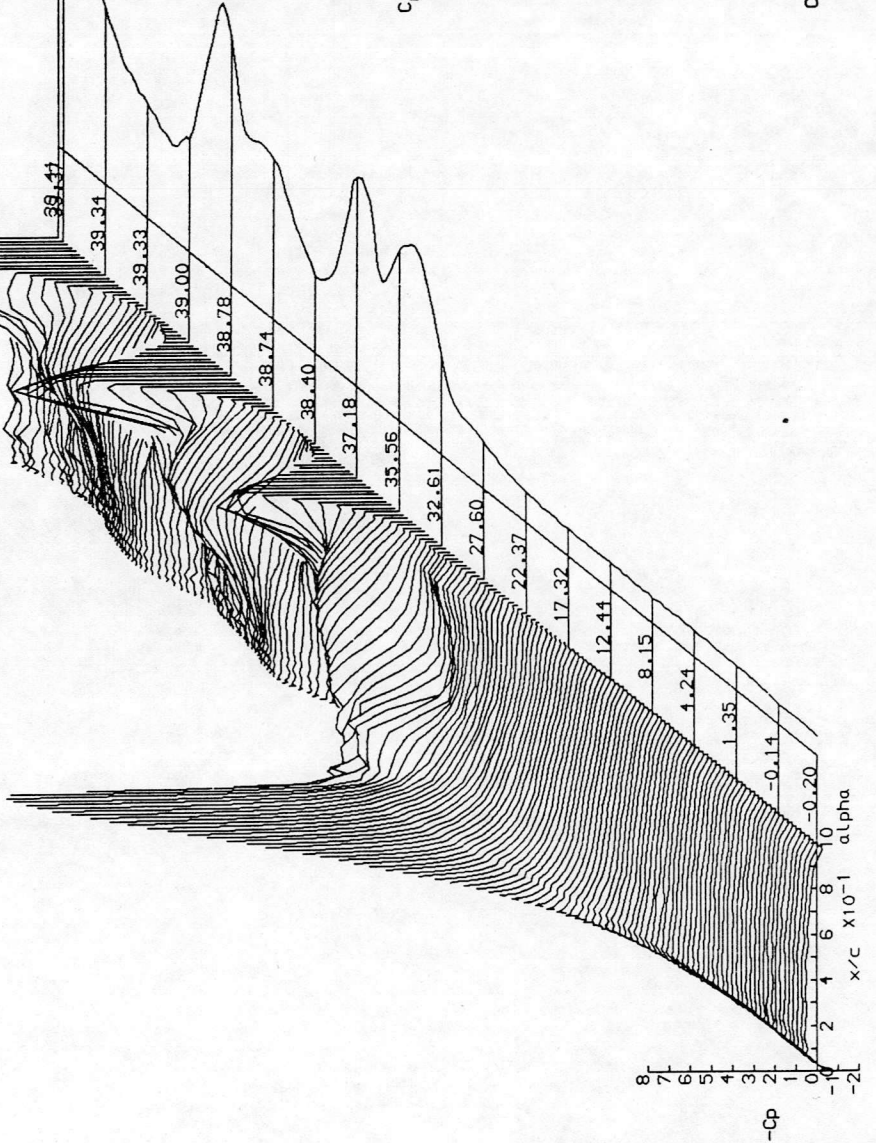
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27831
 RETYNOLDS NUMBER = 1474951.
 DYNAMIC PRESSURE = 1007.27 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES

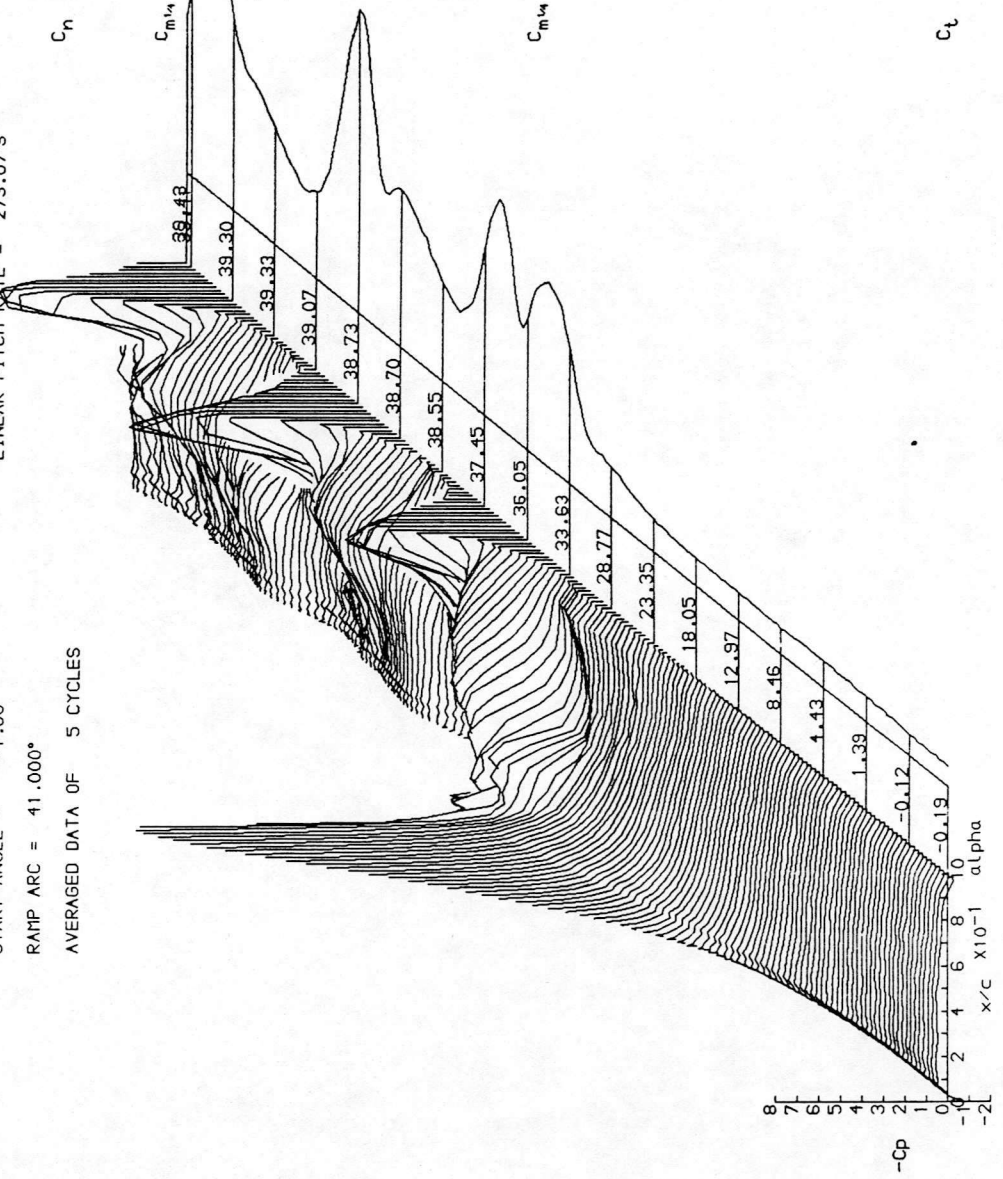
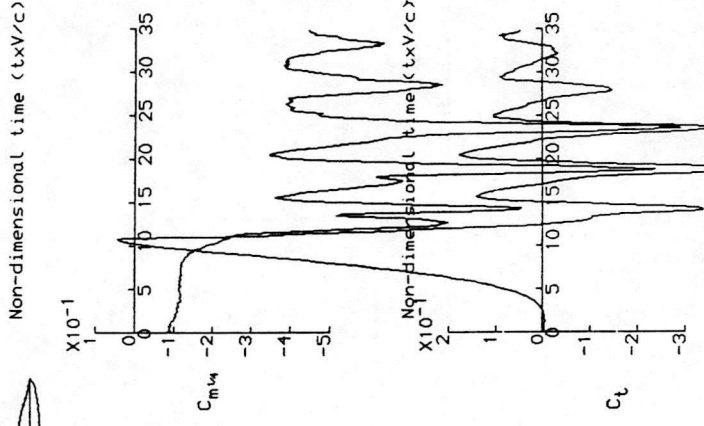
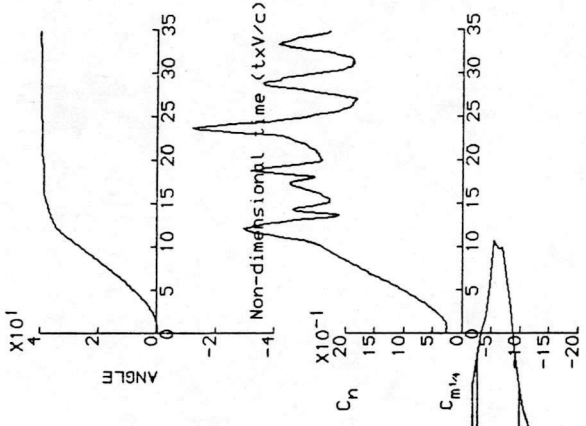
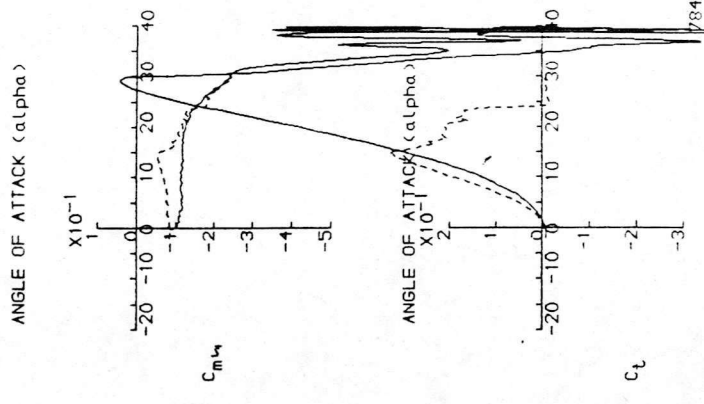
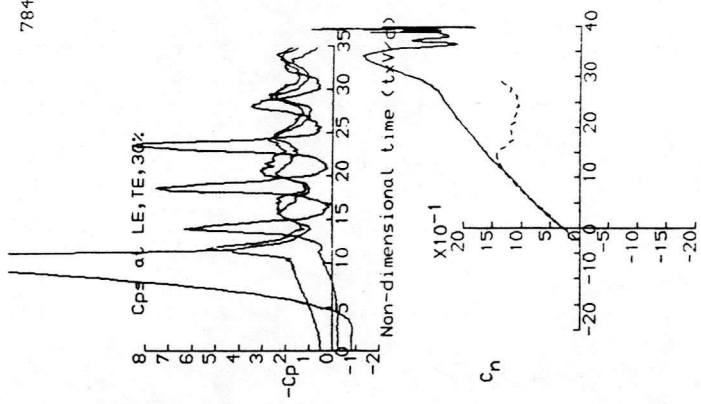
DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.0°C
 SAMPLING FREQUENCY = 550.05 HZ.
 REDUCED PITCH RATE = 0.03115
 LINEAR PITCH RATE = 267.20°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

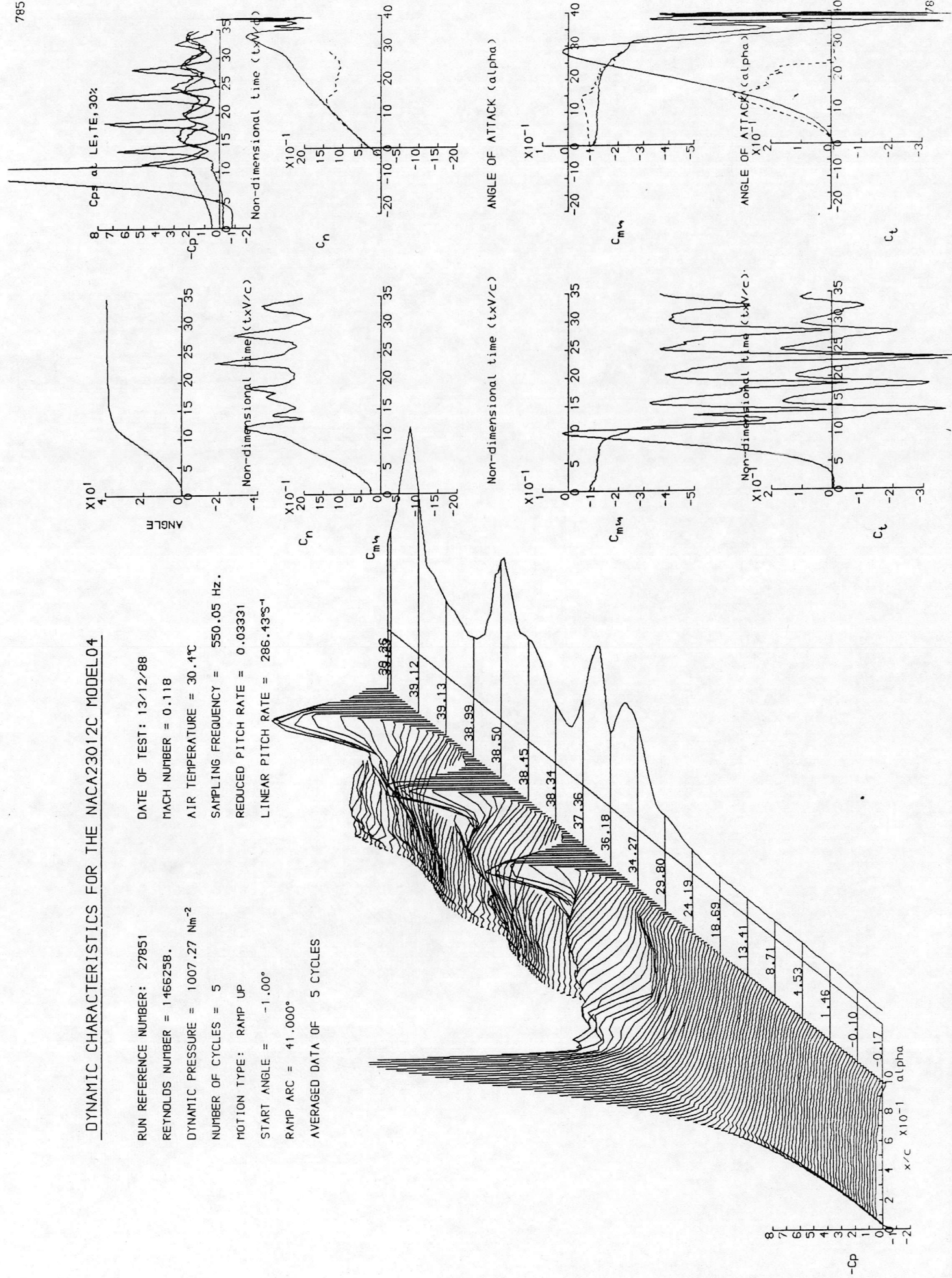
RUN REFERENCE NUMBER: 27841
 REYNOLDS NUMBER = 1468732.
 DYNAMIC PRESSURE = 1007.27 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.03178
 LINEAR PITCH RATE = 273.07°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

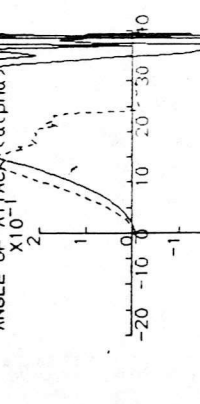
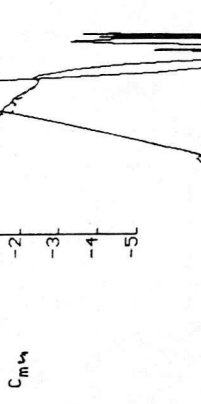
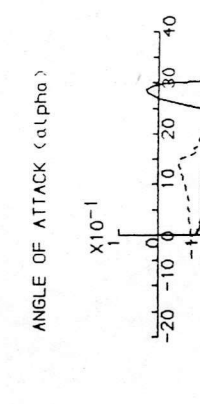
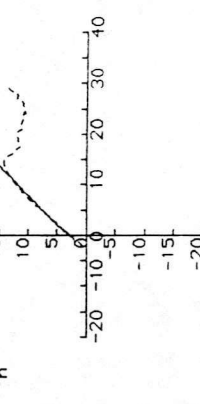
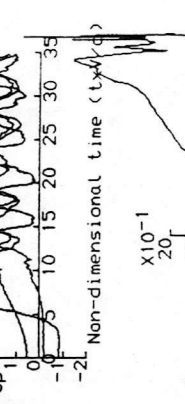
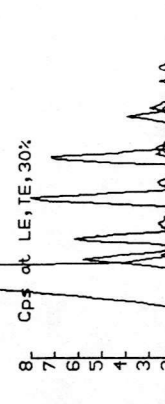
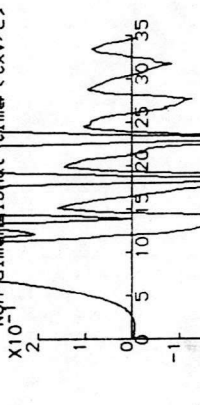
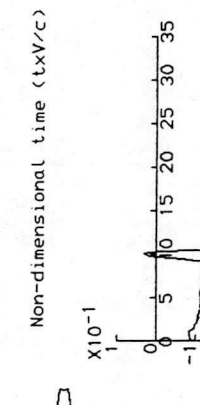
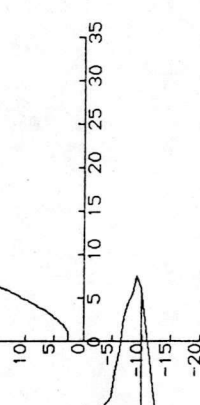
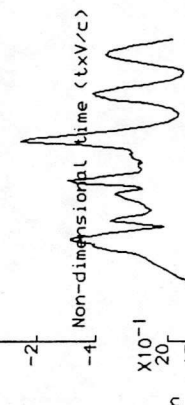
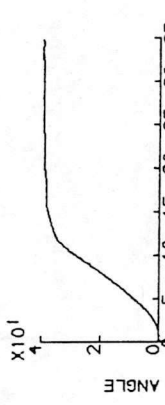
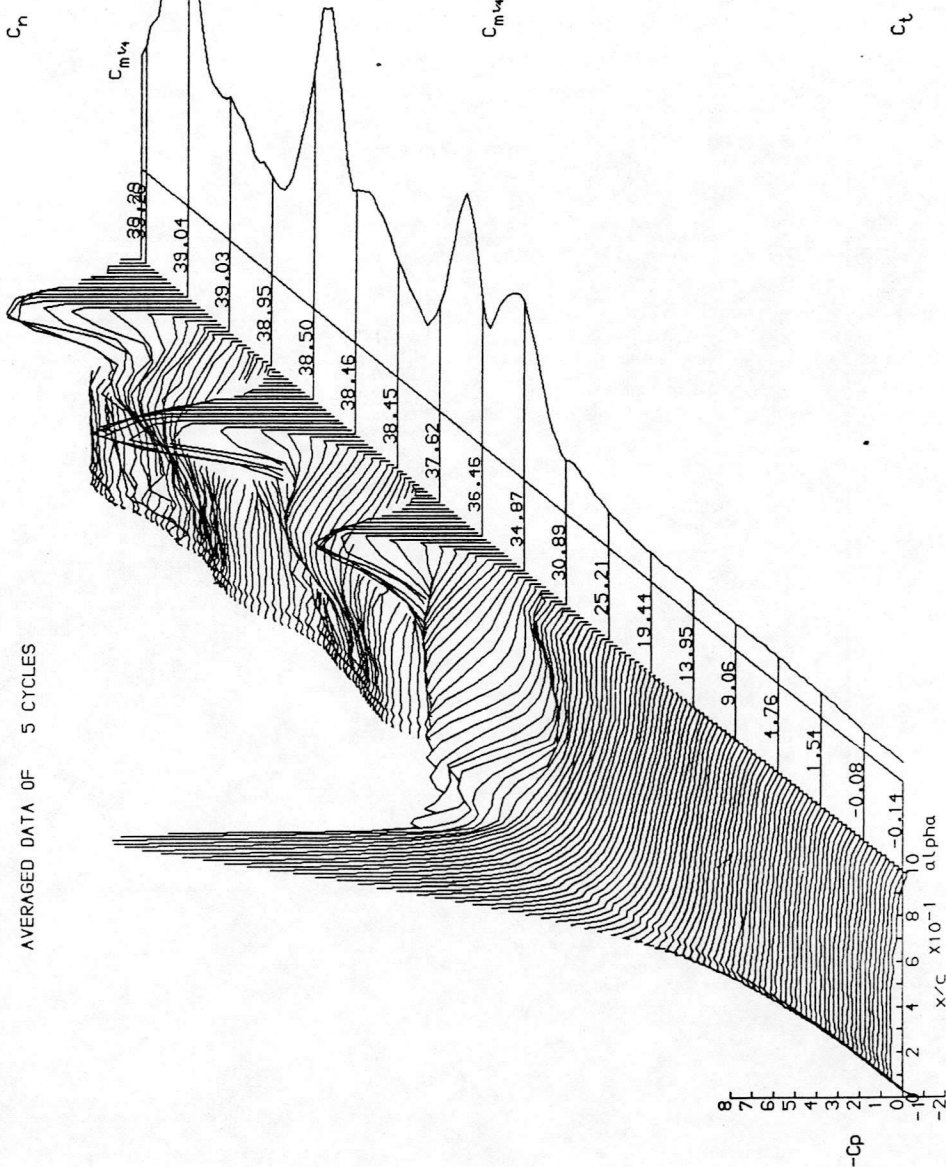
RUN REFERENCE NUMBER: 27851
 RETNOLDS NUMBER = 1466258.
 DYNAMIC PRESSURE = 1007.27 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.4°C
 SAMPLING FREQUENCY = 550.05 HZ.
 REDUCED PITCH RATE = 0.03331
 LINEAR PITCH RATE = 286.43°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27861
 REYNOLDS NUMBER = 1461408.
 DYNAMIC PRESSURE = 1007.27 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.7°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.03405
 LINEAR PITCH RATE = 292.95°s⁻¹

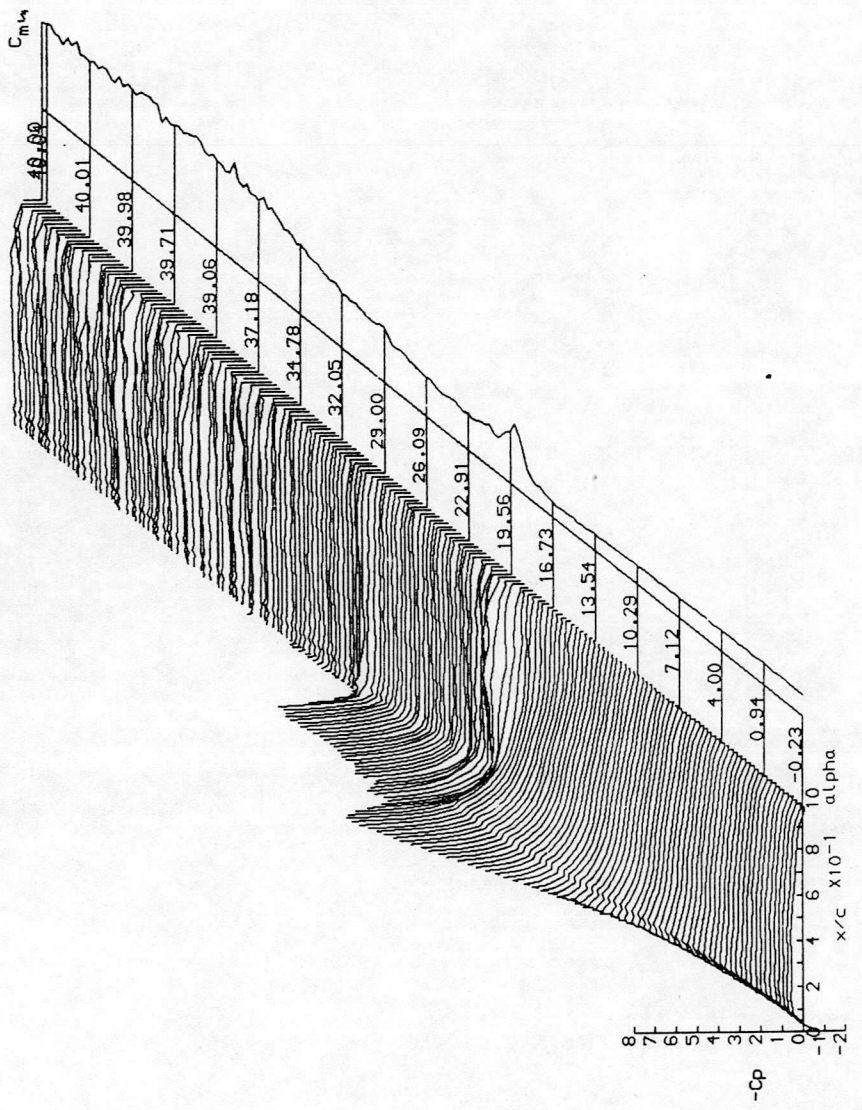
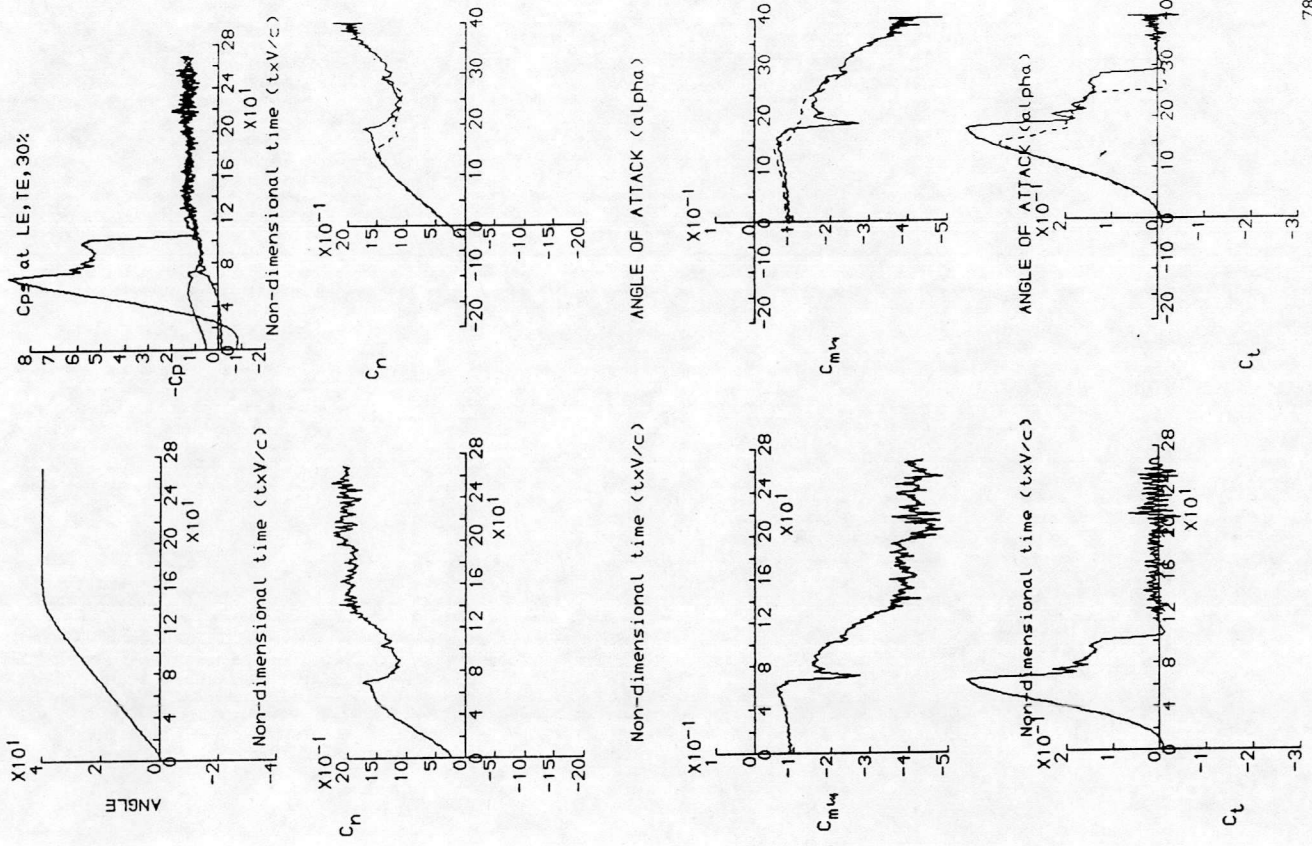
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27871
 REYNOLDS NUMBER = 1932661.
 DYNAMIC PRESSURE = 1754.42 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES

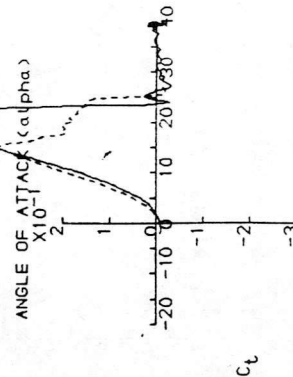
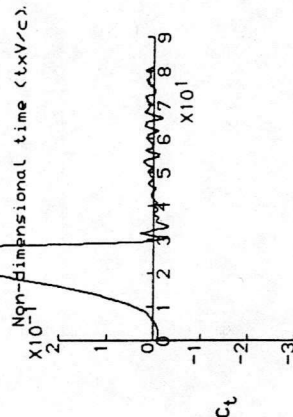
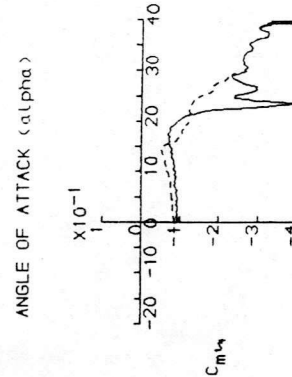
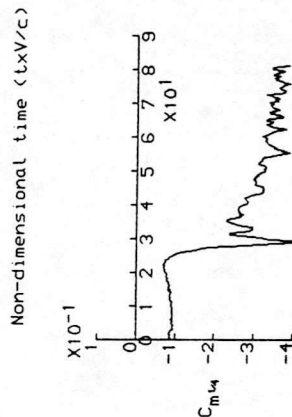
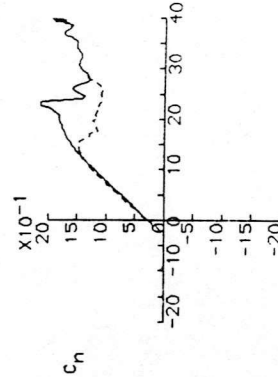
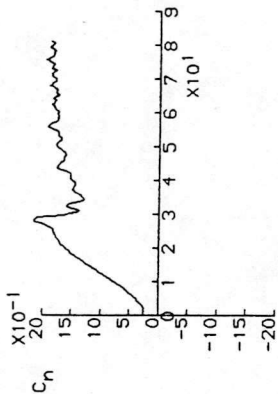
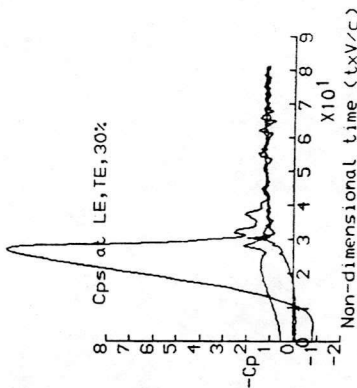
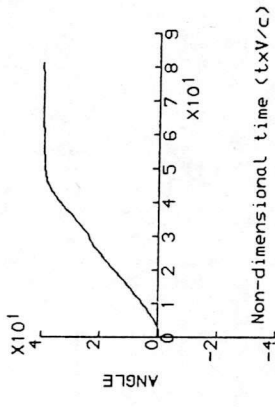
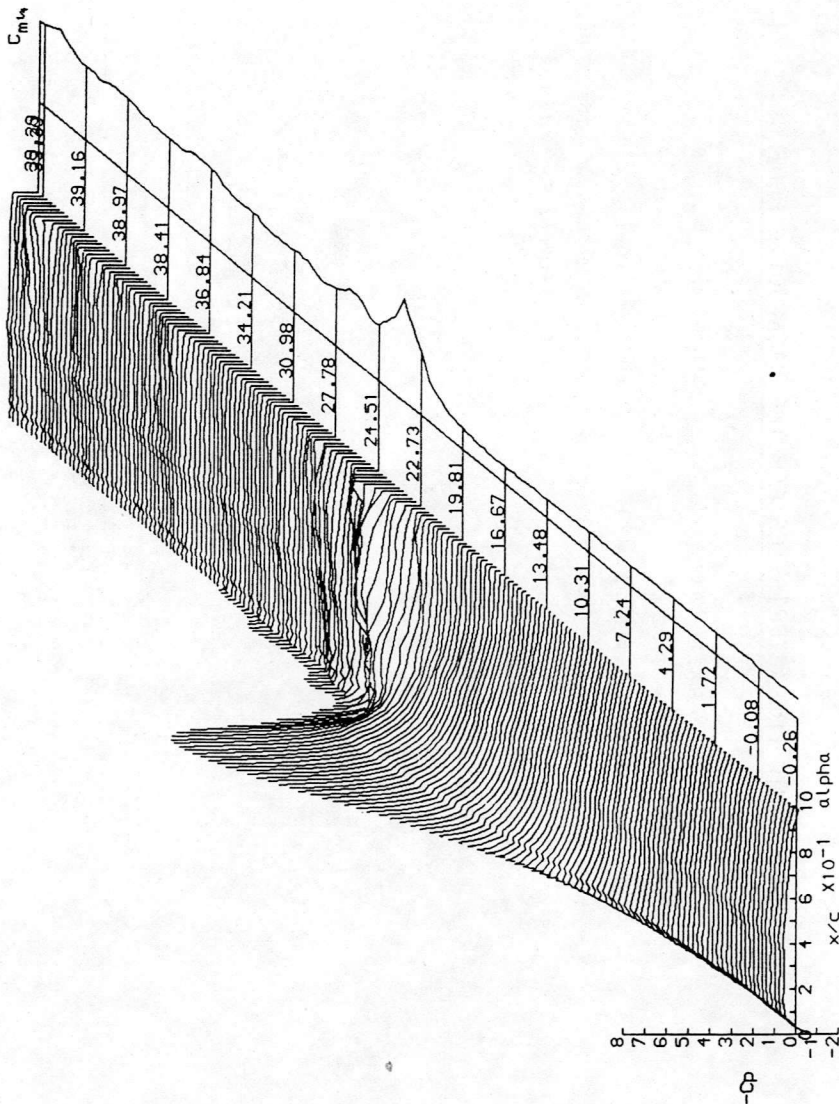
DATE OF TEST: 13/12/88
 MACH NUMBER = 0.156
 AIR TEMPERATURE = 30.7°C
 SAMPLING FREQUENCY = 93.70 Hz.
 REDUCED PITCH RATE = 0.00260
 LINEAR PITCH RATE = 29.51°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27881
 RETNOLDS NUMBER = 1923759.
 DYNAMIC PRESSURE = 1754.42 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.156
 AIR TEMPERATURE = 31.8°C
 SAMPLING FREQUENCY = 312.01 Hz.
 REDUCED PITCH RATE = 0.00861
 LINEAR PITCH RATE = 97.99°S⁻¹

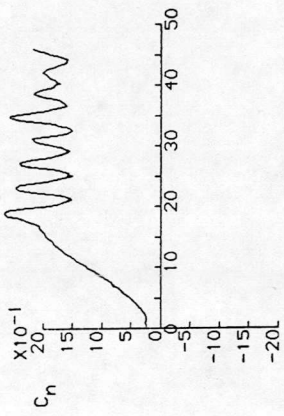
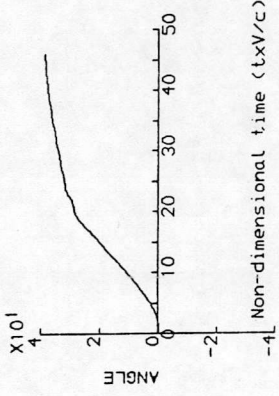
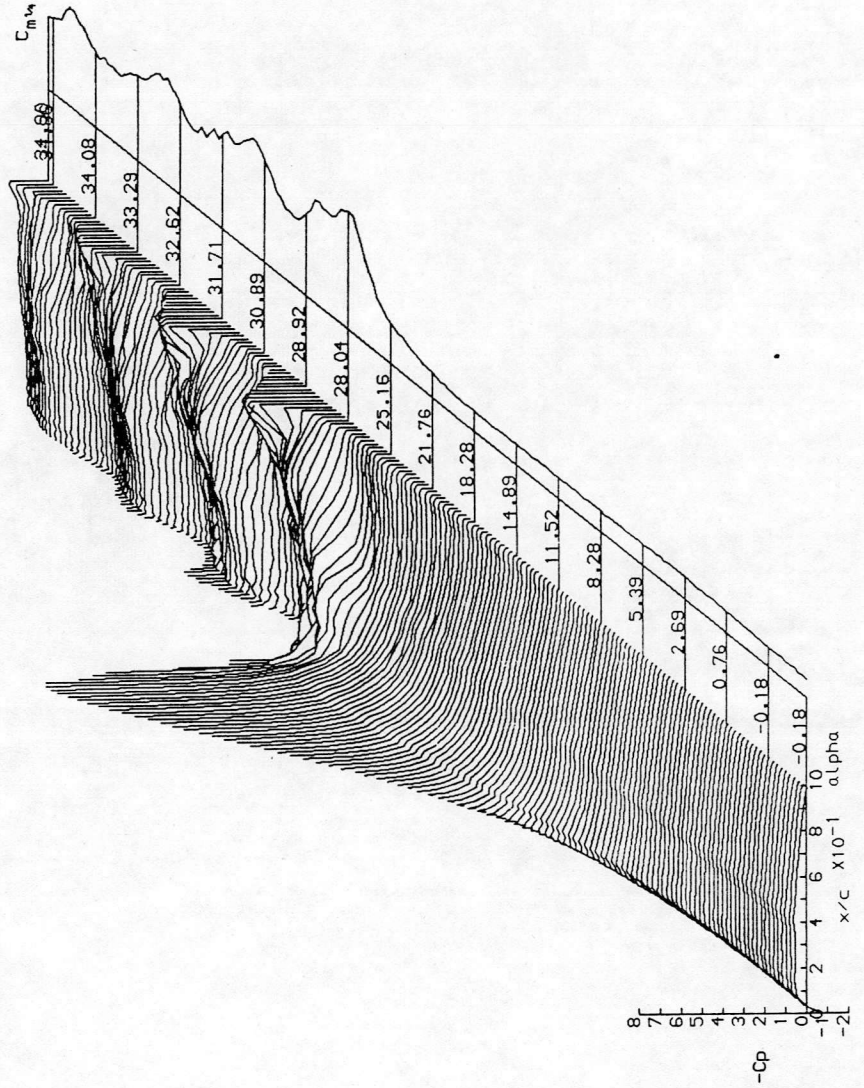
AVERAGED DATA OF 5 CYCLES



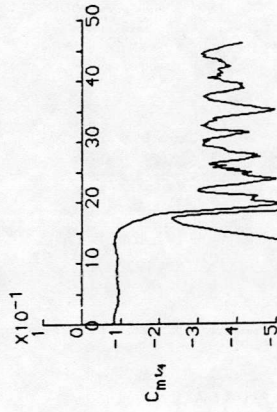
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27891
 REYNOLDS NUMBER = 1916533.
 DYNAMIC PRESSURE = 1754.42 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 AVERAGED DATA OF 5 CYCLES

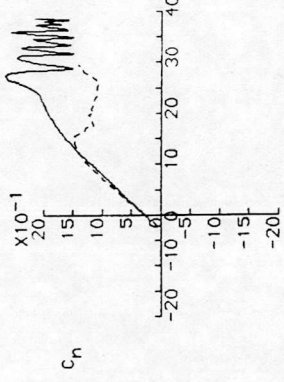
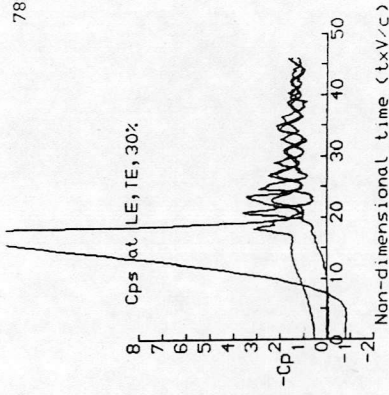
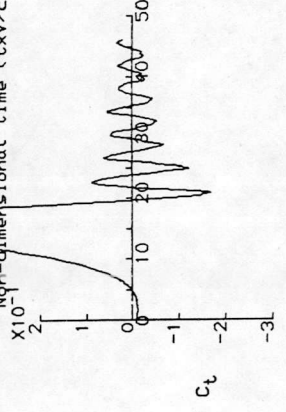
DATE OF TEST: 13/12/88
 MACH NUMBER = 0.156
 AIR TEMPERATURE = 32.7°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.01627
 LINEAR PITCH RATE = 185.33°s⁻¹



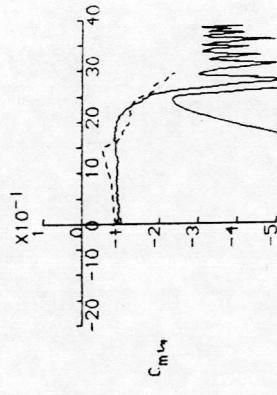
Non-dimensional time (txV/c)



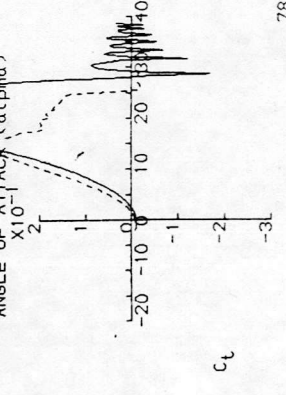
Non-dimensional time (txV/c)



ANGLE OF ATTACK (alpha)



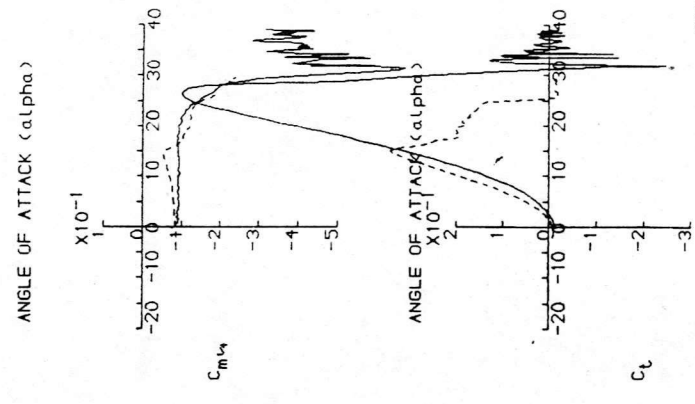
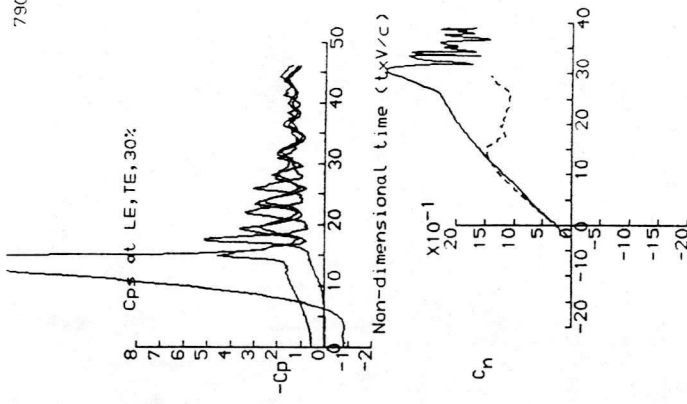
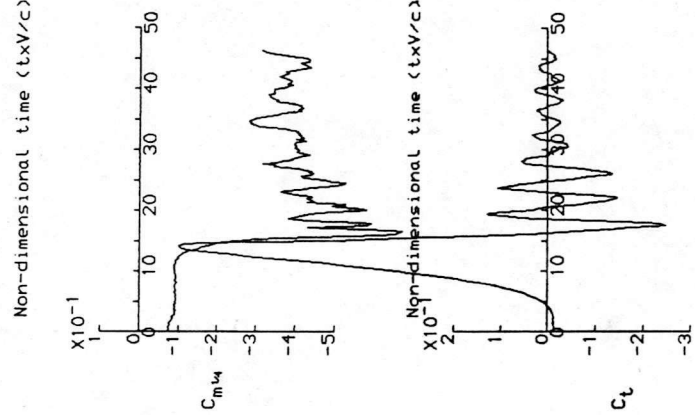
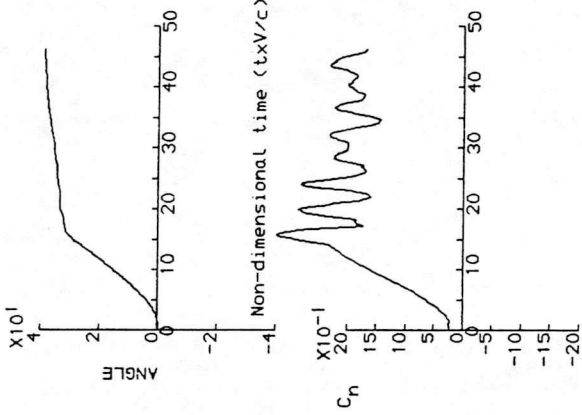
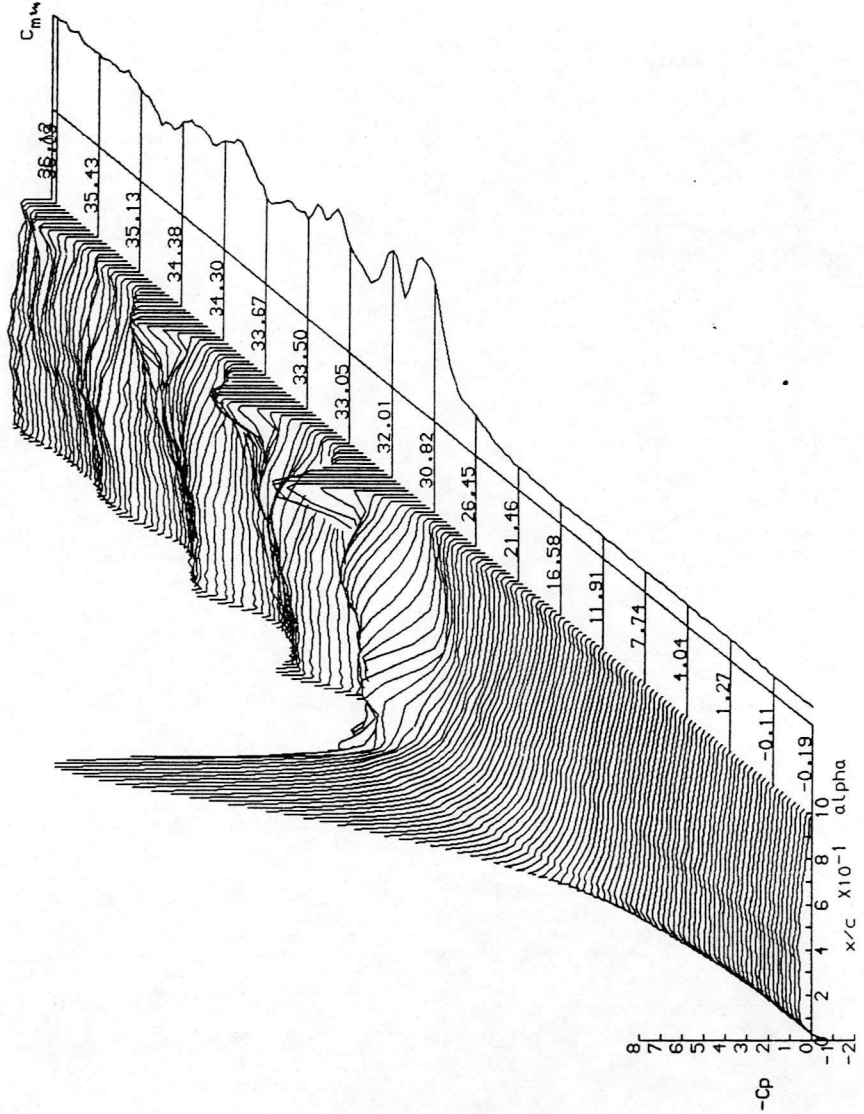
ANGLE OF ATTACK (alpha)



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 27901
 REYNOLDS NUMBER = 1910153.
 DYNAMIC PRESSURE = 1754.42 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP UP
 START ANGLE = -1.00°
 RAMP ARC = 41.000°
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.156
 AIR TEMPERATURE = 33.5°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = 0.02261
 LINEAR PITCH RATE = 257.90°s⁻¹

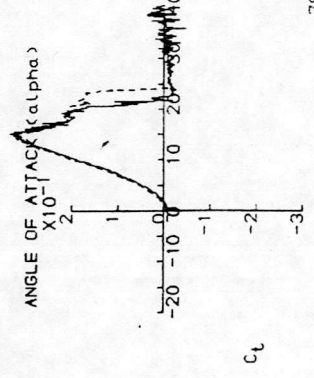
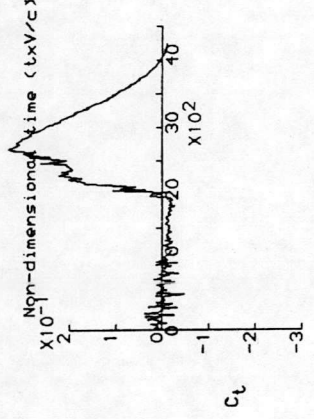
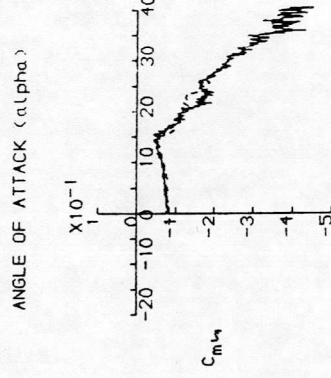
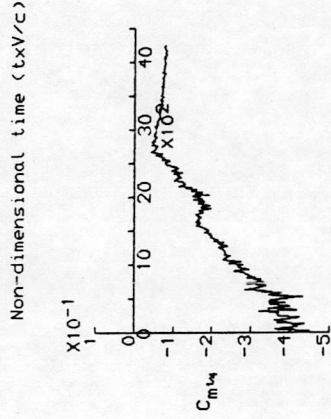
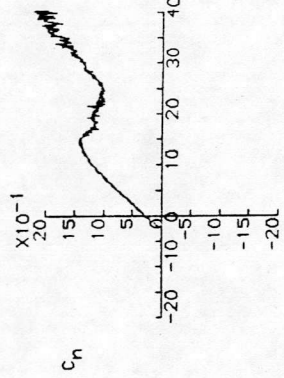
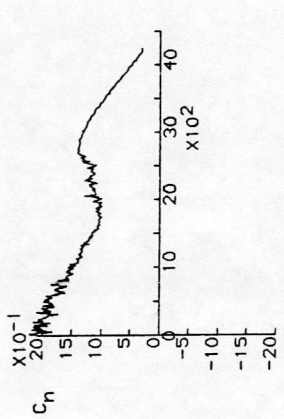
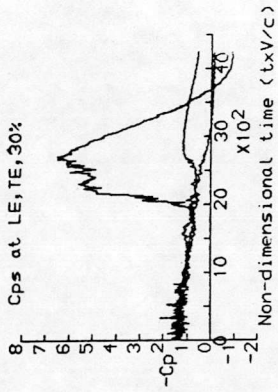
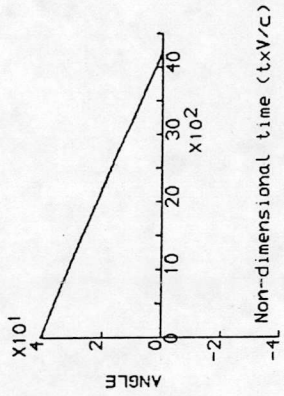
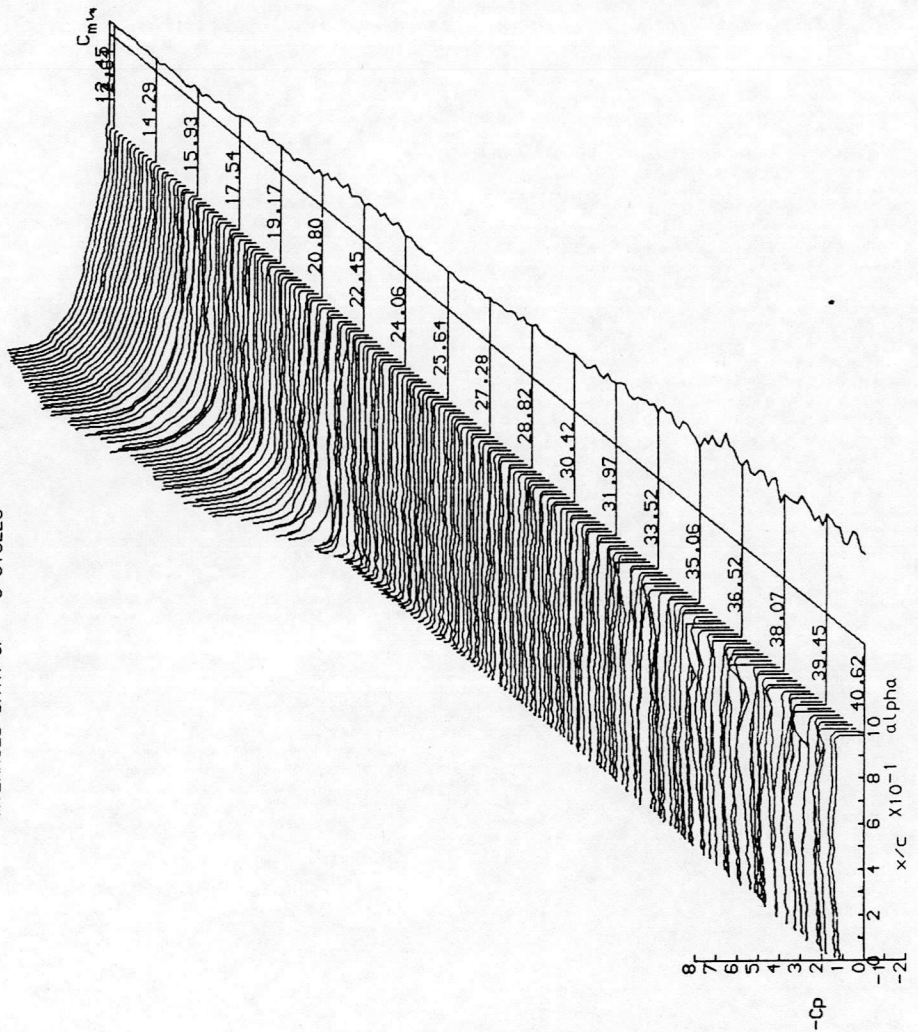
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER = 37921
 REYNOLDS NUMBER = 1509926.
 DYNAMIC PRESSURE = 1021.28 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 25.5°C
 SAMPLING FREQUENCY = 4.50 Hz.
 REDUCED PITCH RATE = -0.00008
 LINEAR PITCH RATE = -0.72°S⁻¹

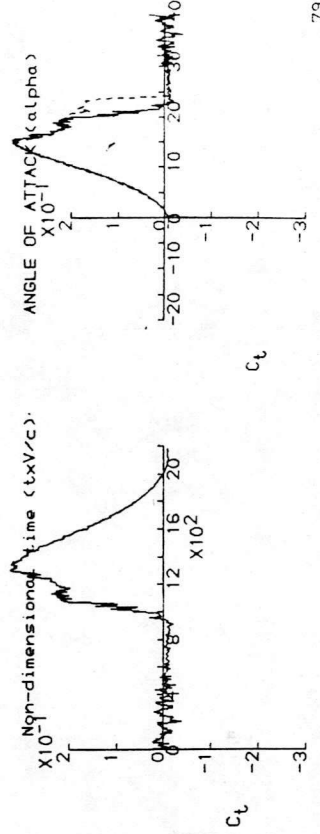
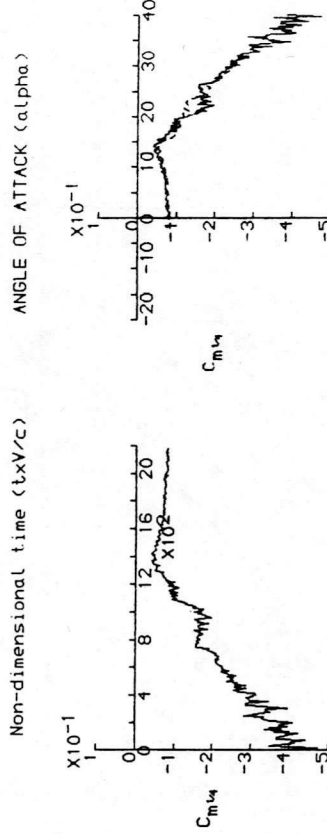
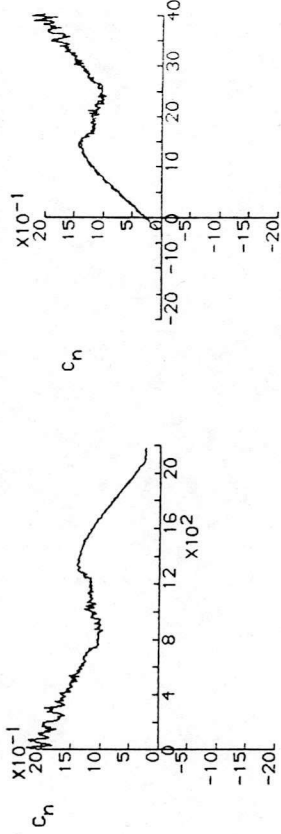
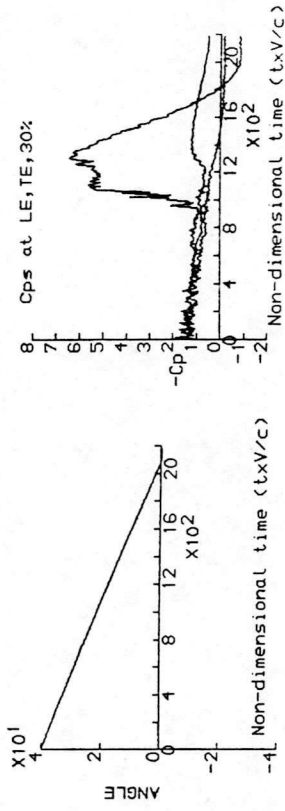
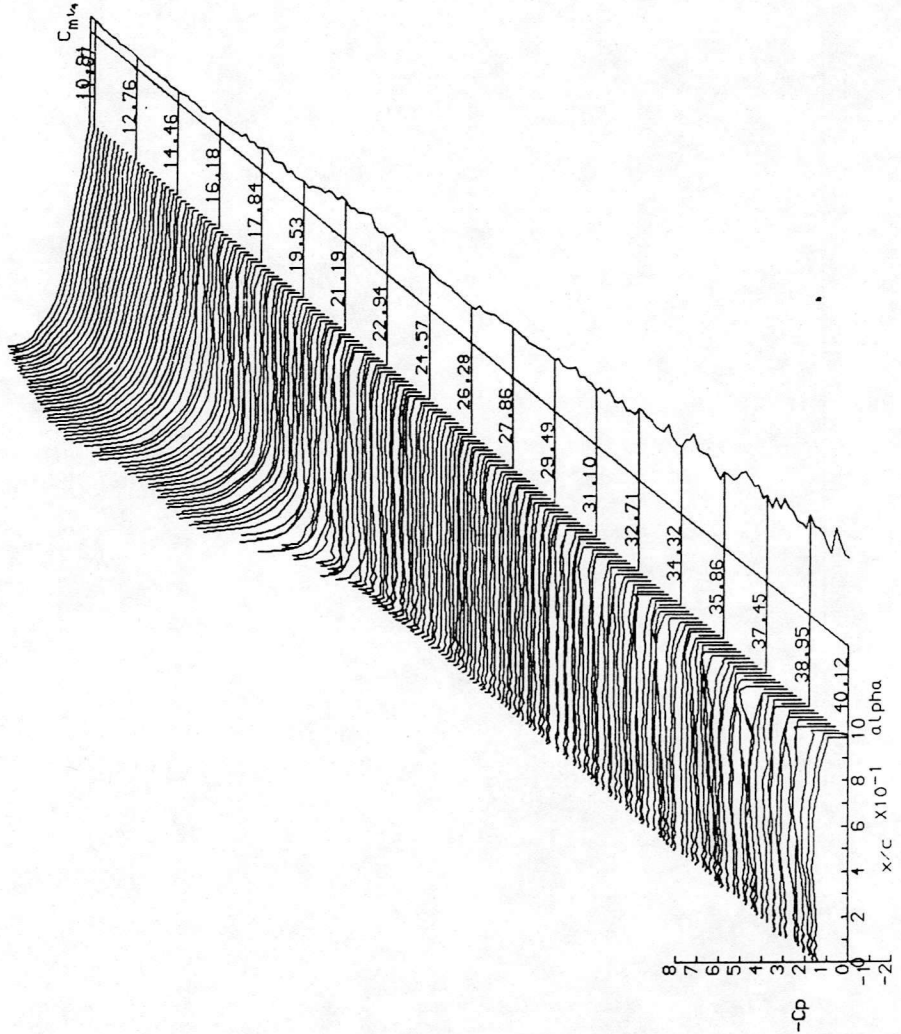
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

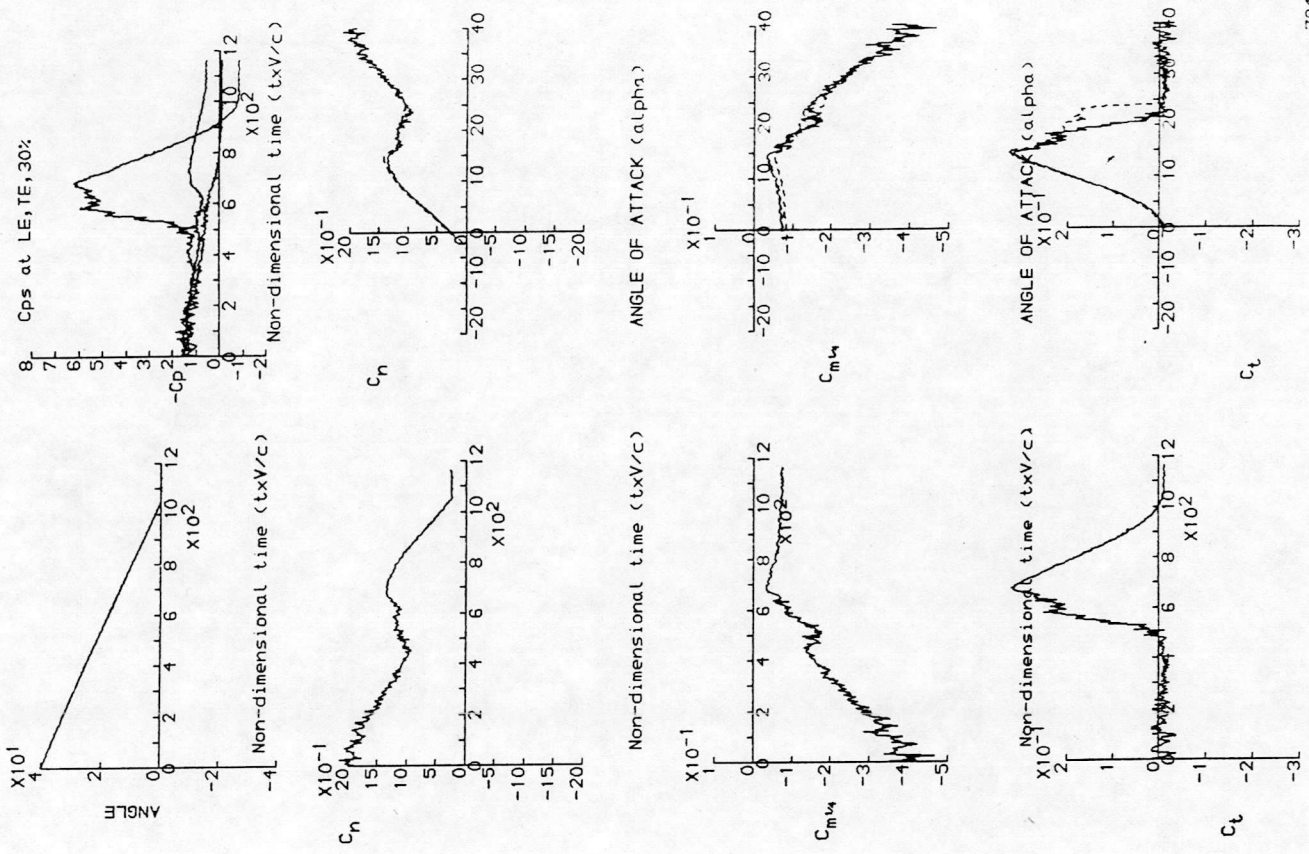
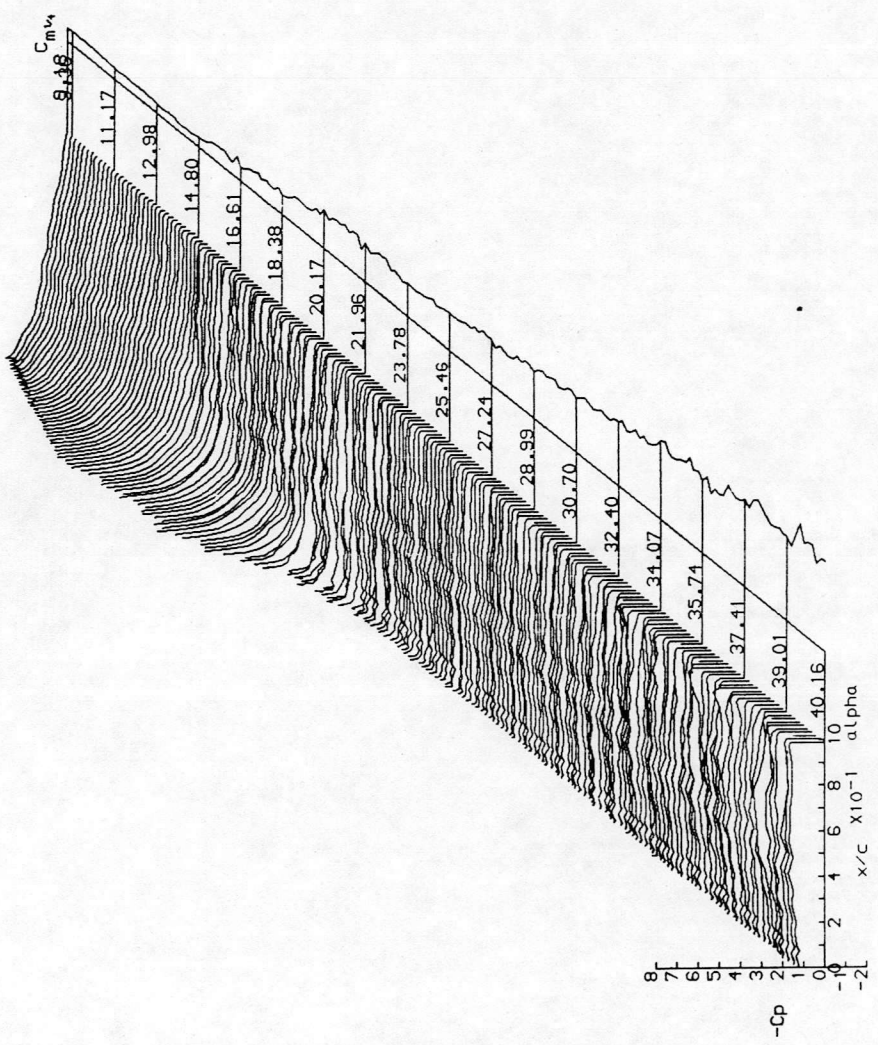
RUN REFERENCE NUMBER: 37931
 REYNOLDS NUMBER = 1494298.
 DYNAMIC PRESSURE = 1008.85 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 26.5°C
 SAMPLING FREQUENCY = 8.70 Hz.
 REDUCED PITCH RATE = -0.00017
 LINEAR PITCH RATE = -1.43°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

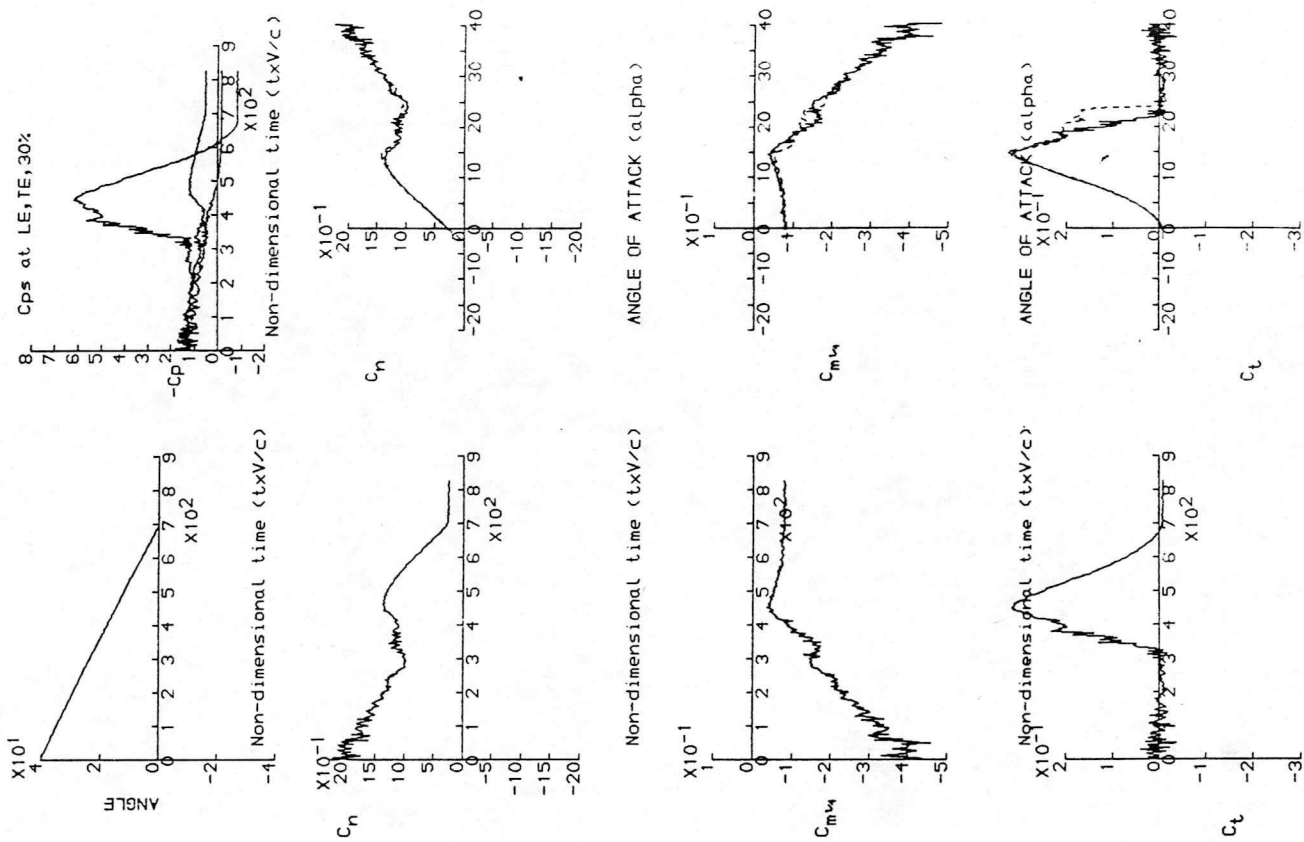
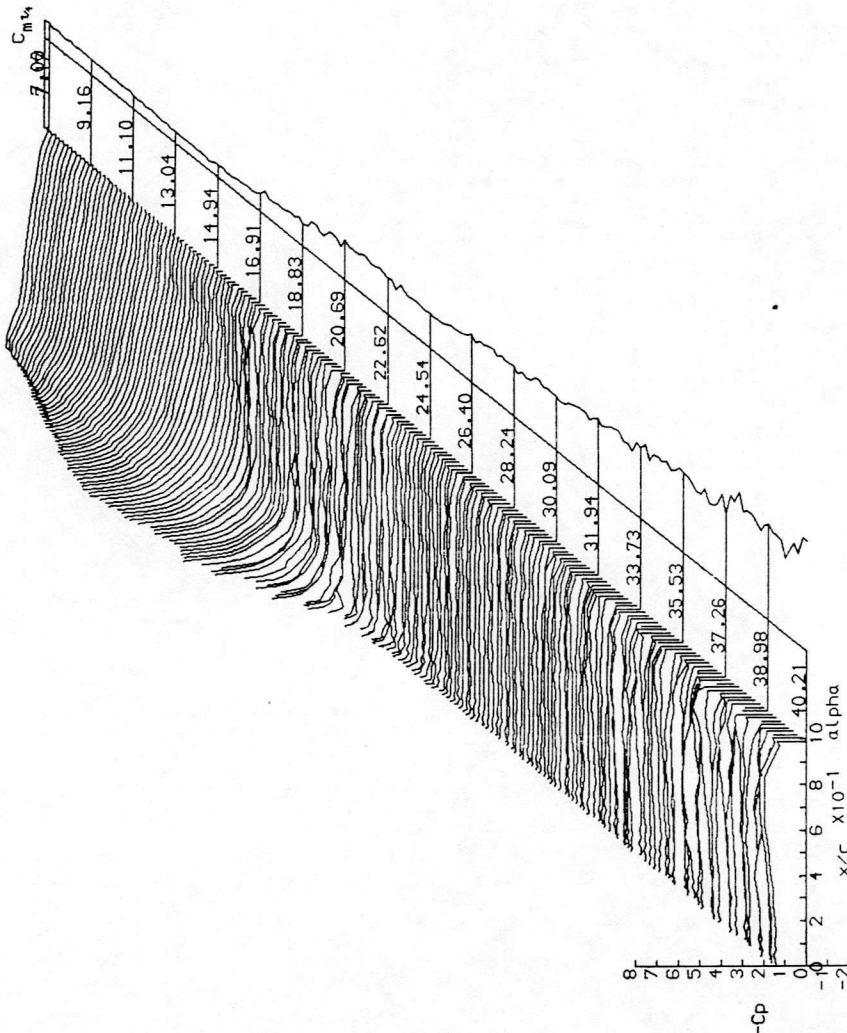
RUN REFERENCE NUMBER: 37941
 REYNOLDS NUMBER = 1483515.
 DYNAMIC PRESSURE = 1008.85 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.2°C
 SAMPLING FREQUENCY = 16.40 Hz.
 REDUCED PITCH RATE = -0.00034
 LINEAR PITCH RATE = -2.87°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C_MODEL04

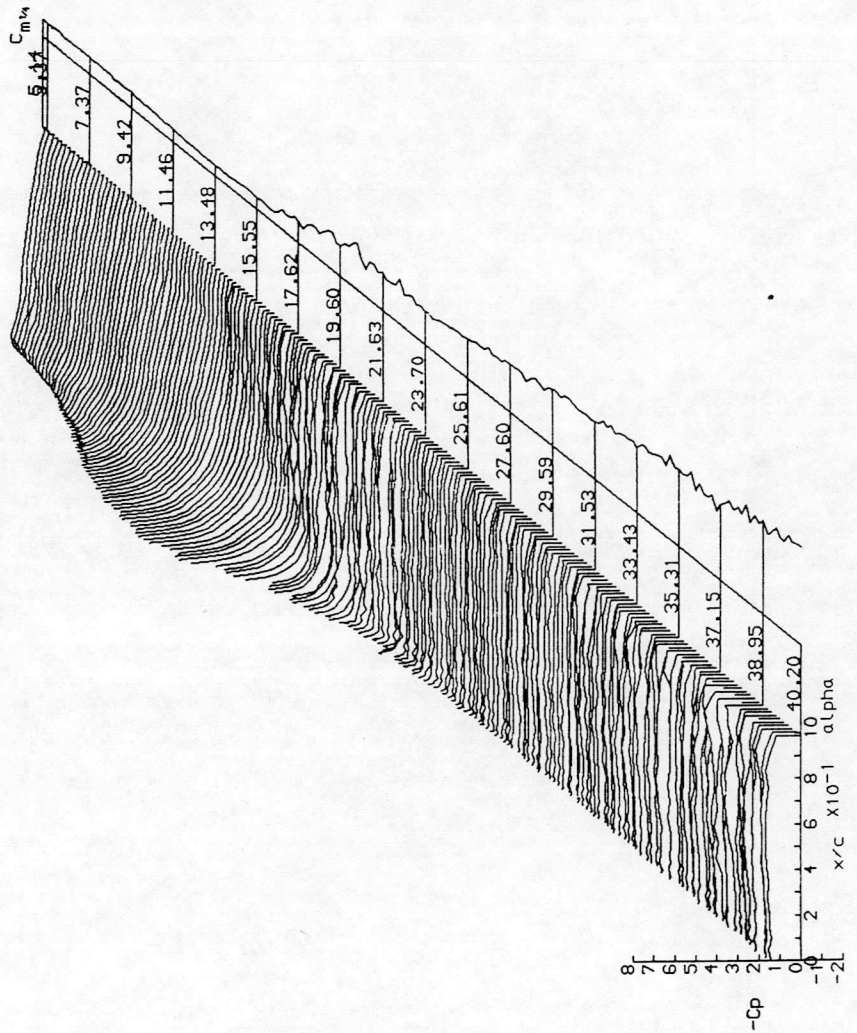
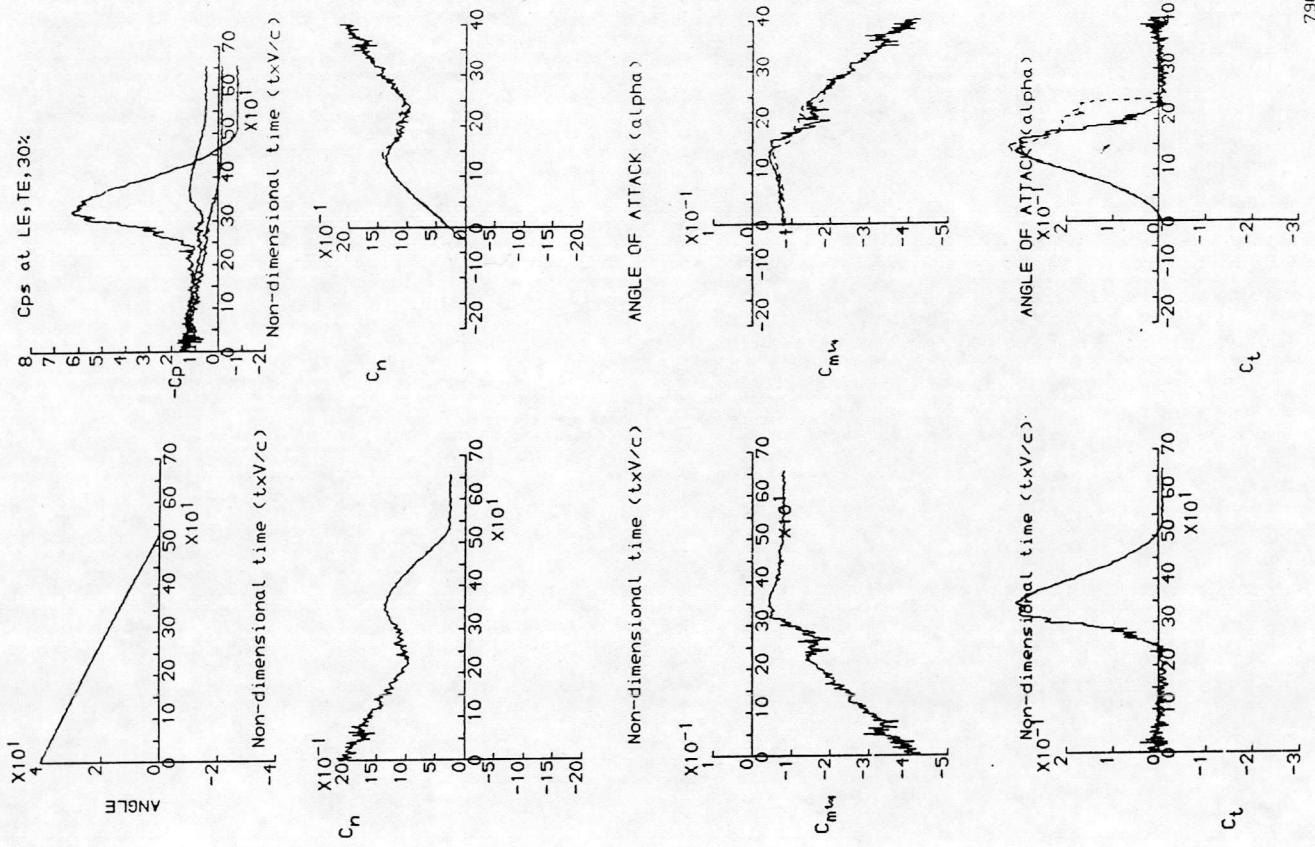
RUN REFERENCE NUMBER = 37951
 RETNOLDOS NUMBER = 1484011.
 DYNAMIC PRESSURE = 1003.53 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.5°C
 SAMPLING FREQUENCY = 23.00 HZ.
 REDUCED PITCH RATE = -0.00051
 LINEAR PITCH RATE = -4.31°S⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

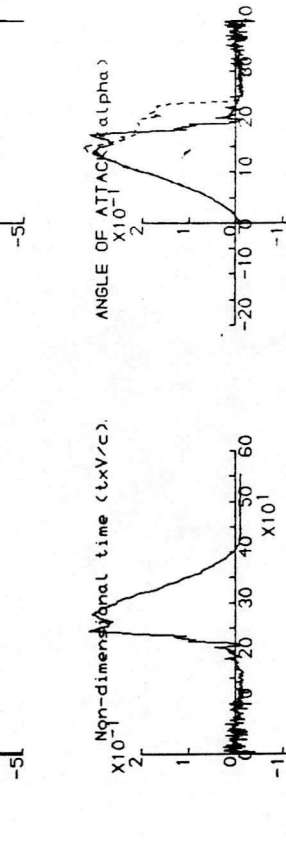
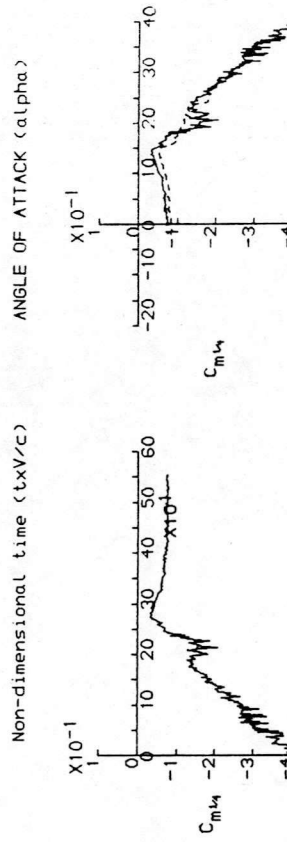
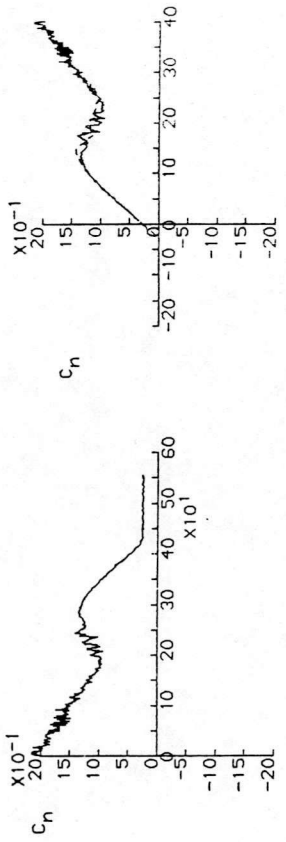
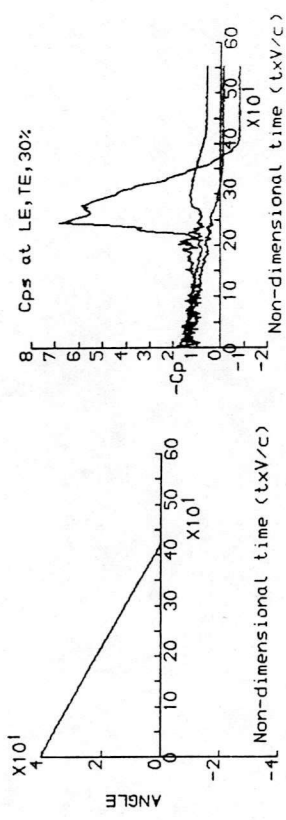
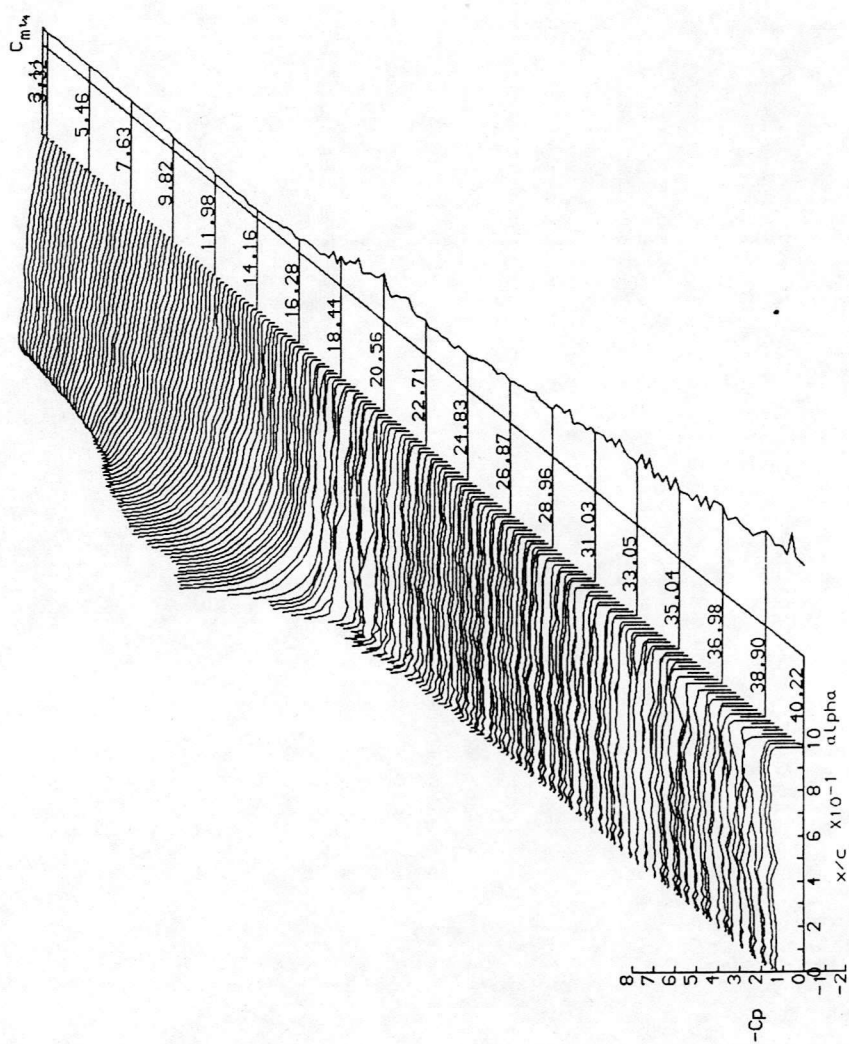
RUN REFERENCE NUMBER: 37961
 REYNOLDS NUMBER = 1477718.
 DYNAMIC PRESSURE = 1003.53 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.5°C
 SAMPLING FREQUENCY = 29.00 Hz.
 REDUCED PITCH RATE = -0.00068
 LINEAR PITCH RATE = -5.77°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

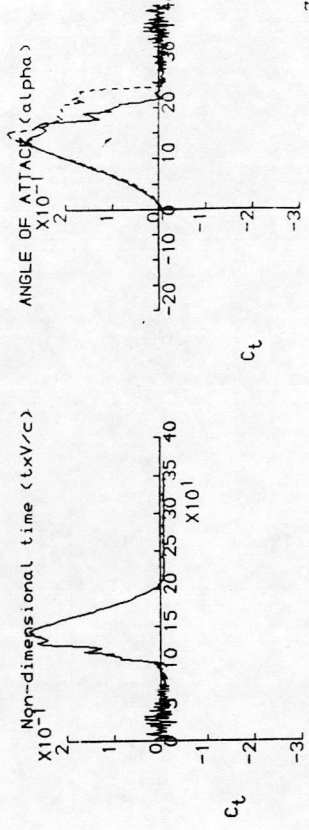
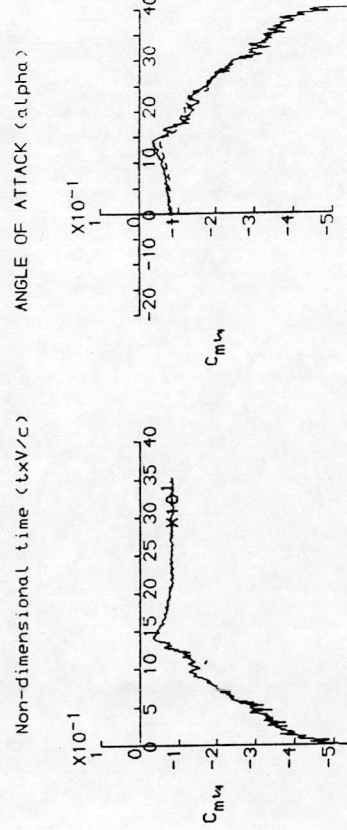
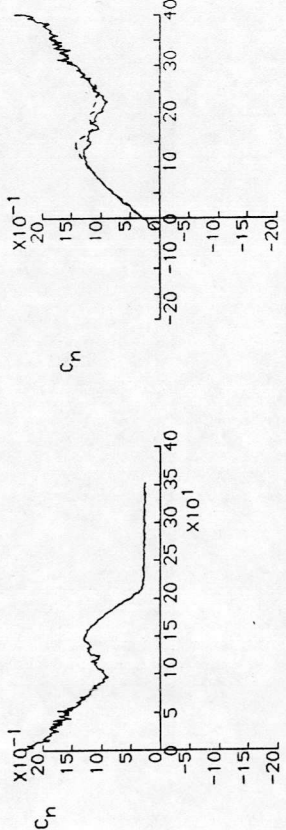
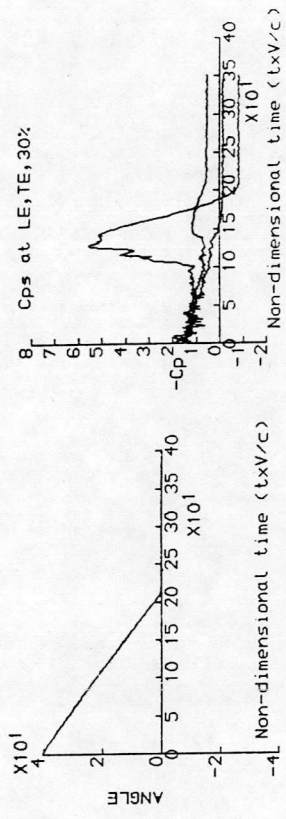
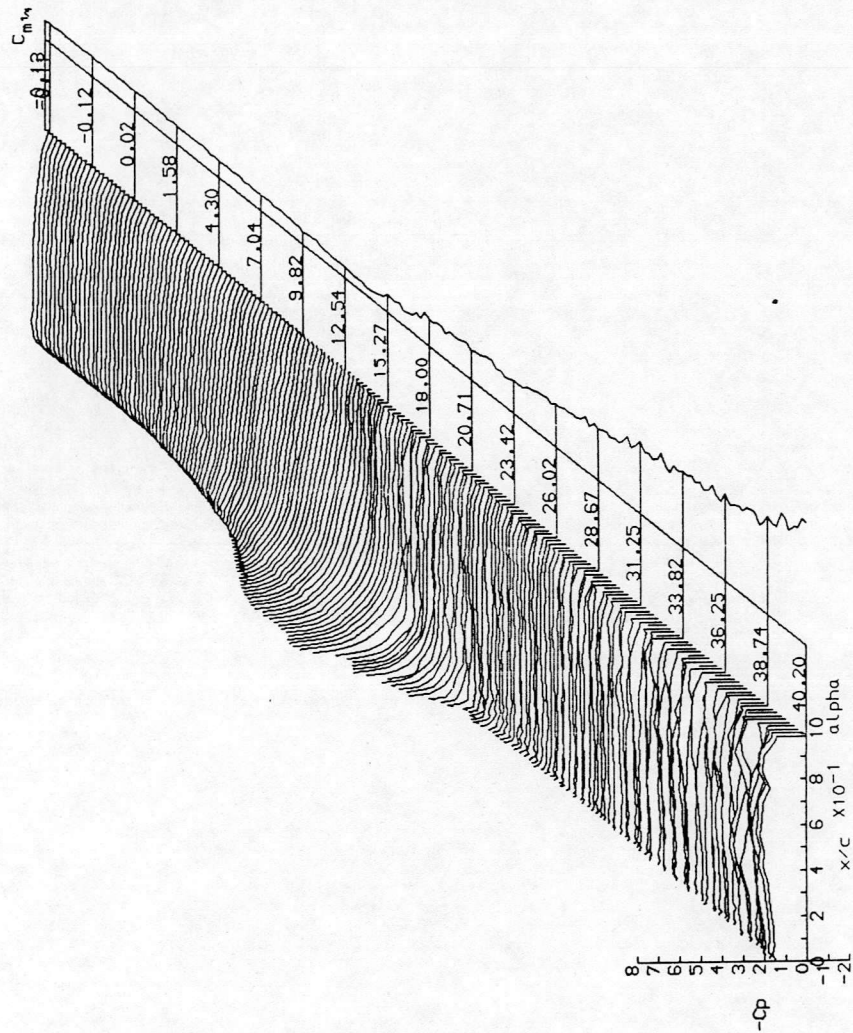
RUN REFERENCE NUMBER = 37971
 REYNOLDS NUMBER = 1474590.
 DYNAMIC PRESSURE = 1003.53 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.0°C
 SAMPLING FREQUENCY = 34.30 Hz.
 REDUCED PITCH RATE = -0.00084
 LINEAR PITCH RATE = -7.20°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

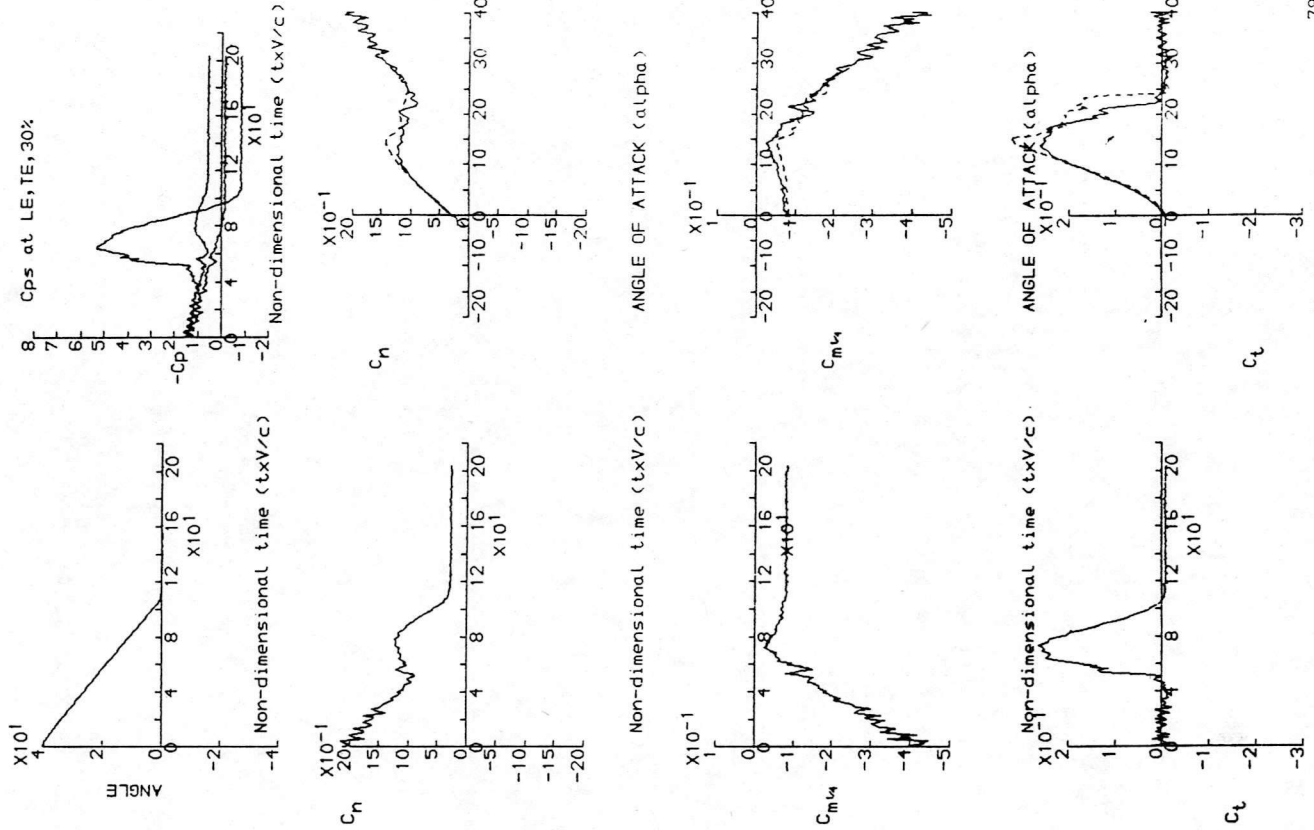
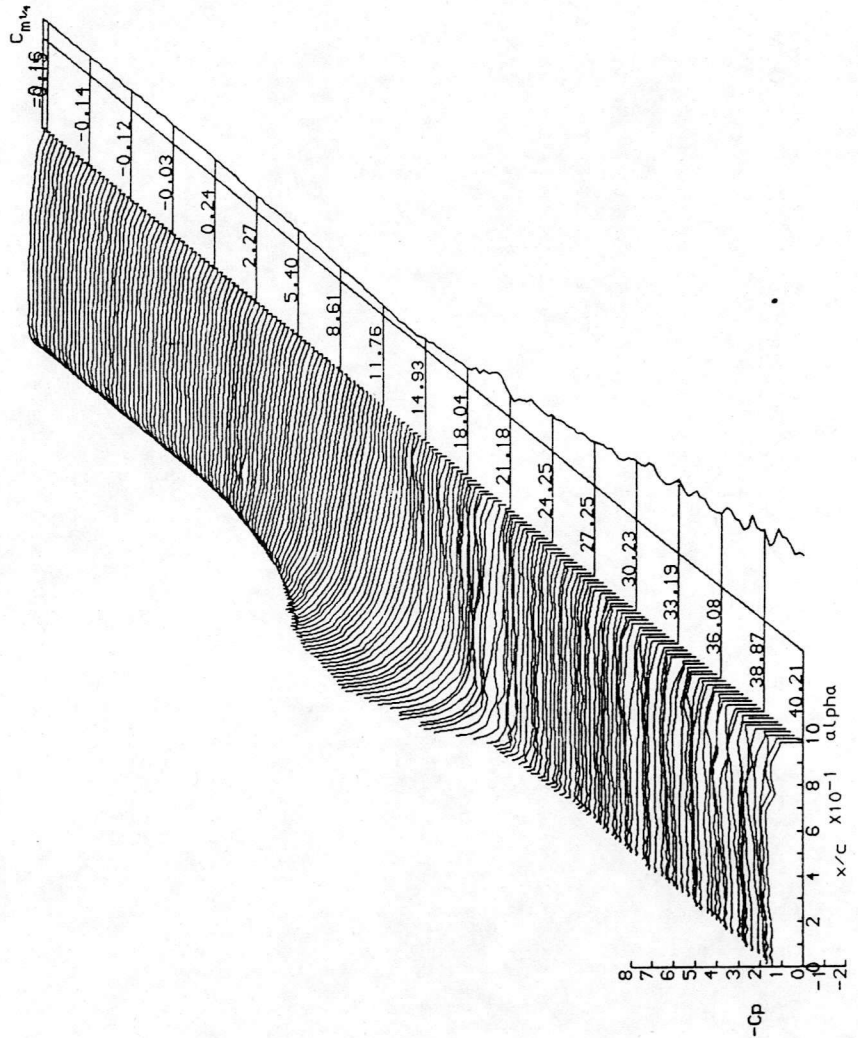
RUN REFERENCE NUMBER: 37981
 REYNOLDS NUMBER = 1482581.
 DYNAMIC PRESSURE = 1005.87 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.0°C
 SAMPLING FREQUENCY = 54.10 Hz.
 REDUCED PITCH RATE = -0.00167
 LINEAR PITCH RATE = -14.27°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

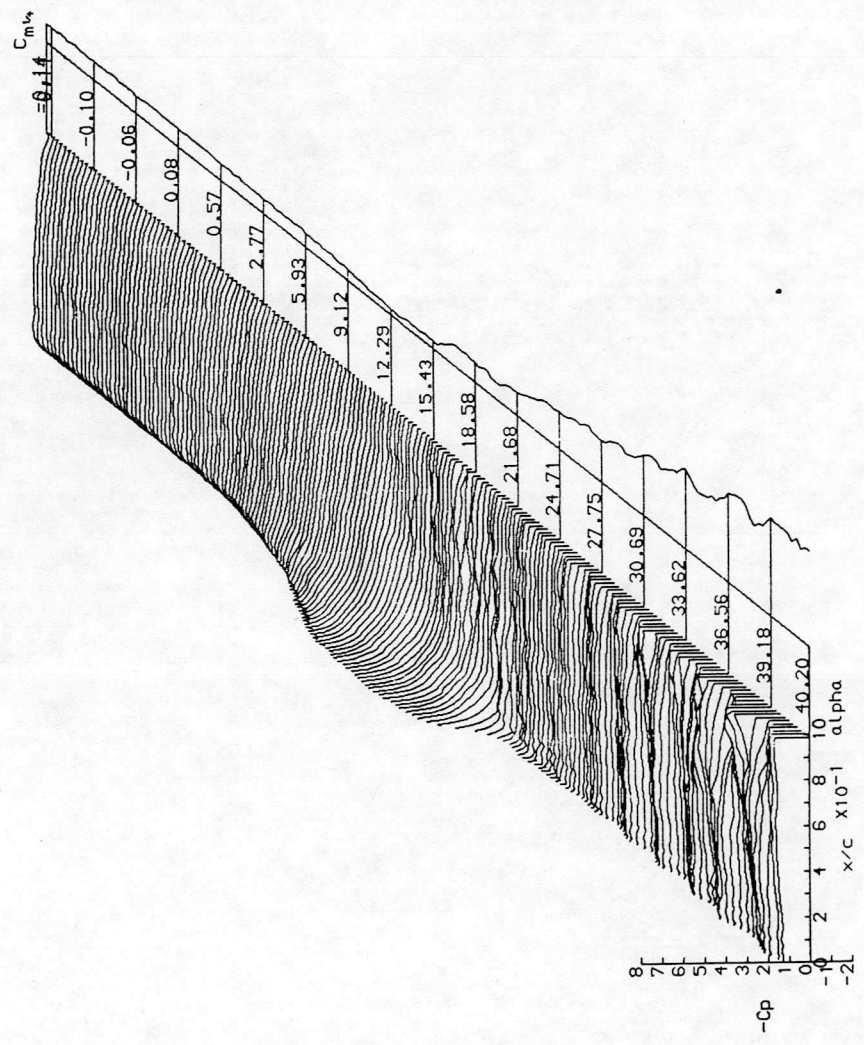
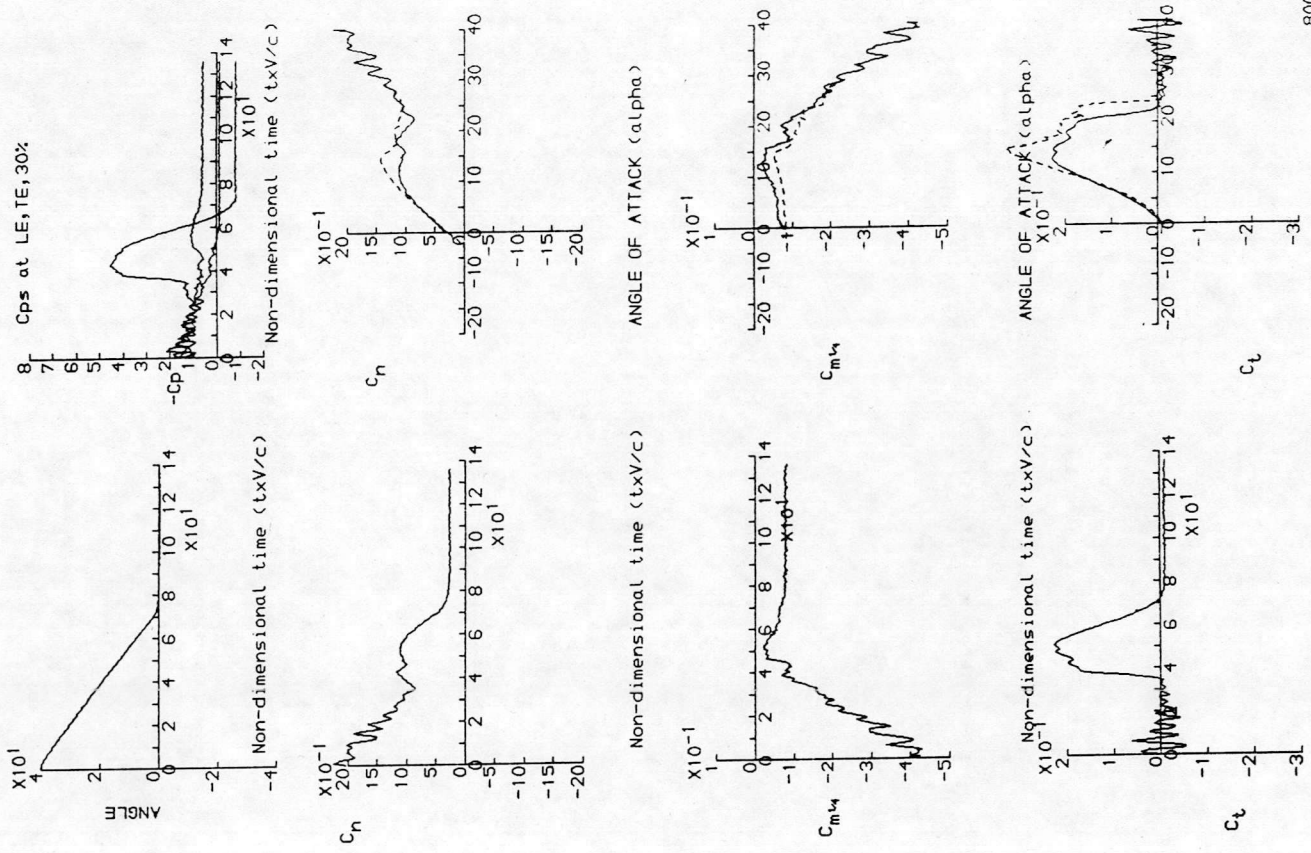
RUN REFERENCE NUMBER: 37991
 RETNOLDS NUMBER = 1476306.
 DYNAMIC PRESSURE = 1005.87 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.0°C
 SAMPLING FREQUENCY = 93.70 Hz.
 REDUCED PITCH RATE = -0.00331
 LINEAR PITCH RATE = -28.32°S⁻¹

AVERAGED DATA OF 5 CYCLES



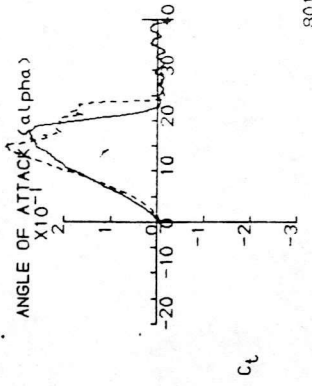
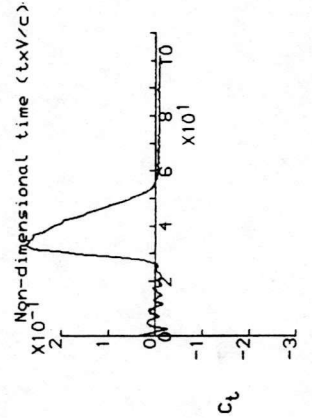
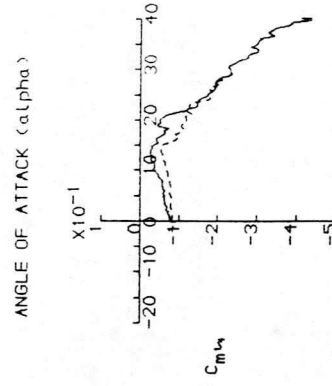
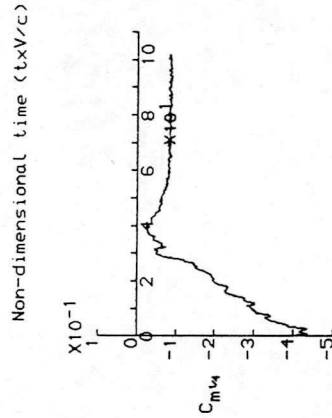
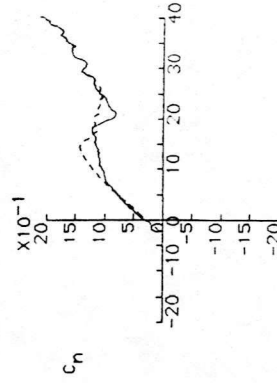
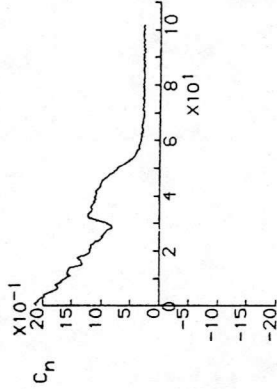
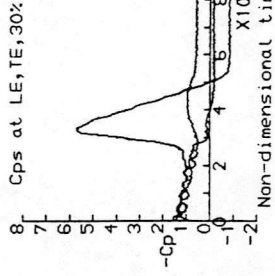
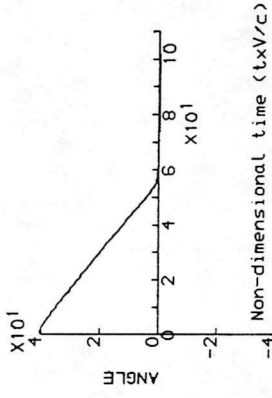
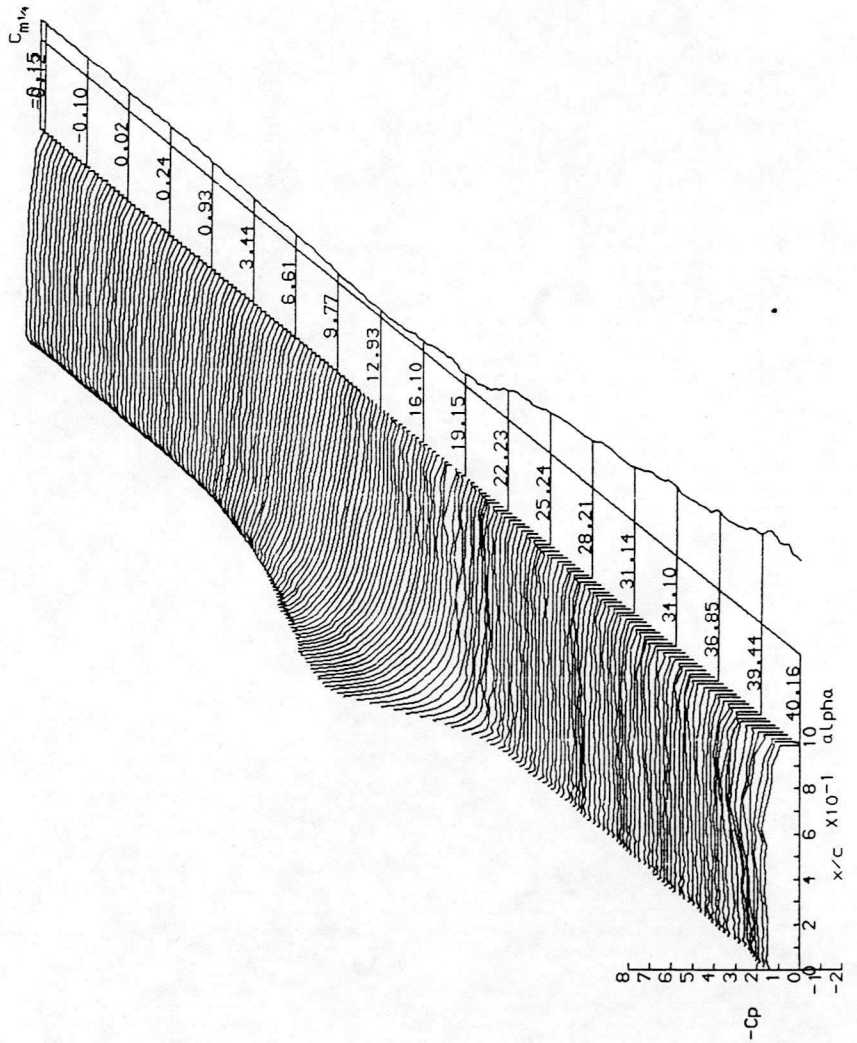
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38001
 REYNOLDS NUMBER = 1475057.
 DYNAMIC PRESSURE = 1005.87 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.2°C
 SAMPLING FREQUENCY = 140.00 Hz.
 REDUCED PITCH RATE = -0.00502
 LINEAR PITCH RATE = -43.00°s⁻¹



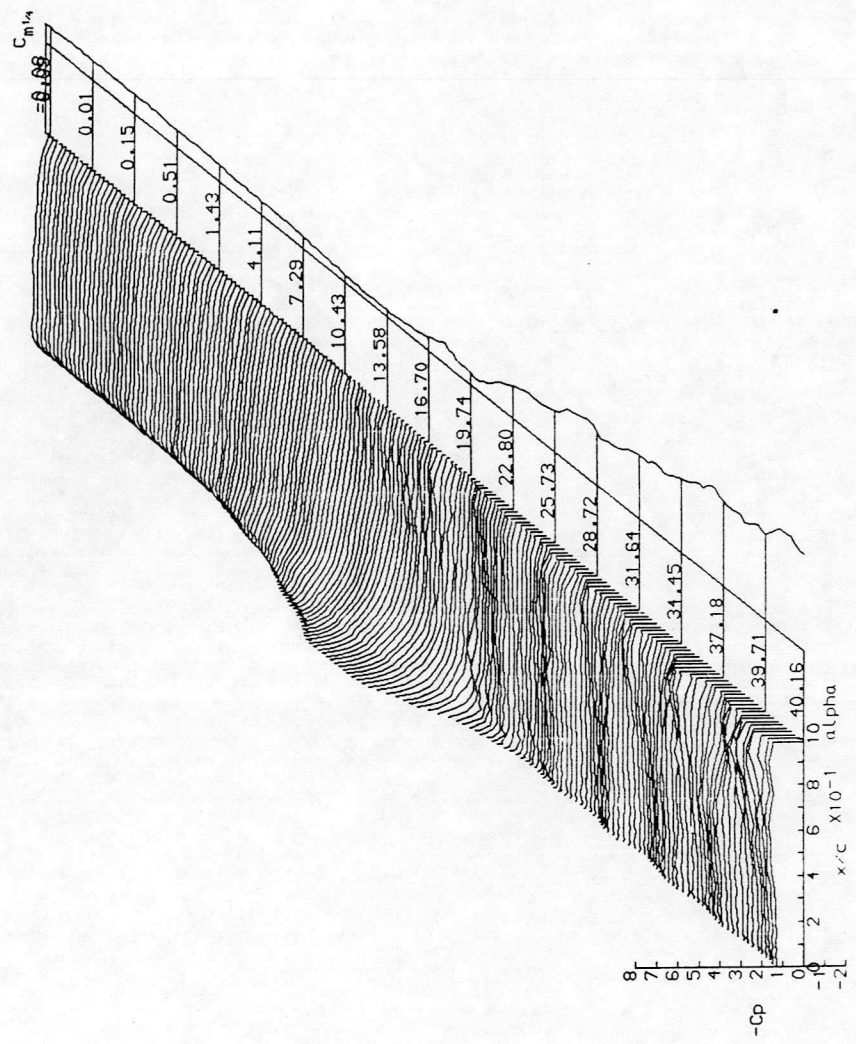
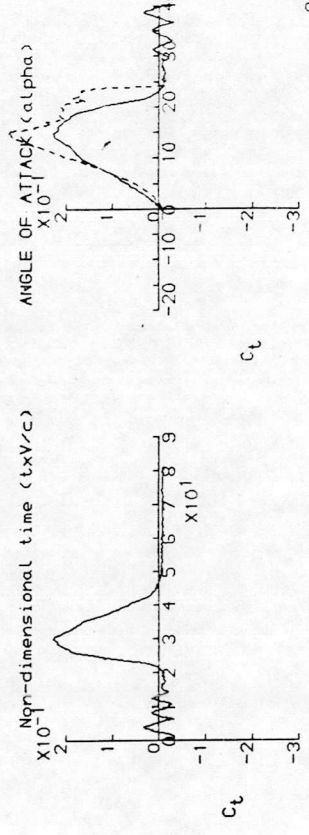
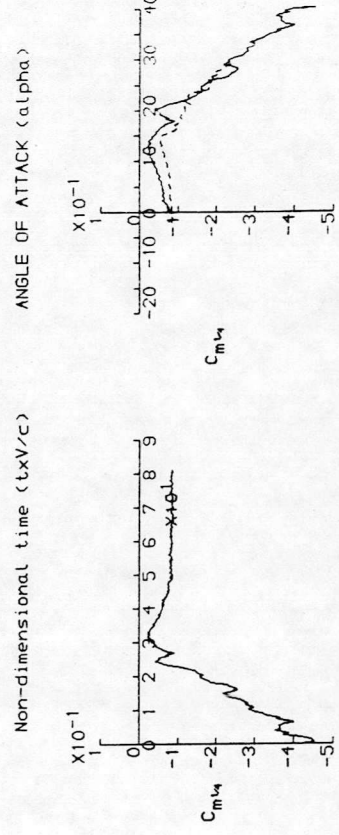
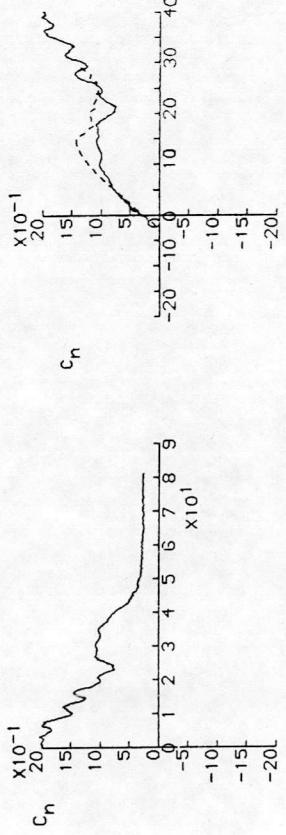
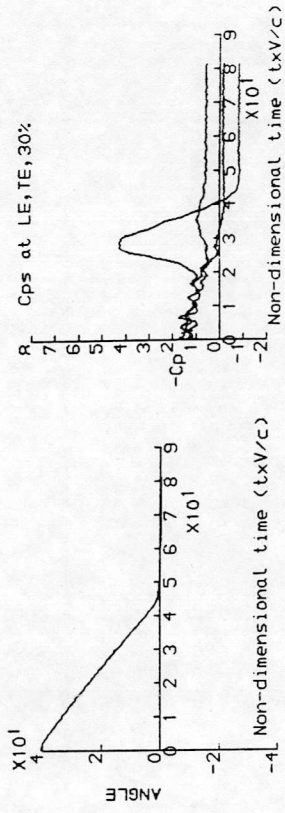
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38011
 REYNOLDS NUMBER = 1477008.
 DYNAMIC PRESSURE = 1002.57 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.5°C
 SAMPLING FREQUENCY = 186.99 Hz.
 REDUCED PITCH RATE = -0.00656
 LINEAR PITCH RATE = -56.02°s⁻¹
 AVERAGED DATA OF 5 CYCLES



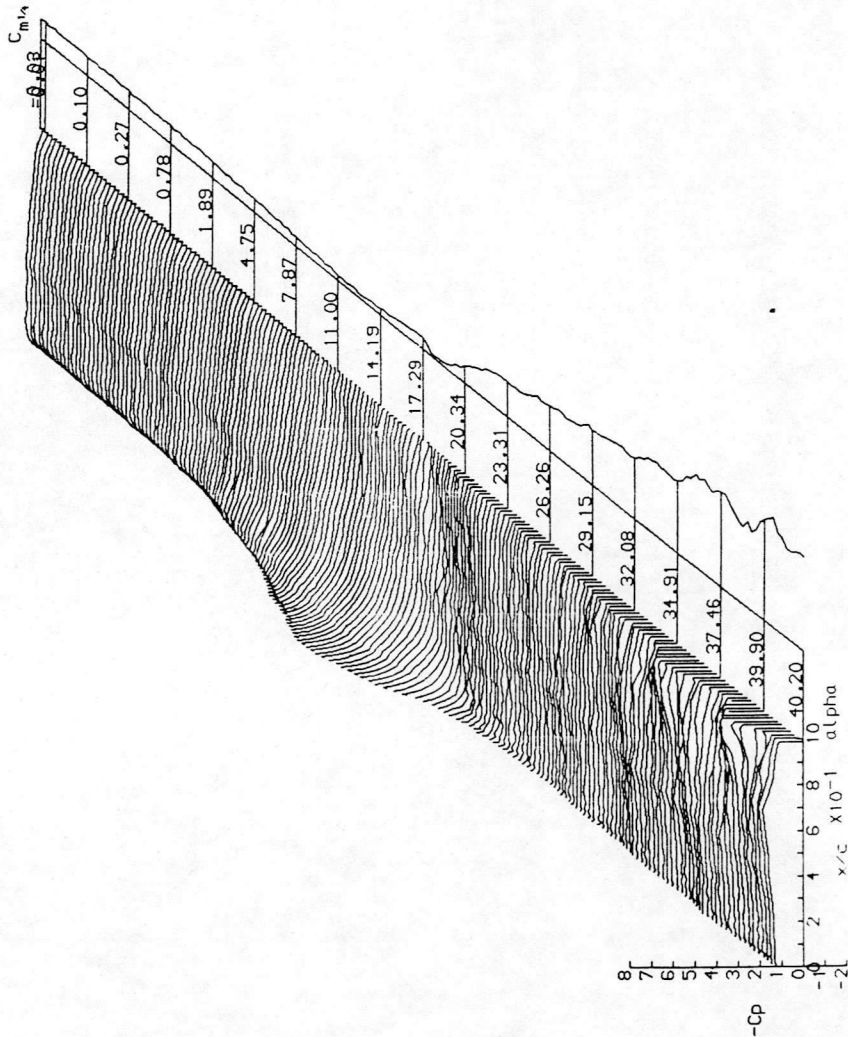
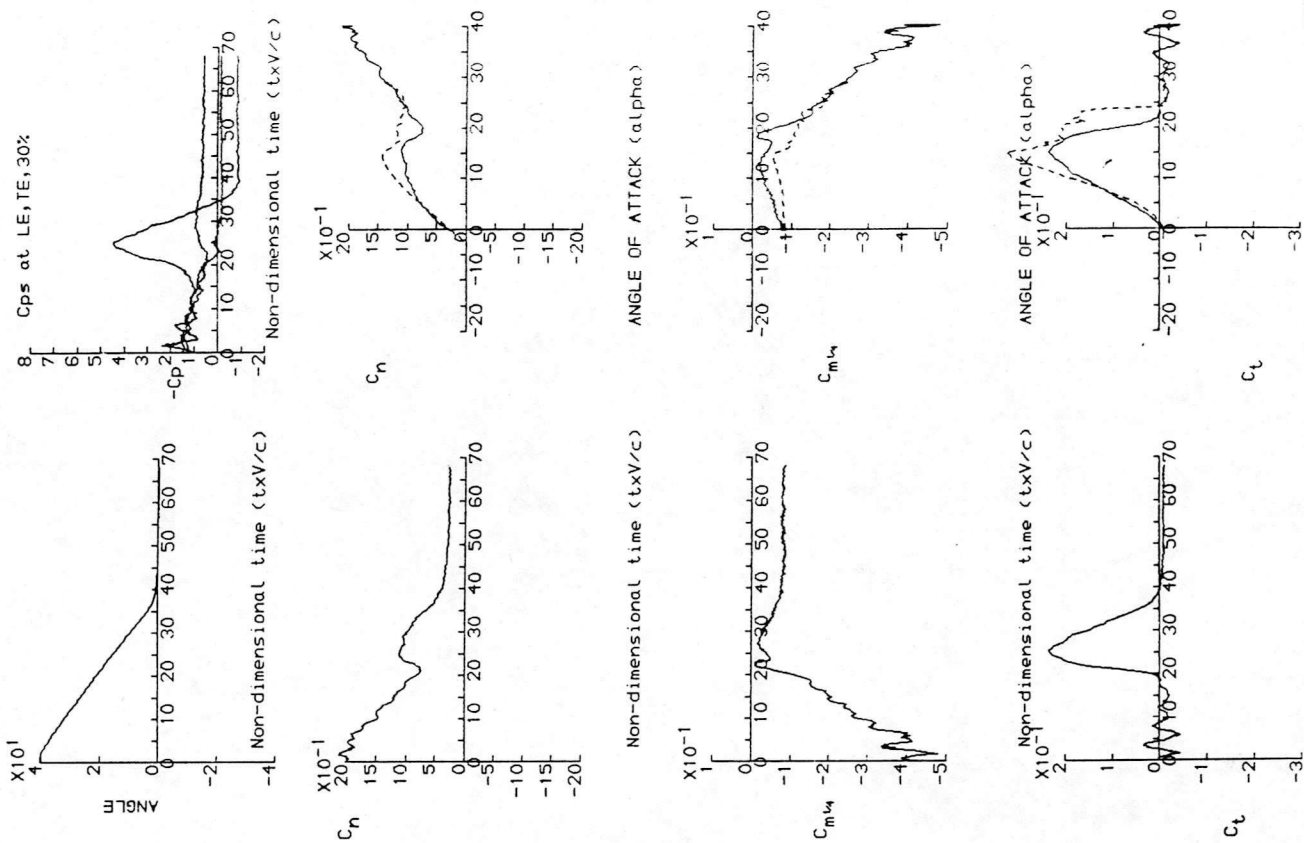
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38021
 REYNOLDS NUMBER = 1472635.
 DYNAMIC PRESSURE = 1002.57 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.2°C
 SAMPLING FREQUENCY = 233.97 Hz.
 REDUCED PITCH RATE = -0.00810
 LINEAR PITCH RATE = -69.22°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

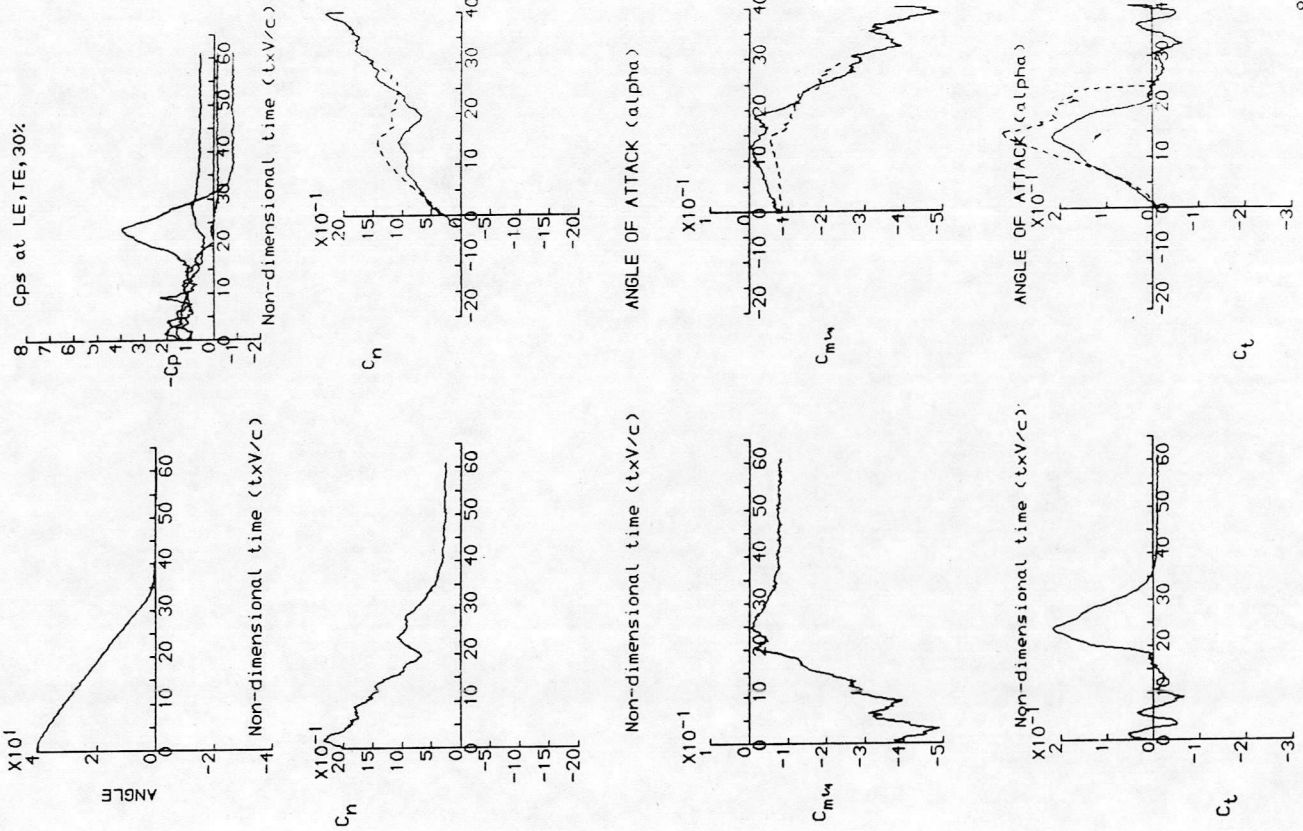
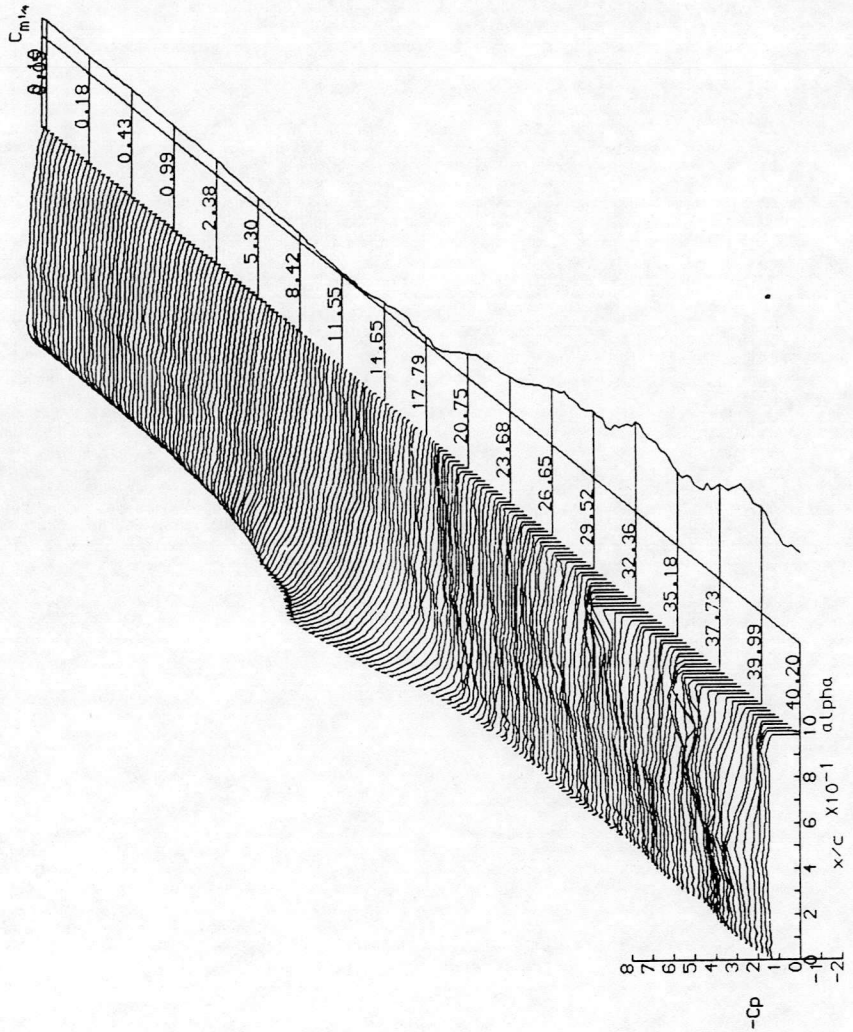
RUN REFERENCE NUMBER: 38031
 RETNOLDS NUMBER = 1472013.
 DYNAMIC PRESSURE = 1002.57 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.3°C
 SAMPLING FREQUENCY = 280.03 Hz.
 REDUCED PITCH RATE = -0.00957
 LINEAR PITCH RATE = -81.85°S⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38041
 DATE OF TEST: 14/12/88
 REYNOLDS NUMBER = 1470147
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1002.57 Nm⁻²
 AIR TEMPERATURE = 29.6°C
 NUMBER OF CYCLES = 5
 SAMPLING FREQUENCY = 312.01 Hz.
 MOTION TYPE: RAMP DOWN
 REDUCED PITCH RATE = -0.01069
 START ANGLE = 40.00°
 LINEAR PITCH RATE = -91.42°s⁻¹
 RAMP ARC = -41.000°

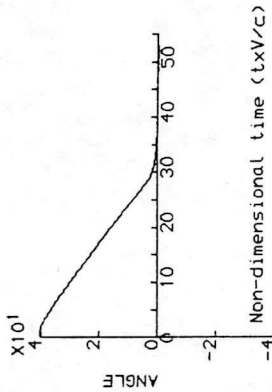
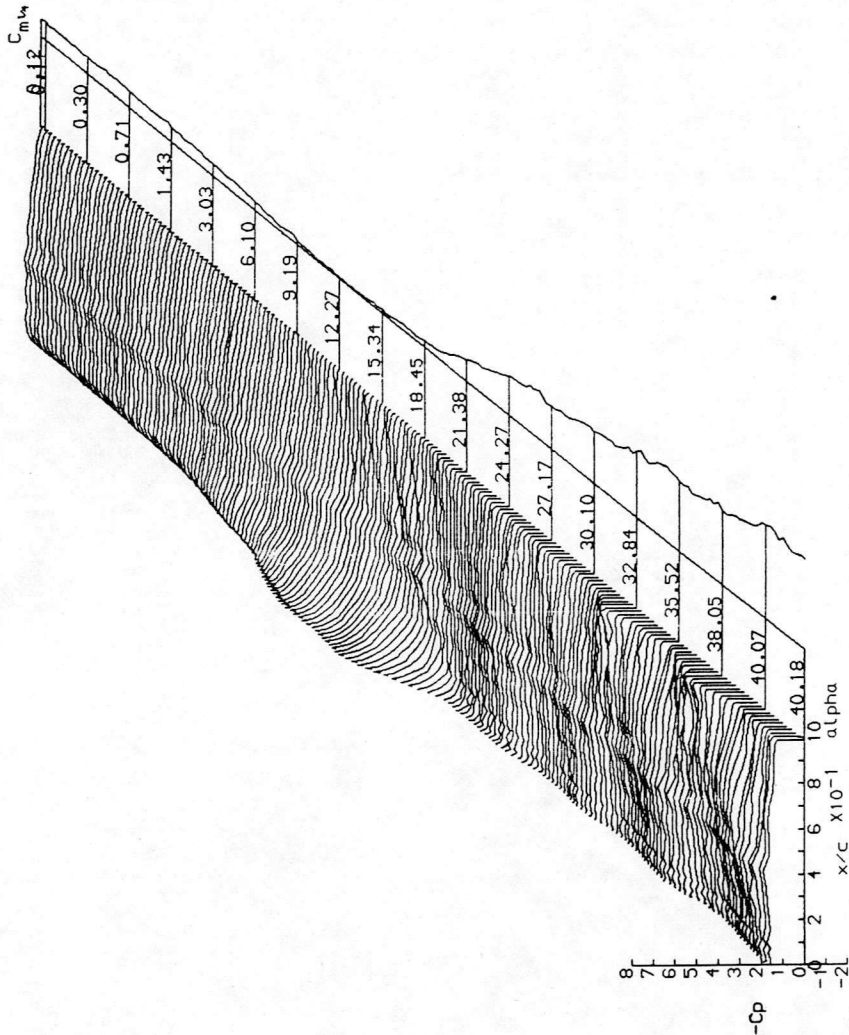
AVERAGED DATA OF 5 CYCLES



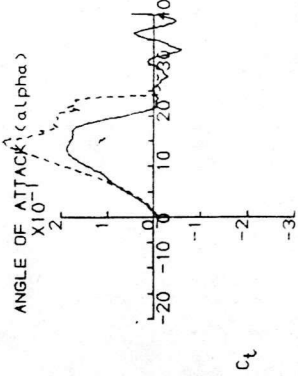
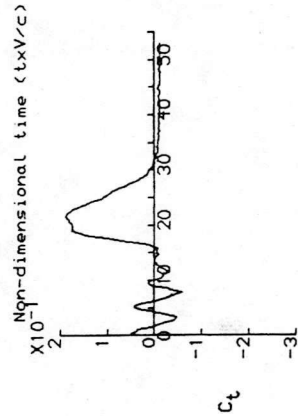
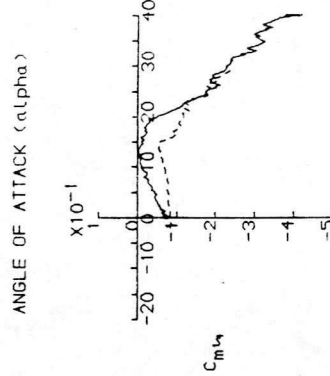
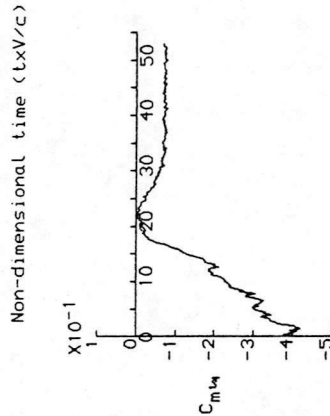
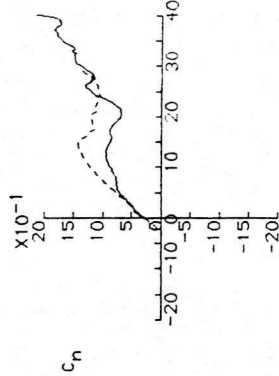
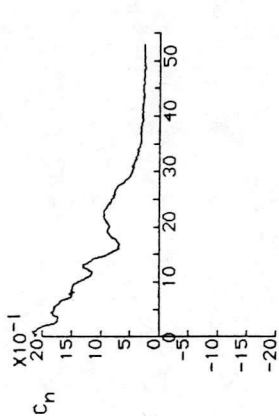
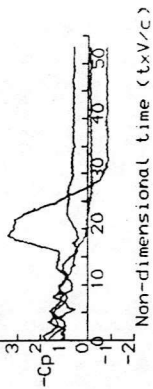
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38051
 REYNOLDS NUMBER = 1468907.
 DYNAMIC PRESSURE = 1002.57 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.8°C
 SAMPLING FREQUENCY = 359.97 Hz.
 REDUCED PITCH RATE = -0.01223
 LINEAR PITCH RATE = -104.65°s⁻¹

AVERAGED DATA OF 5 CYCLES

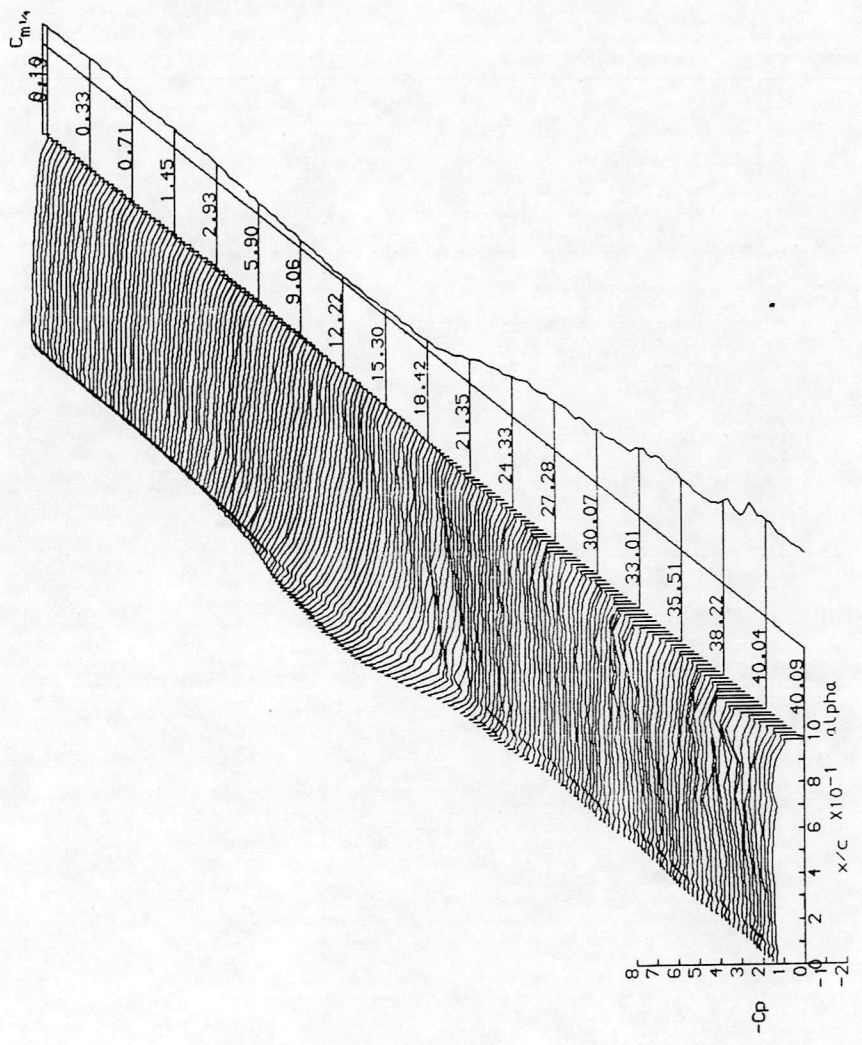
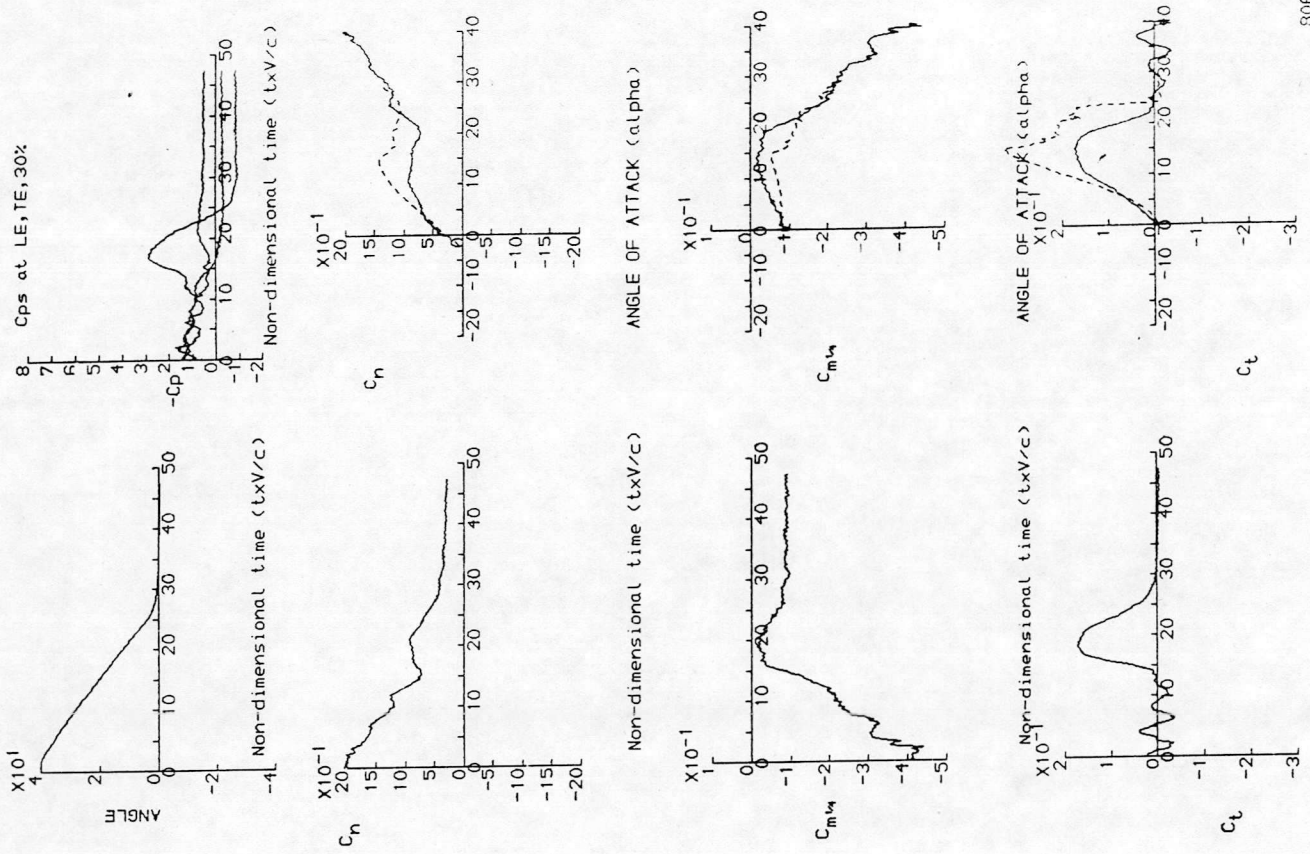


Cps at LE, TE, 30%



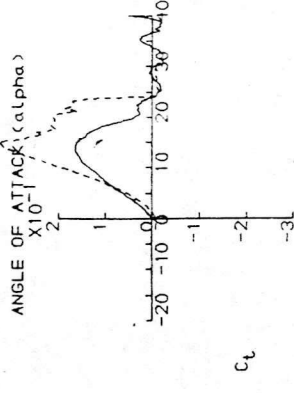
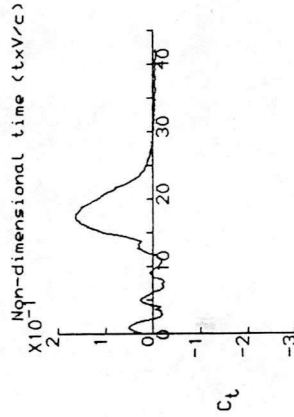
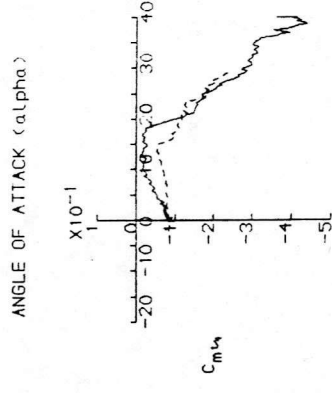
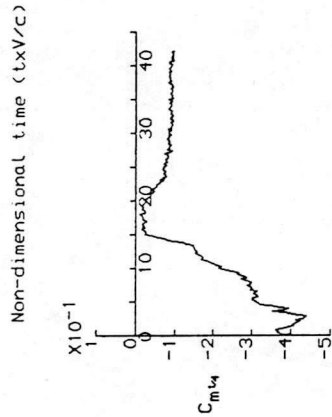
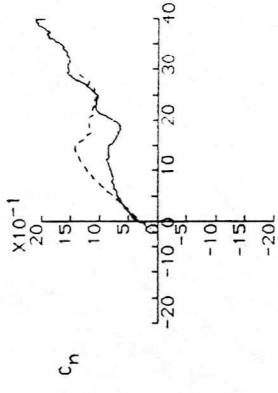
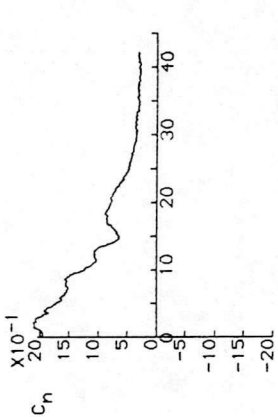
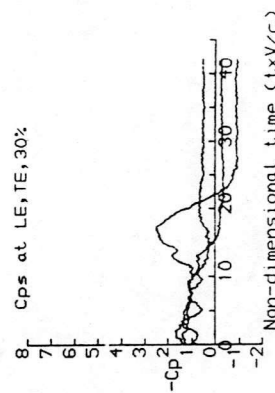
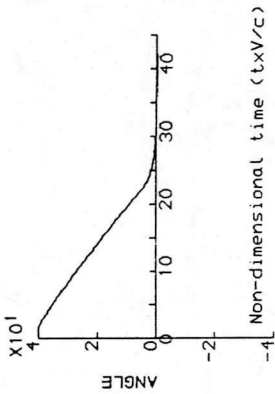
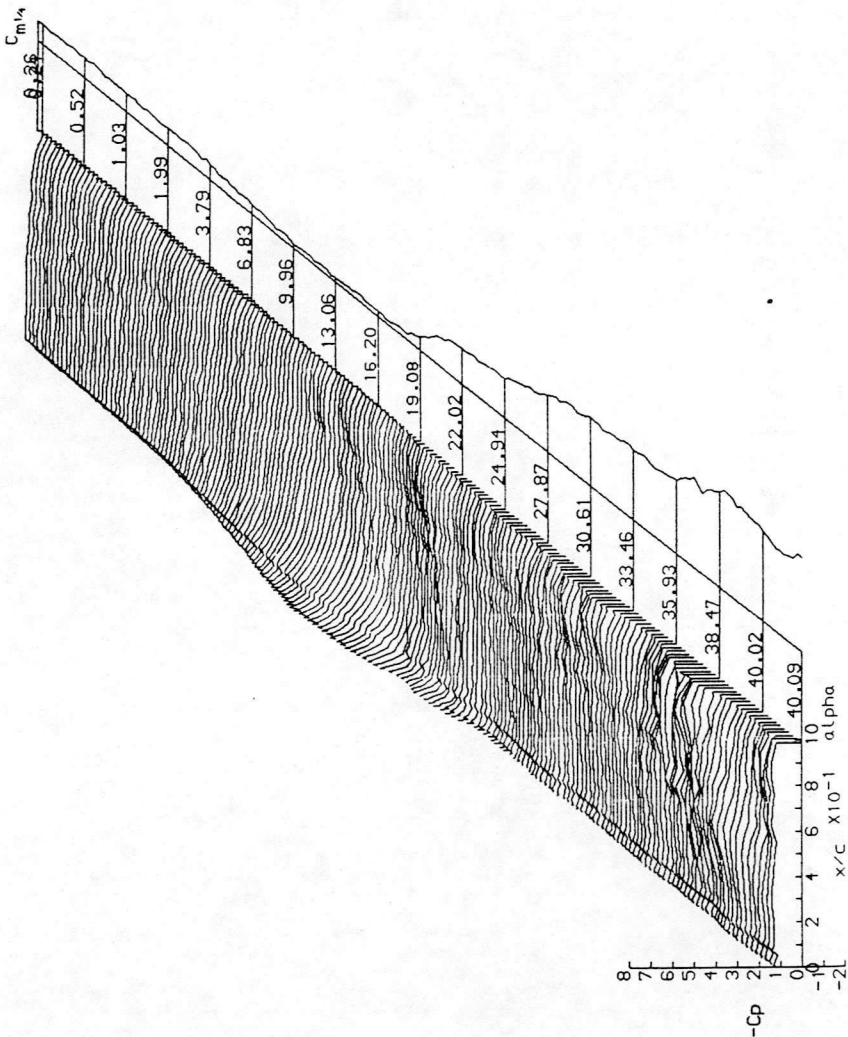
DYNAMIC CHARACTERISTICS FOR THE NACA23012C_MODEL04

RUN REFERENCE NUMBER: 38061
 REYNOLDS NUMBER = 1488913.
 DYNAMIC PRESSURE = 1004.16 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 26.8°C
 SAMPLING FREQUENCY = 400.00 Hz.
 REDUCED PITCH RATE = -0.01369
 LINEAR PITCH RATE = -1116.63°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

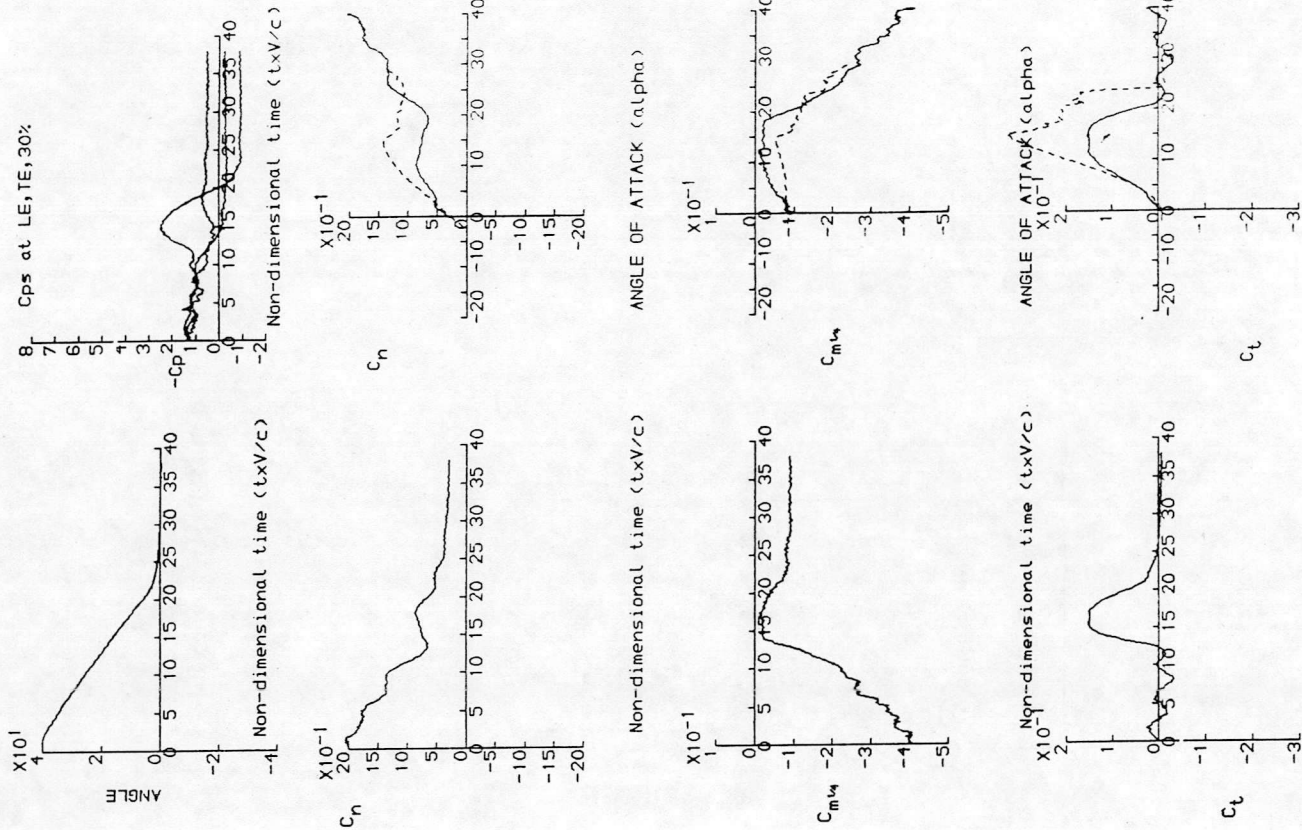
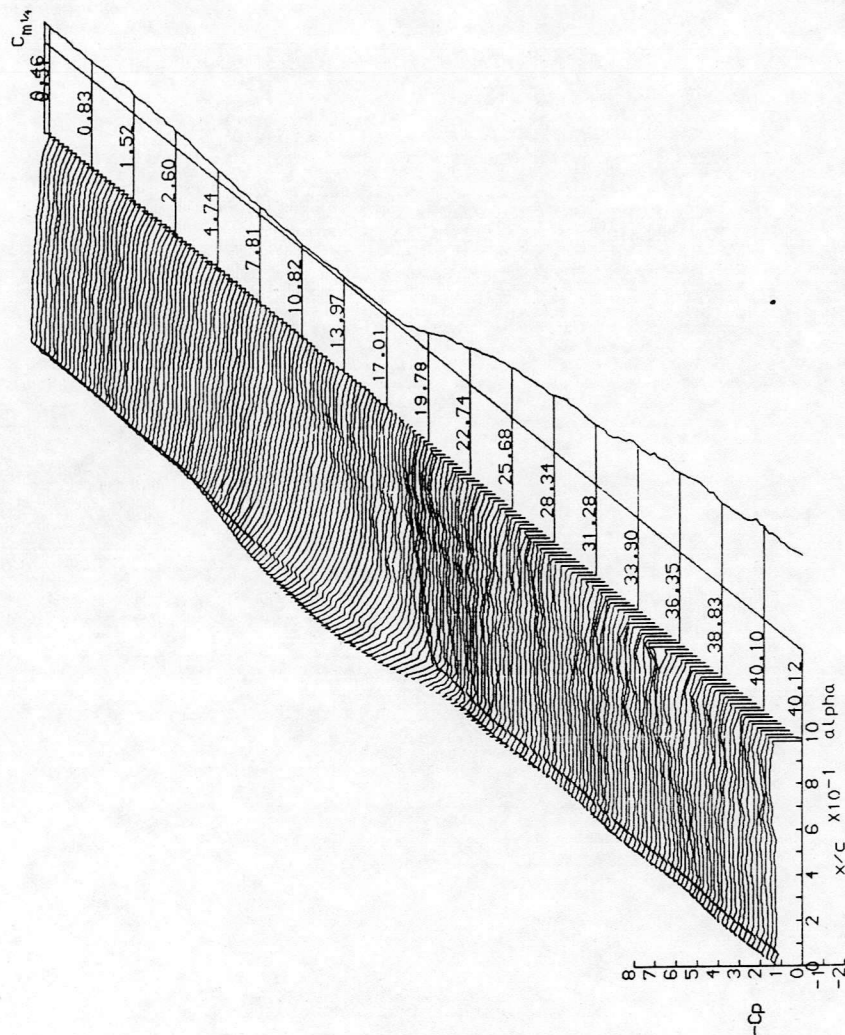
RUN REFERENCE NUMBER: 38071
 REYNOLDS NUMBER = 1483844.
 DYNAMIC PRESSURE = 1004.16 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.6°C
 SAMPLING FREQUENCY = 450.05 Hz.
 REDUCED PITCH RATE = -0.01502
 LINEAR PITCH RATE = -128.17°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

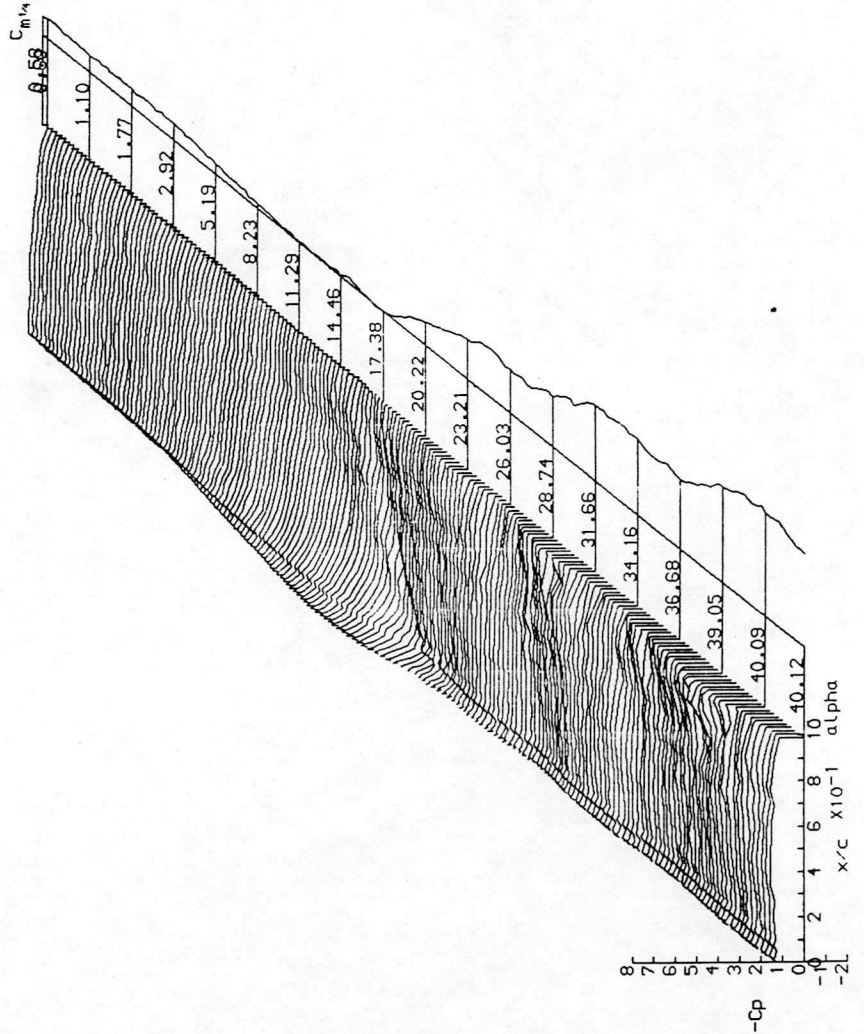
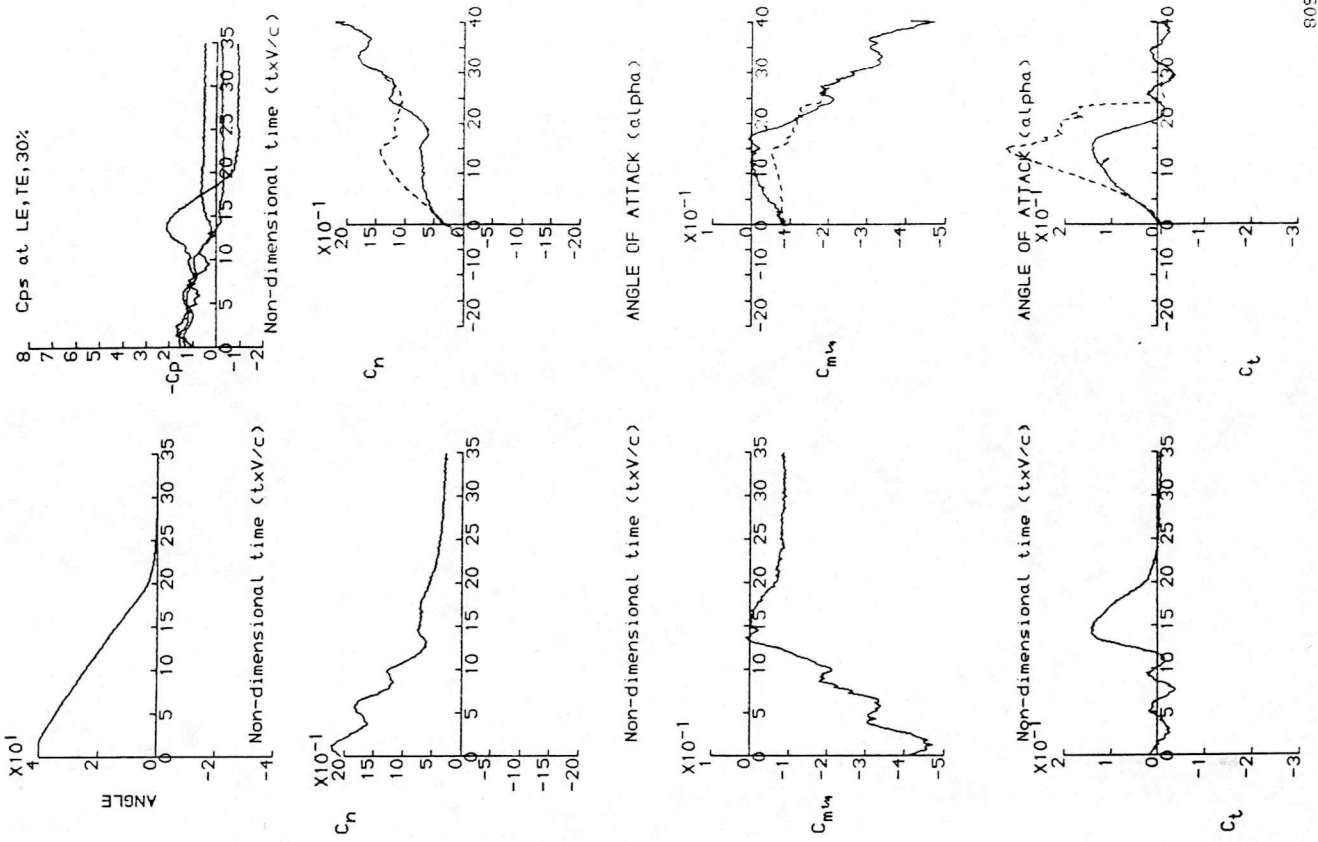
RUN REFERENCE NUMBER: 38081
 REYNOLDS NUMBER = 1481322.
 DYNAMIC PRESSURE = 1004.16 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.0°C
 SAMPLING FREQUENCY = 500.00 Hz.
 REDUCED PITCH RATE = -0.01654
 LINEAR PITCH RATE = -141.18°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

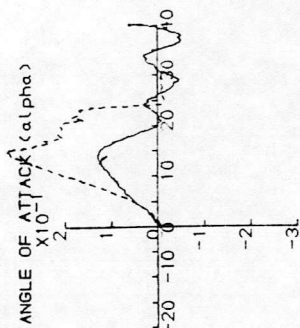
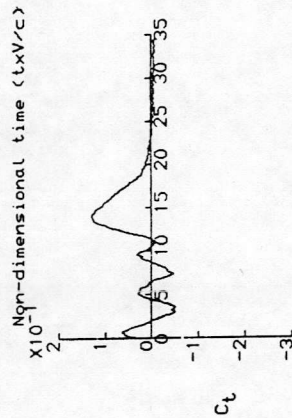
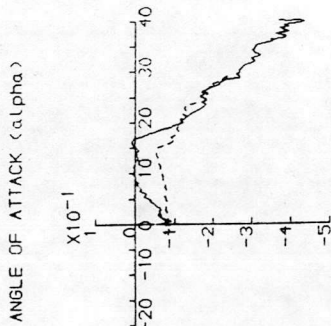
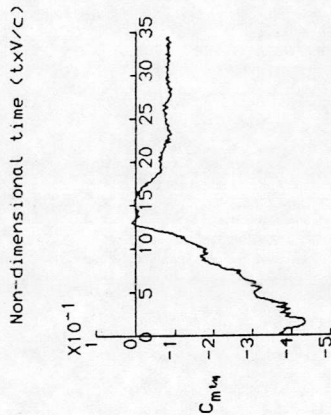
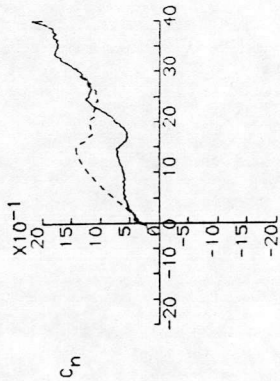
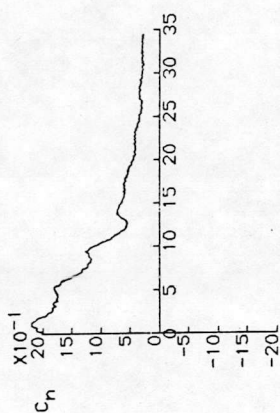
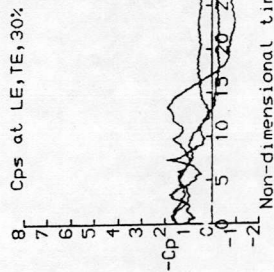
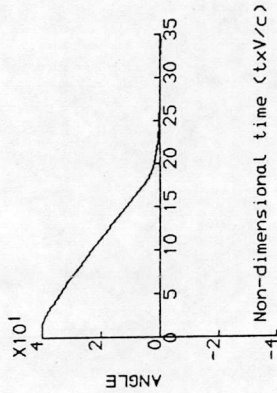
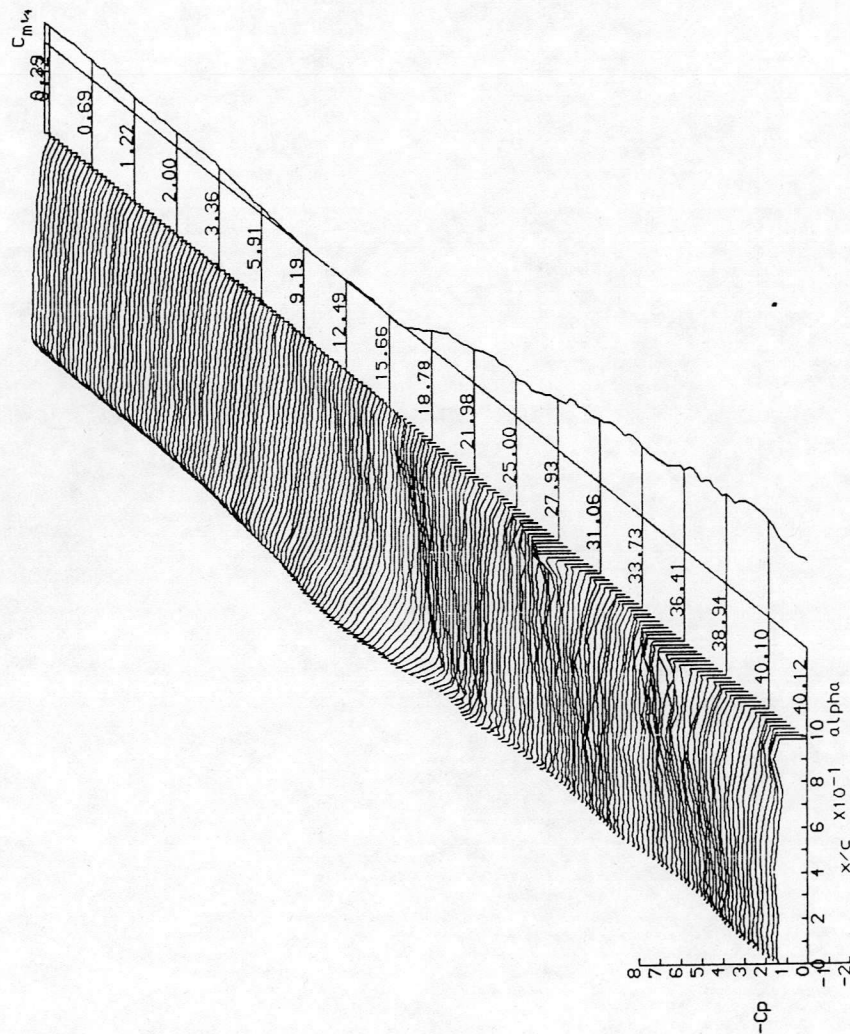
RUN REFERENCE NUMBER: 38031
 REYNOLDS NUMBER = 1479435.
 DYNAMIC PRESSURE = 1004.16 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.3°C
 SAMPLING FREQUENCY = 544.96 Hz.
 REDUCED PITCH RATE = -0.01797
 LINEAR PITCH RATE = -153.50°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

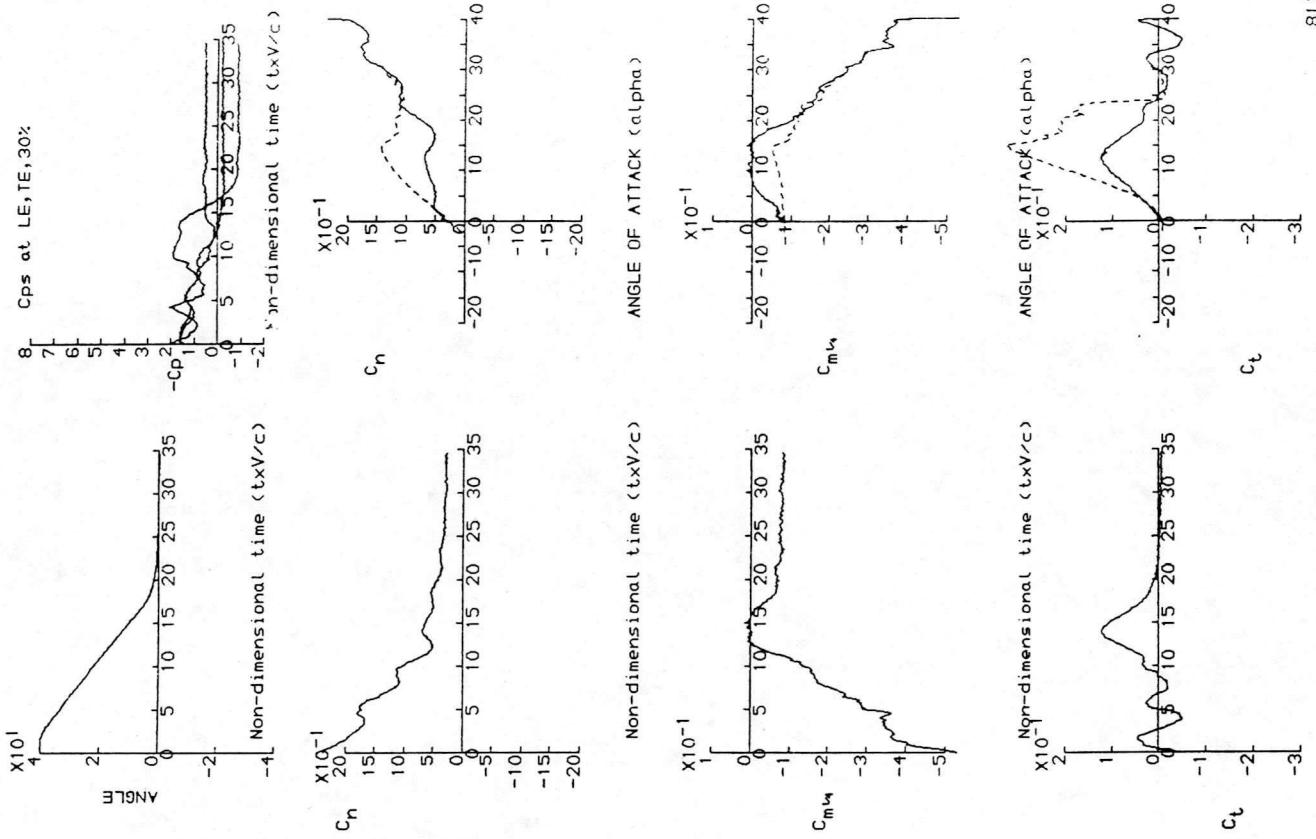
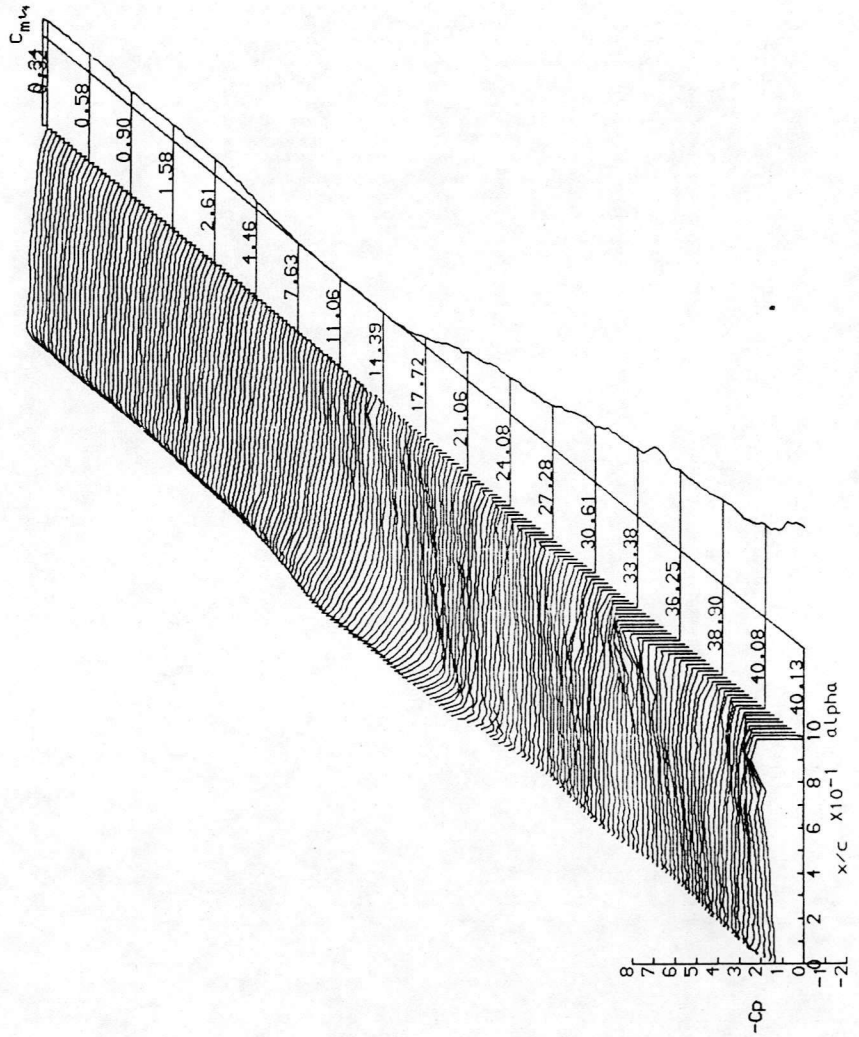
RUN REFERENCE NUMBER: 38101
 RETNOLDS NUMBER = 1481793.
 DYNAMIC PRESSURE = 1003.09 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.8°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01963
 LINEAR PITCH RATE = -167.41°s⁻¹



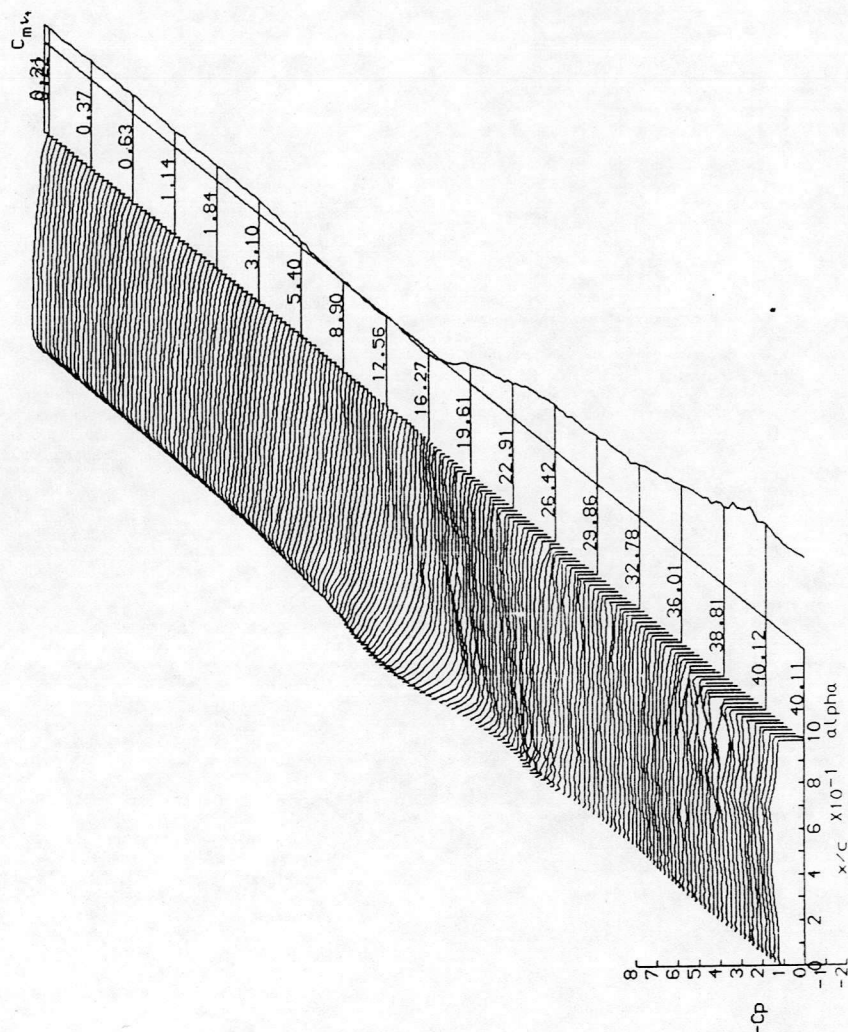
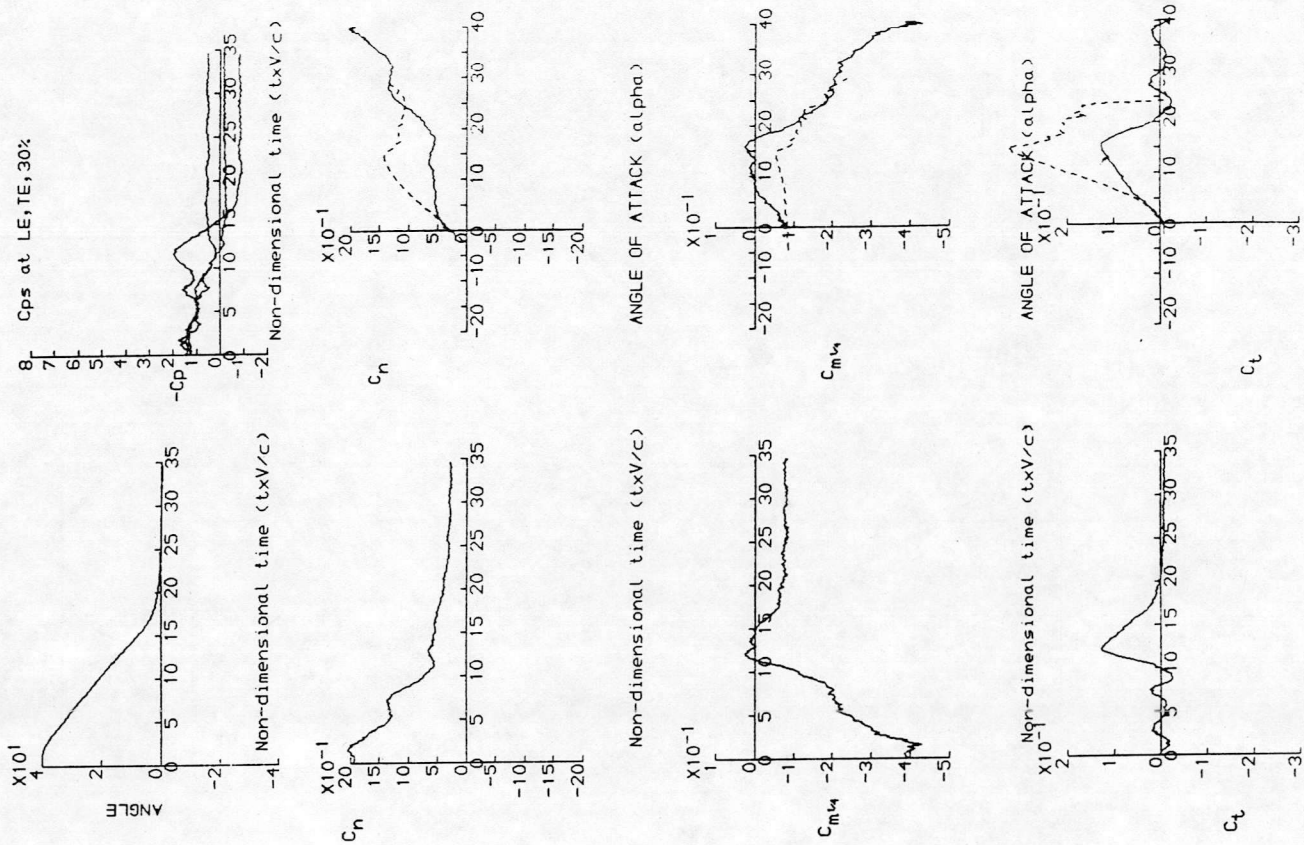
DYNAMIC CHARACTERISTICS FOR THE NACA23012C_MODEL04

RUN REFERENCE NUMBER: 38111
 REYNOLDS NUMBER = 1478021.
 DYNAMIC PRESSURE = 1003.09 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.4°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02057
 LINEAR PITCH RATE = -175.67°S⁻¹
 AVERAGED DATA OF 5 CYCLES



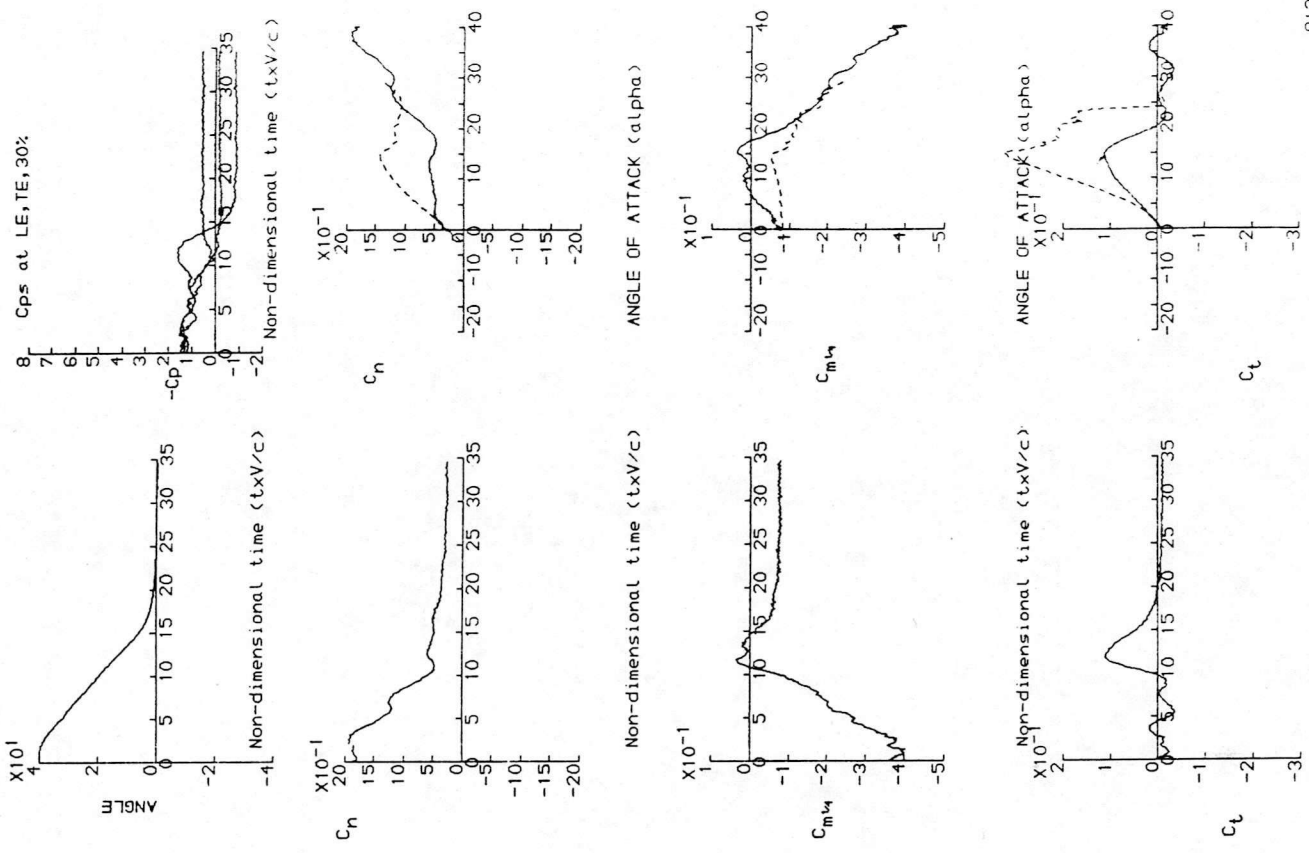
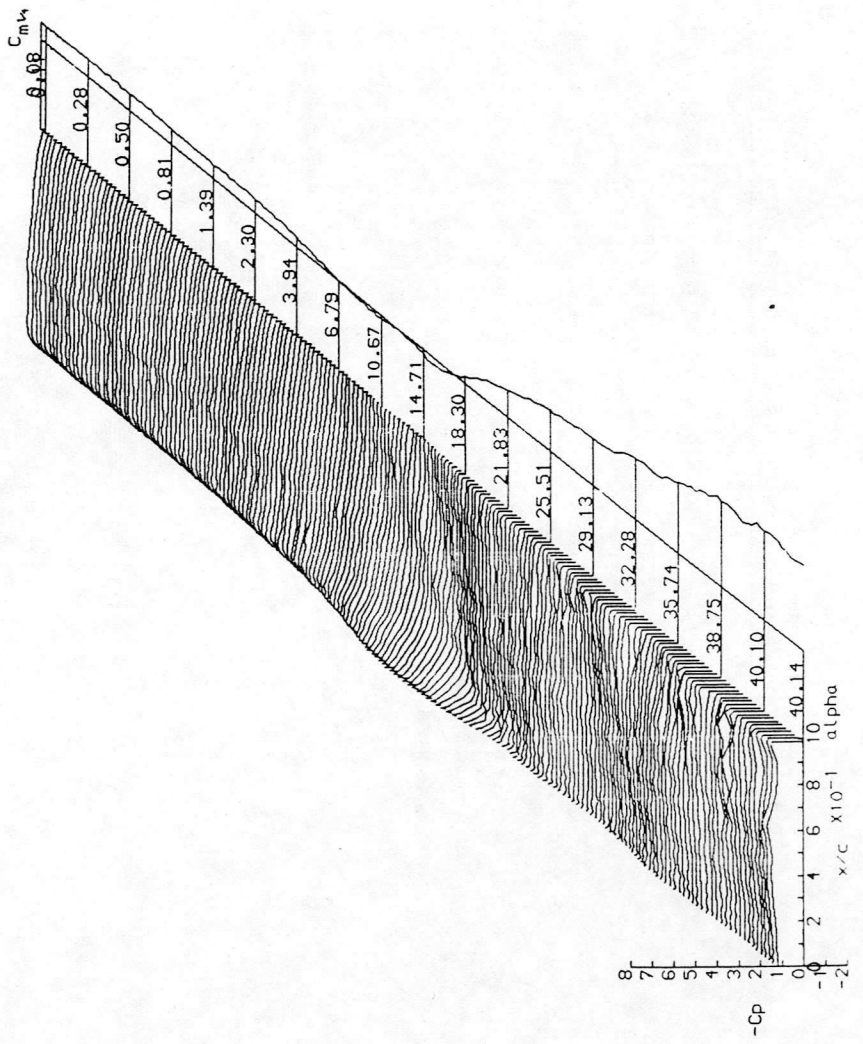
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38121
 REYNOLDS NUMBER = 1476758.
 DYNAMIC PRESSURE = 1003.09 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.6°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02193
 LINEAR PITCH RATE = -187.31°s⁻¹



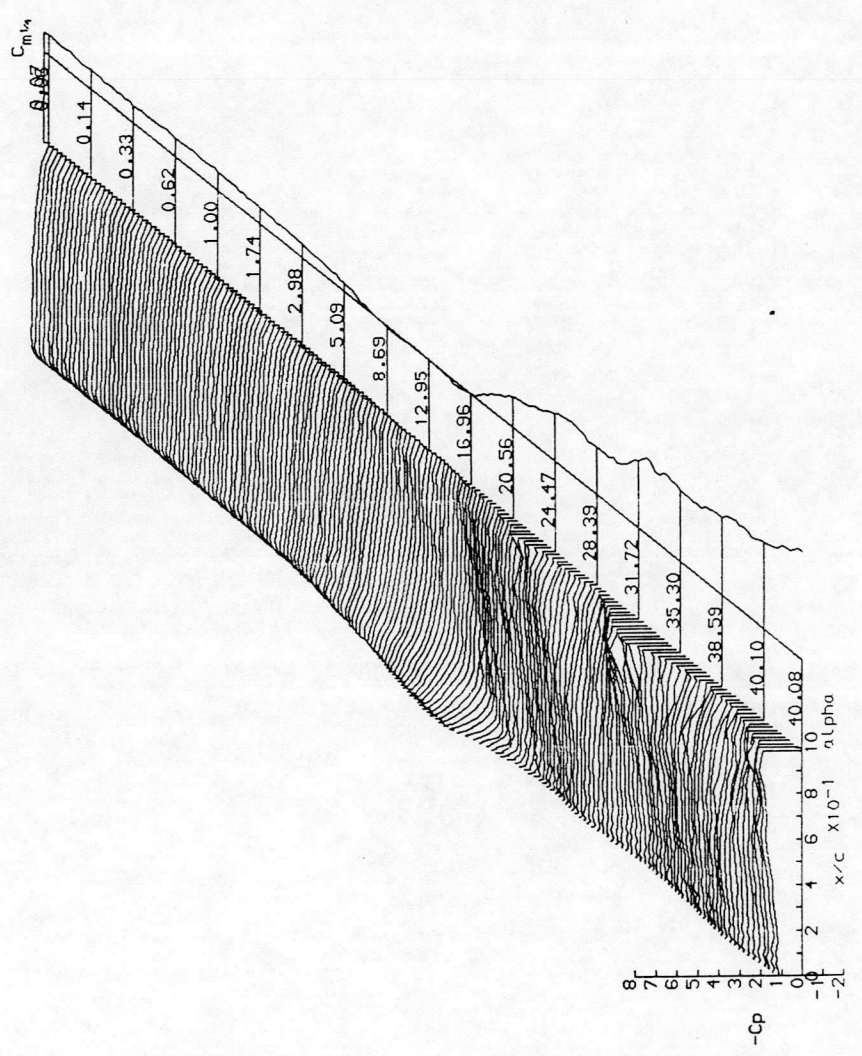
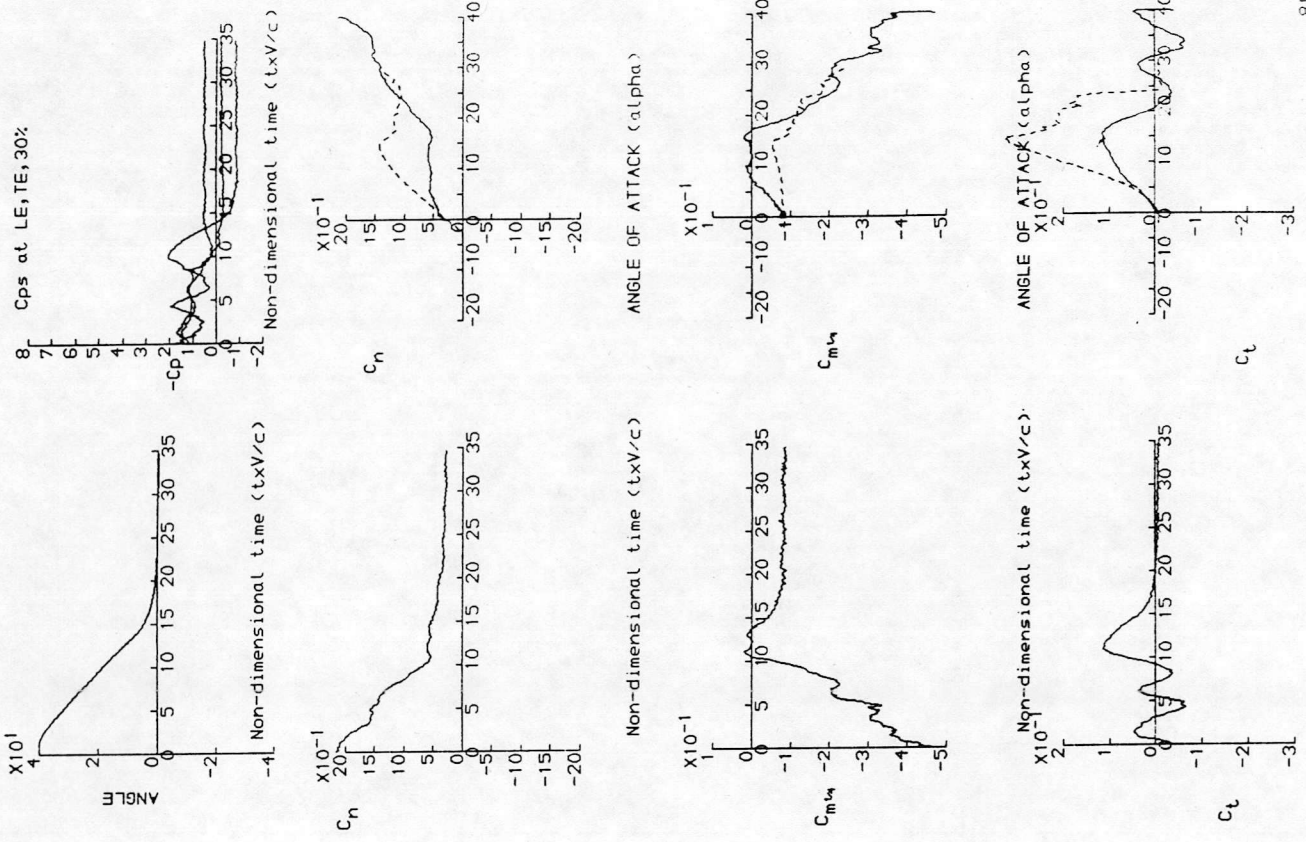
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER = 38131
 RETNOLDS NUMBER = 1474892.
 DYNAMIC PRESSURE = 1003.09 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.9°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02326
 LINEAR PITCH RATE = -198.80°S⁻¹



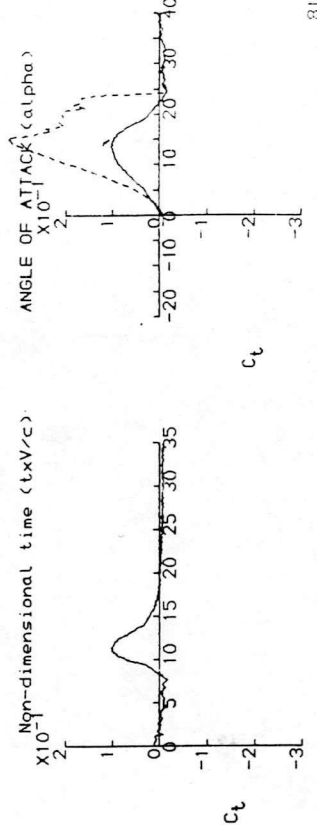
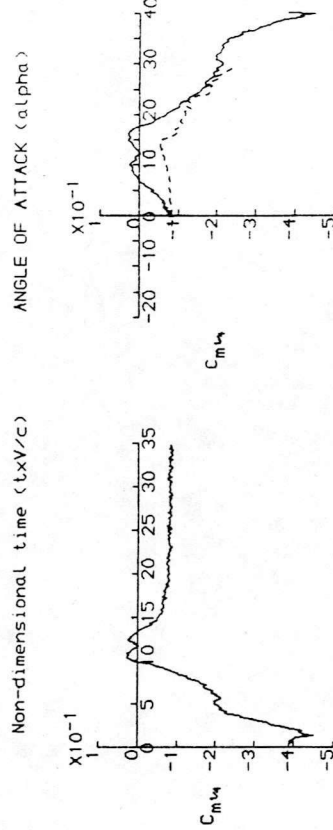
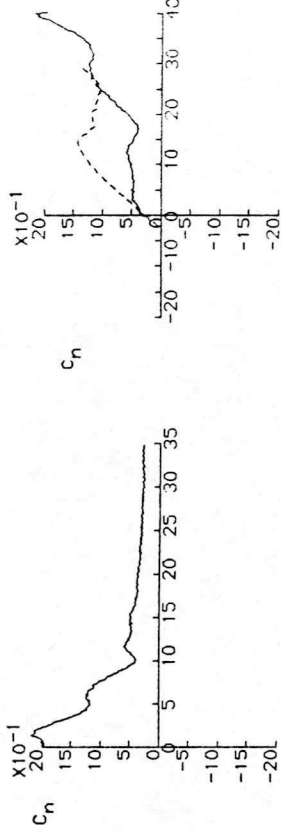
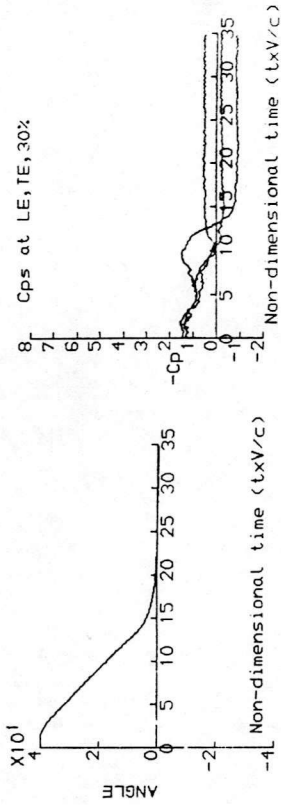
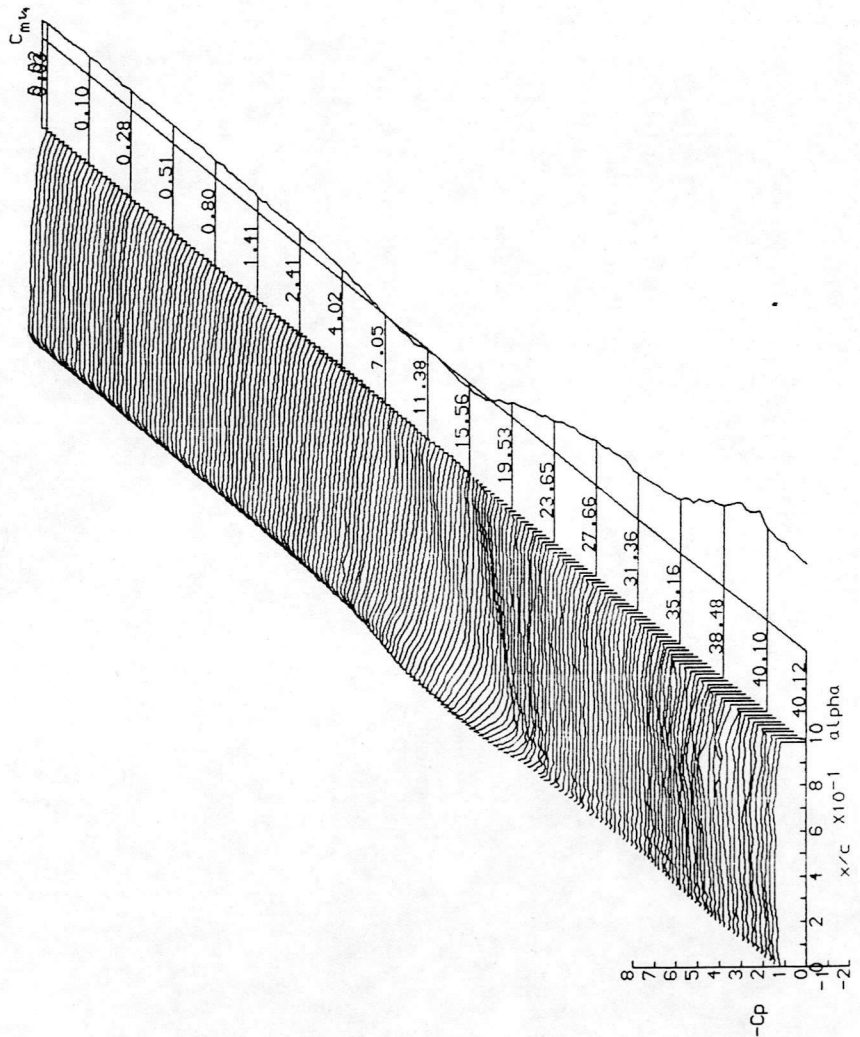
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38141
 REYNOLDS NUMBER = 1489779.
 DYNAMIC PRESSURE = 1015.66 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02439
 LINEAR PITCH RATE = -209.46°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

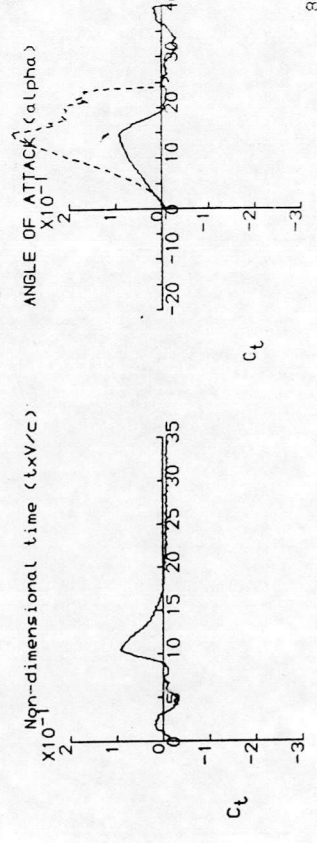
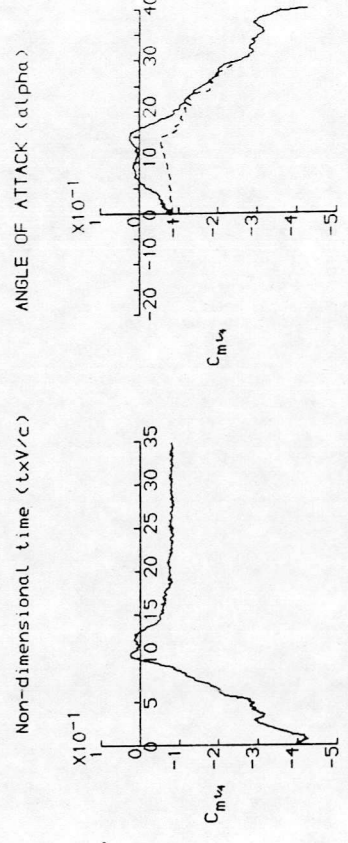
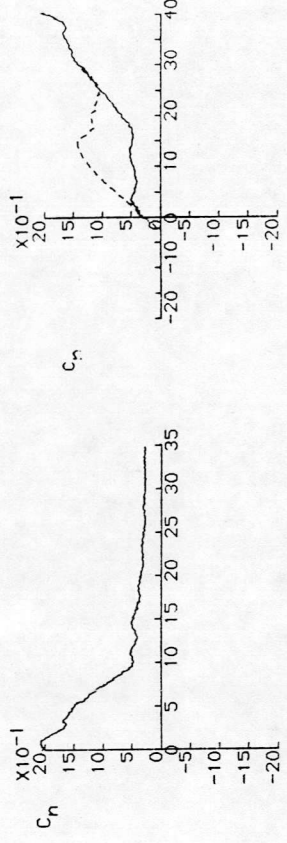
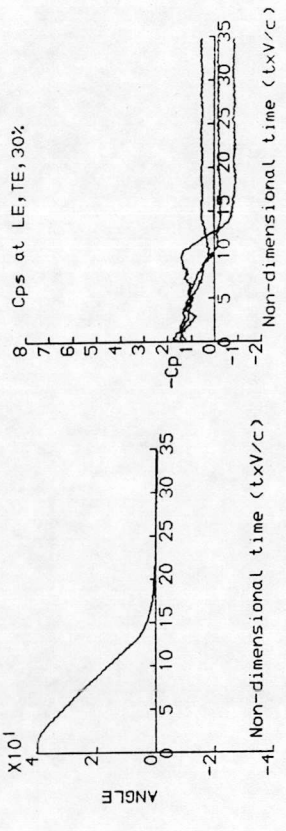
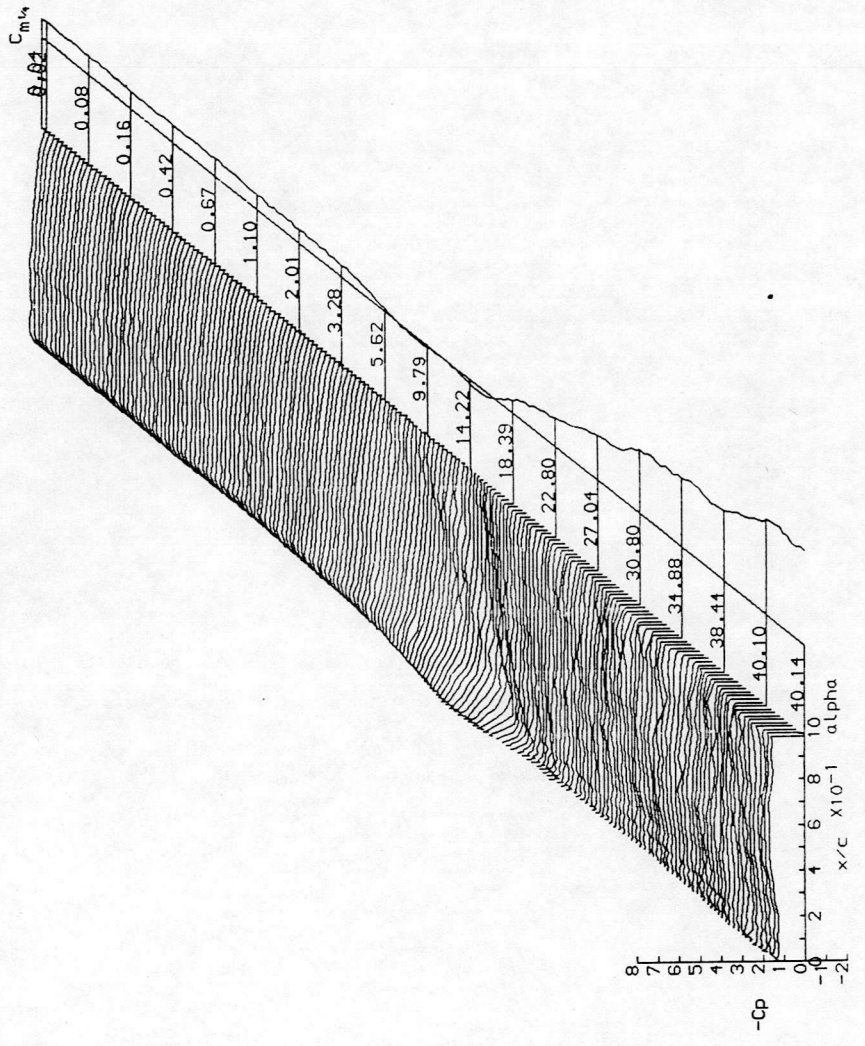
RUN REFERENCE NUMBER: 38151
 RETNOLDS NUMBER = 1484102.
 DYNAMIC PRESSURE = 1015.66 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.9°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02532
 LINEAR PITCH RATE = -217.73°S⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

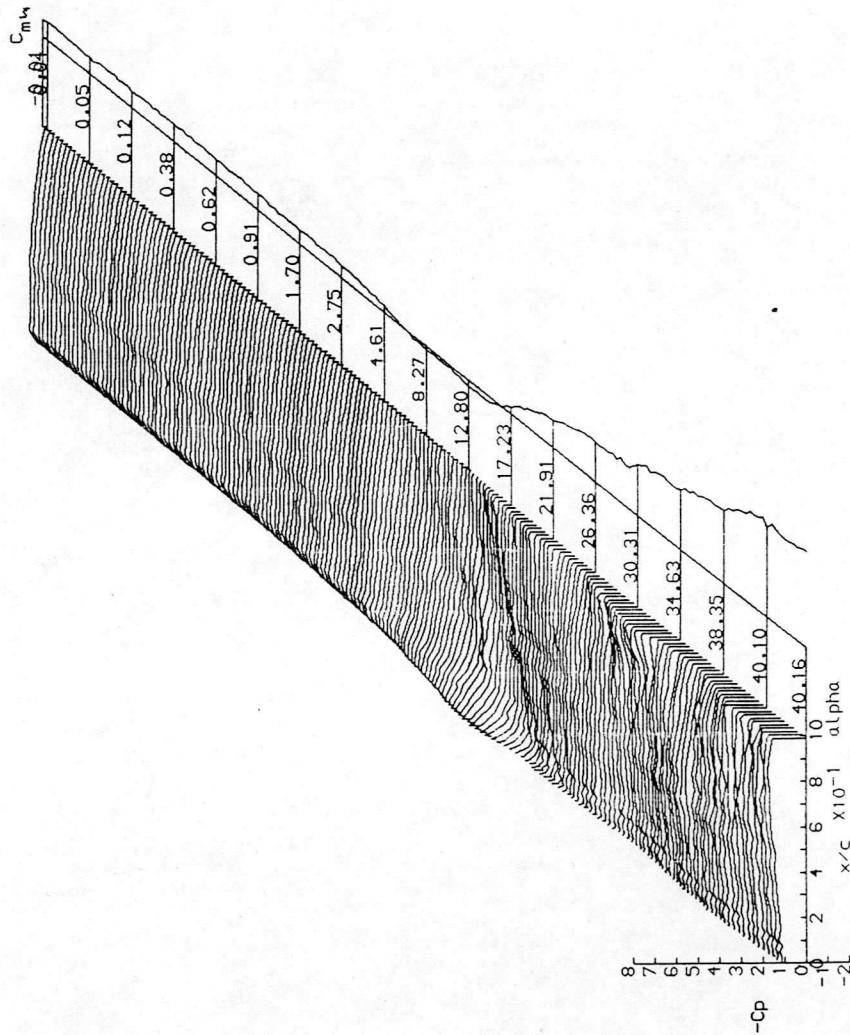
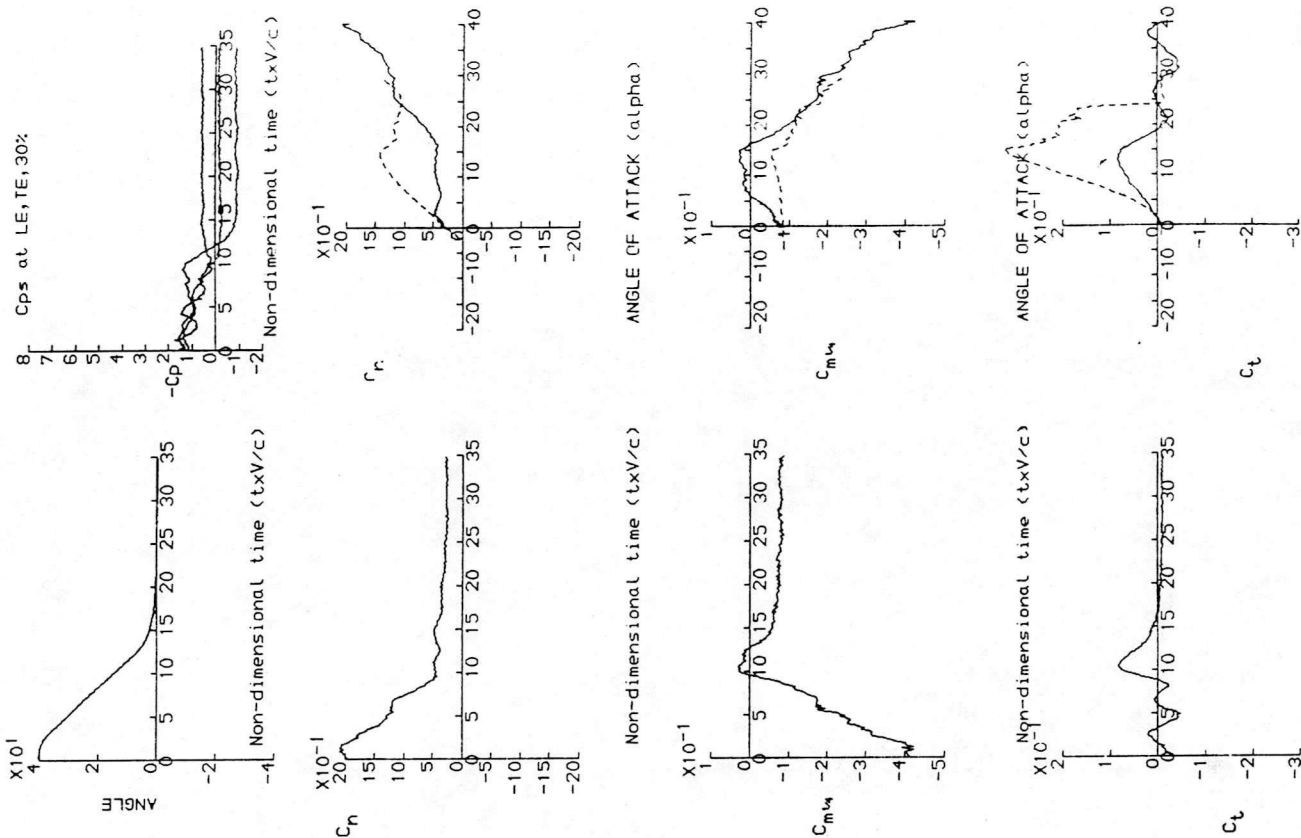
RUN REFERENCE NUMBER: 38161
 REYNOLDS NUMBER = 1481592.
 DYNAMIC PRESSURE = 1015.66 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.3°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02634
 LINEAR PITCH RATE = -226.61°s⁻¹

AVERAGED DATA OF 5 CYCLES



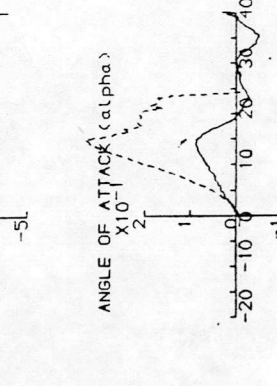
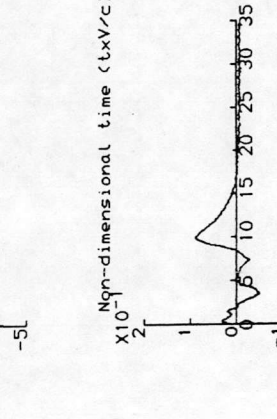
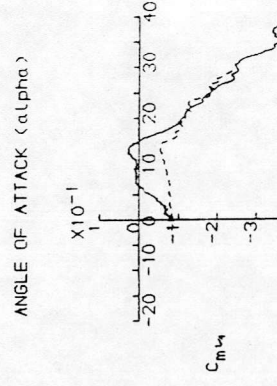
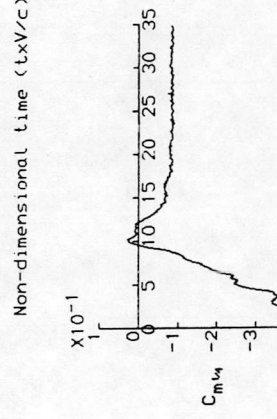
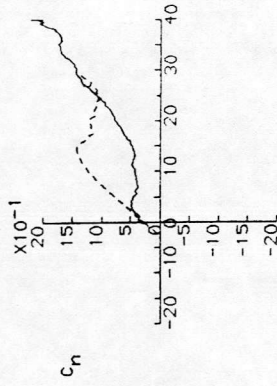
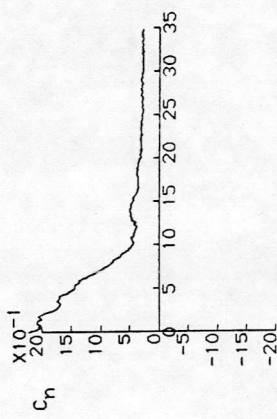
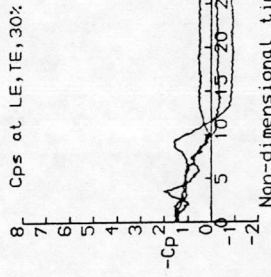
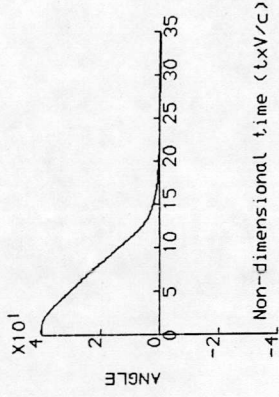
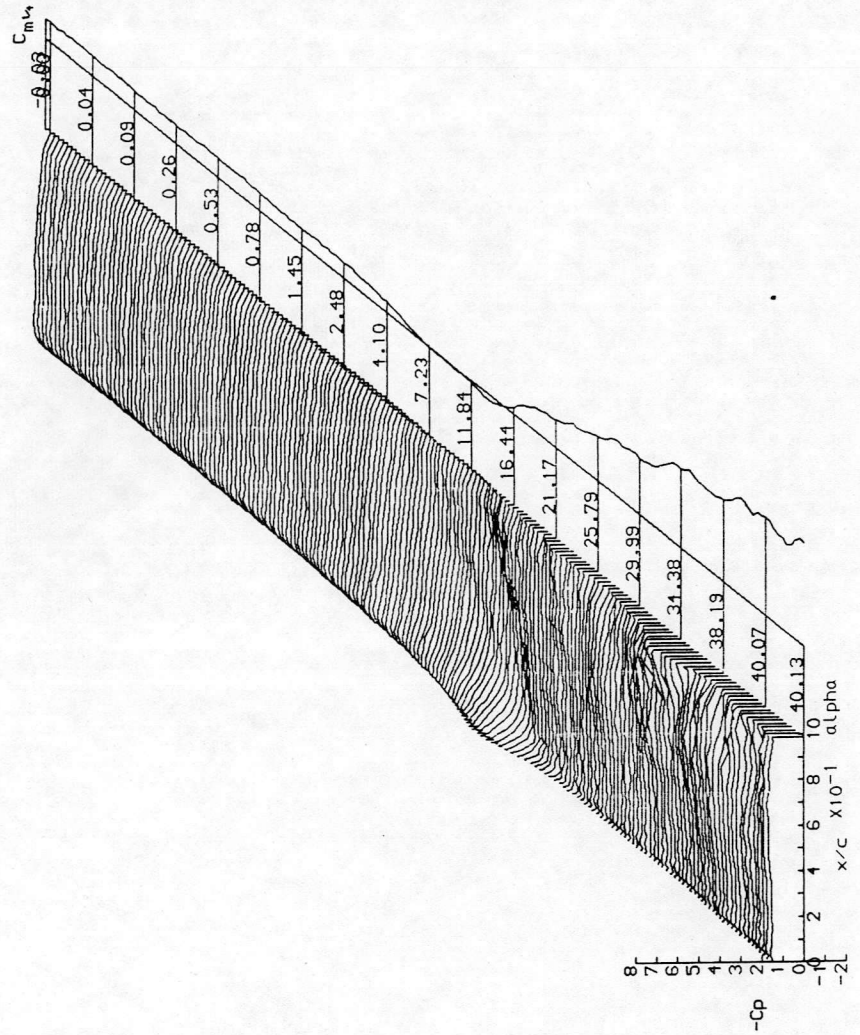
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38171
 REYNOLDS NUMBER = 1479714.
 DYNAMIC PRESSURE = 1015.66 Nm²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.6°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02740
 LINEAR PITCH RATE = -235.86°S⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

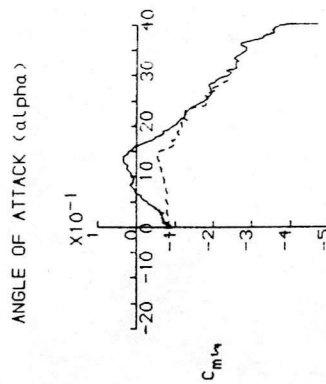
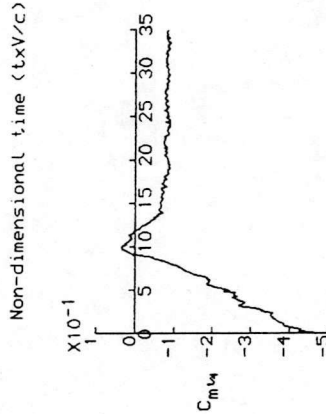
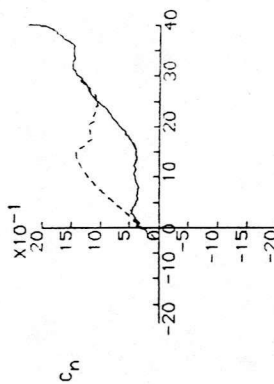
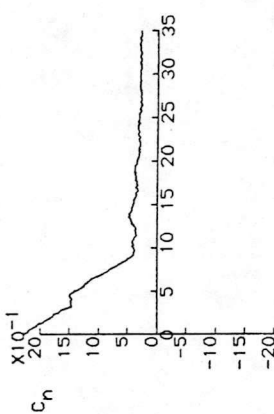
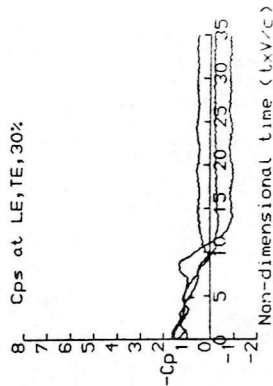
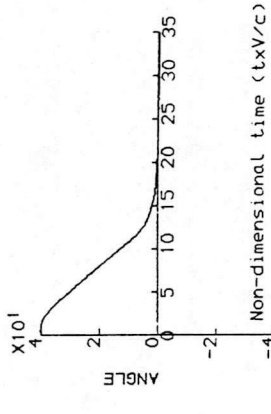
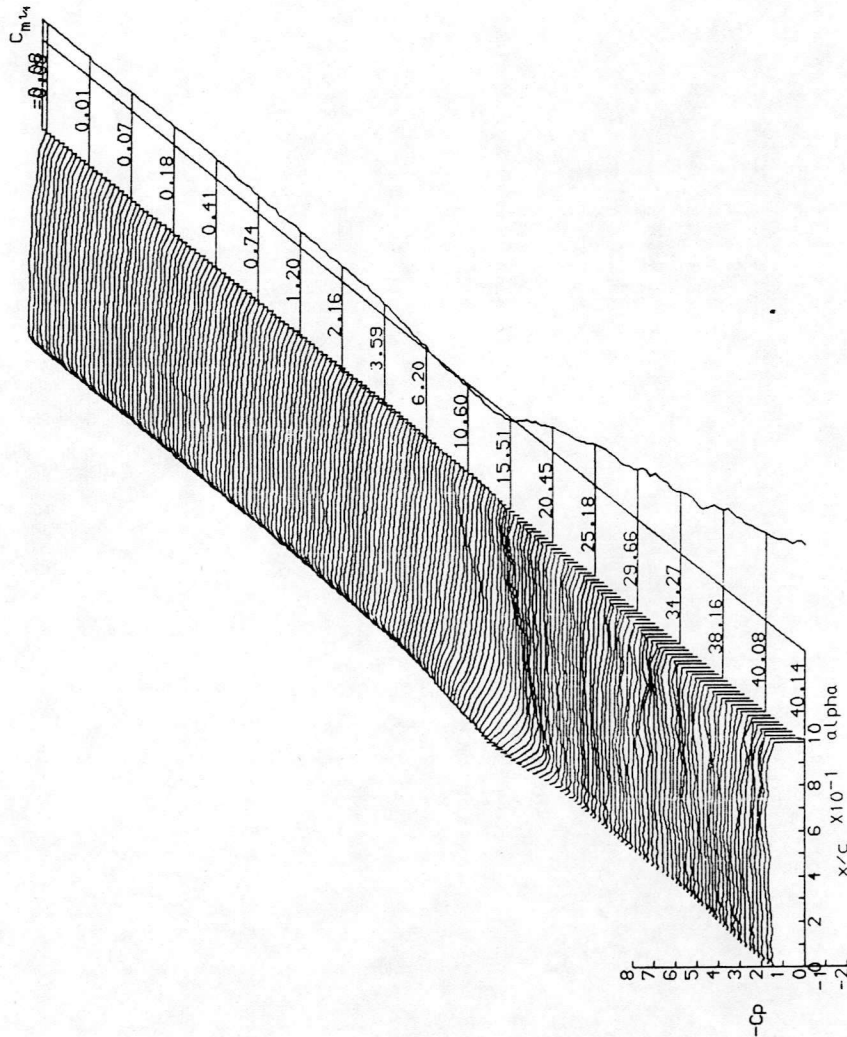
RUN REFERENCE NUMBER = 38181
 REYNOLDS NUMBER = 1485271.
 DYNAMIC PRESSURE = 1017.26 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.1119
 AIR TEMPERATURE = 28.9°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02800
 LINEAR PITCH RATE = -240.93°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38191
 REYNOLDS NUMBER = 1480880.
 DYNAMIC PRESSURE = 1017.26 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 29.6°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02973
 LINEAR PITCH RATE = -256.17°S⁻¹

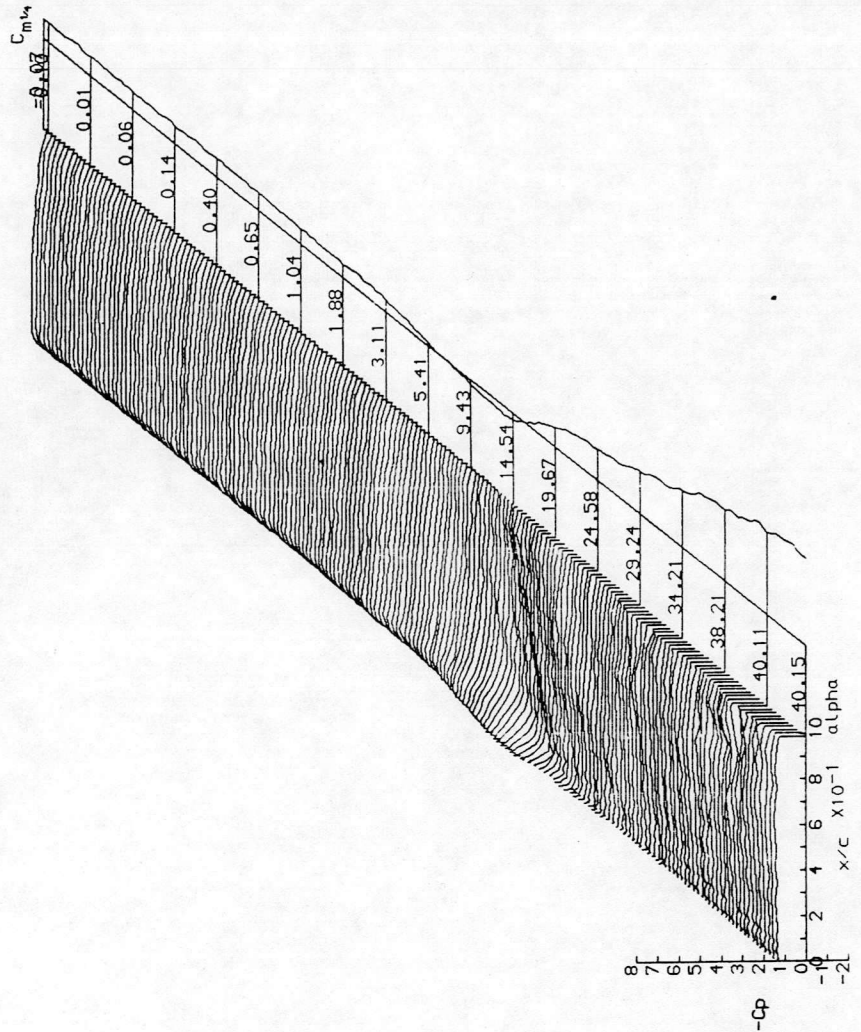
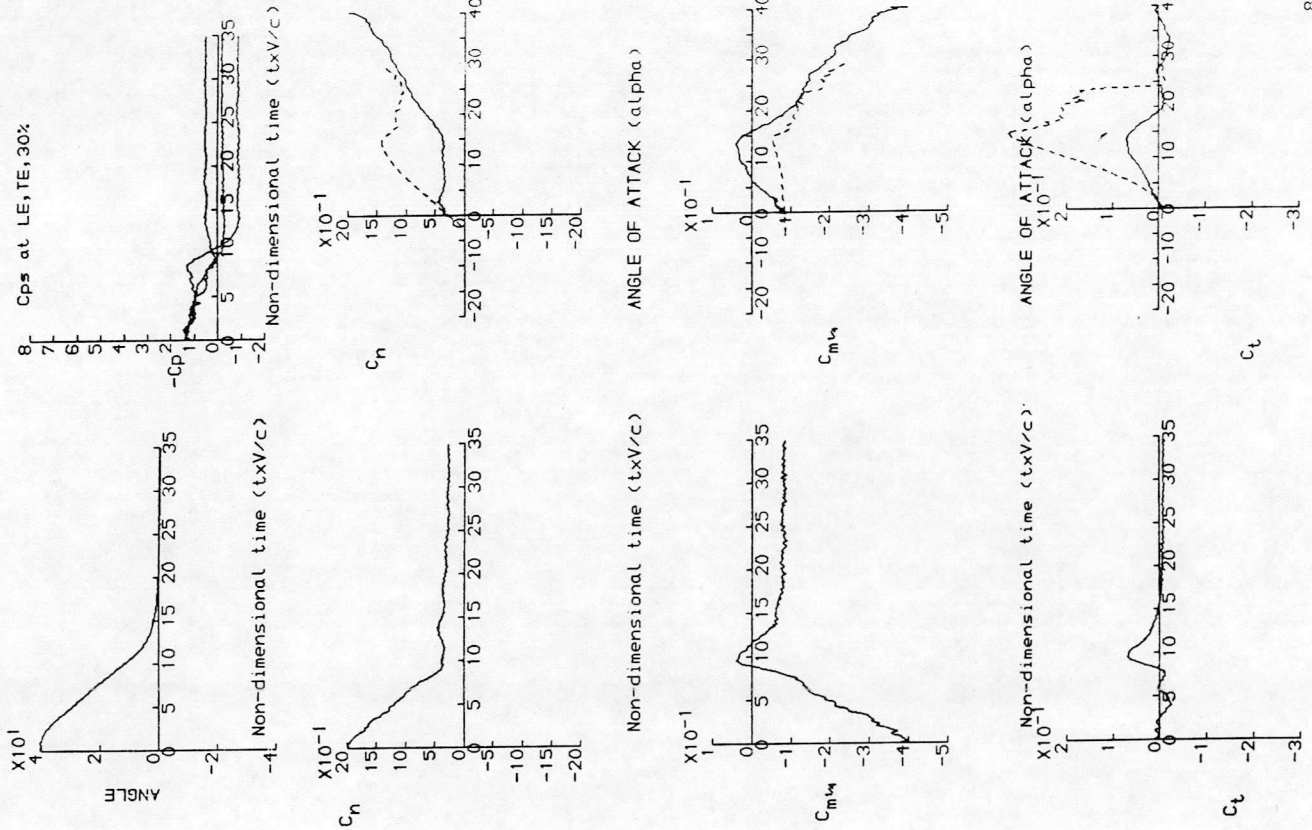
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38201
 REYNOLDS NUMBER = 1479630.
 DYNAMIC PRESSURE = 1017.26 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP ARC = -41.000°
 AVERAGED DATA OF 5 CYCLES

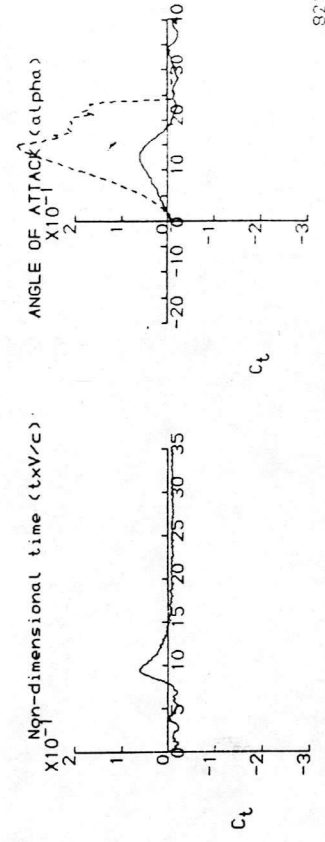
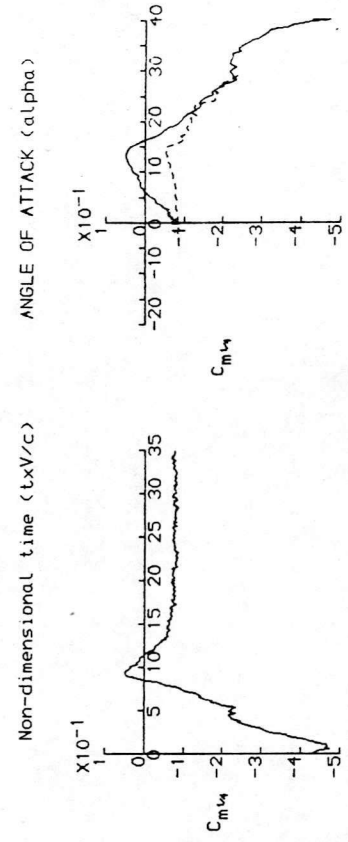
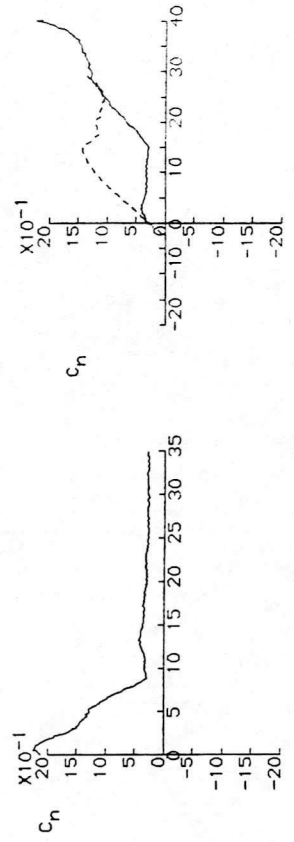
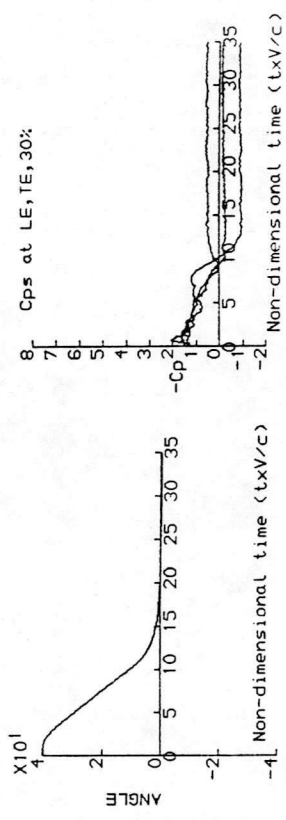
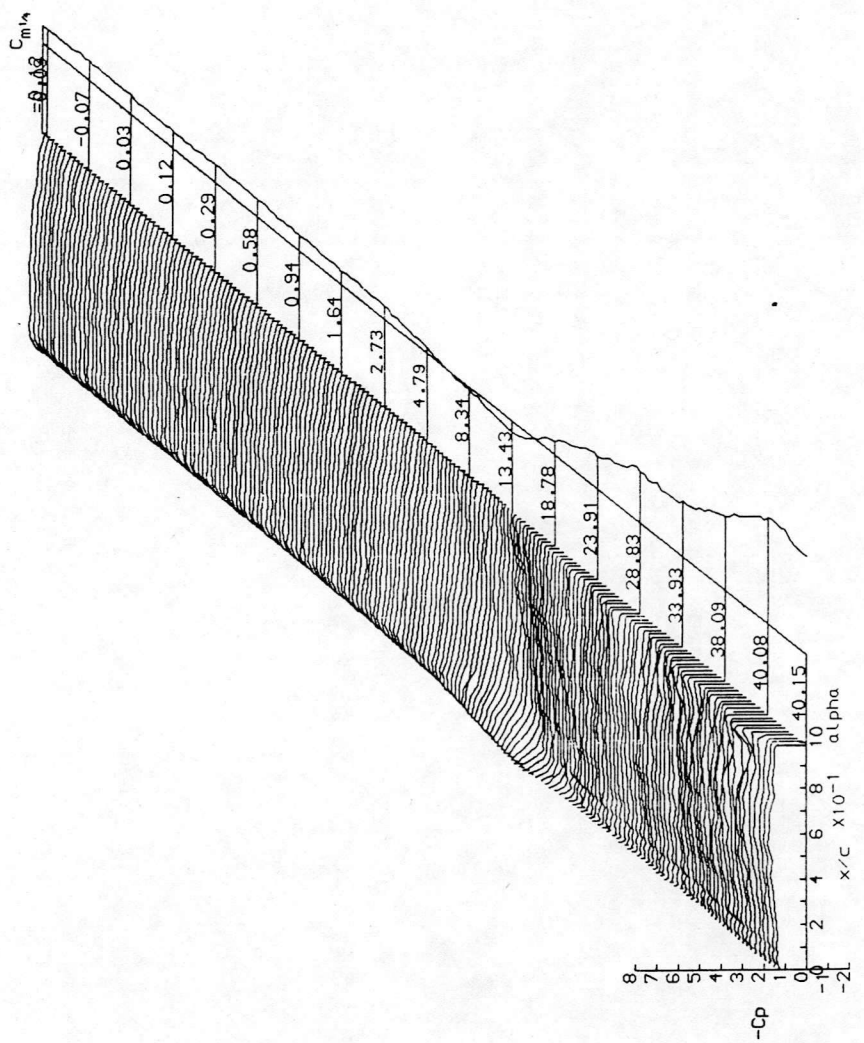
DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 29.8°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03046
 LINEAR PITCH RATE = -262.52°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

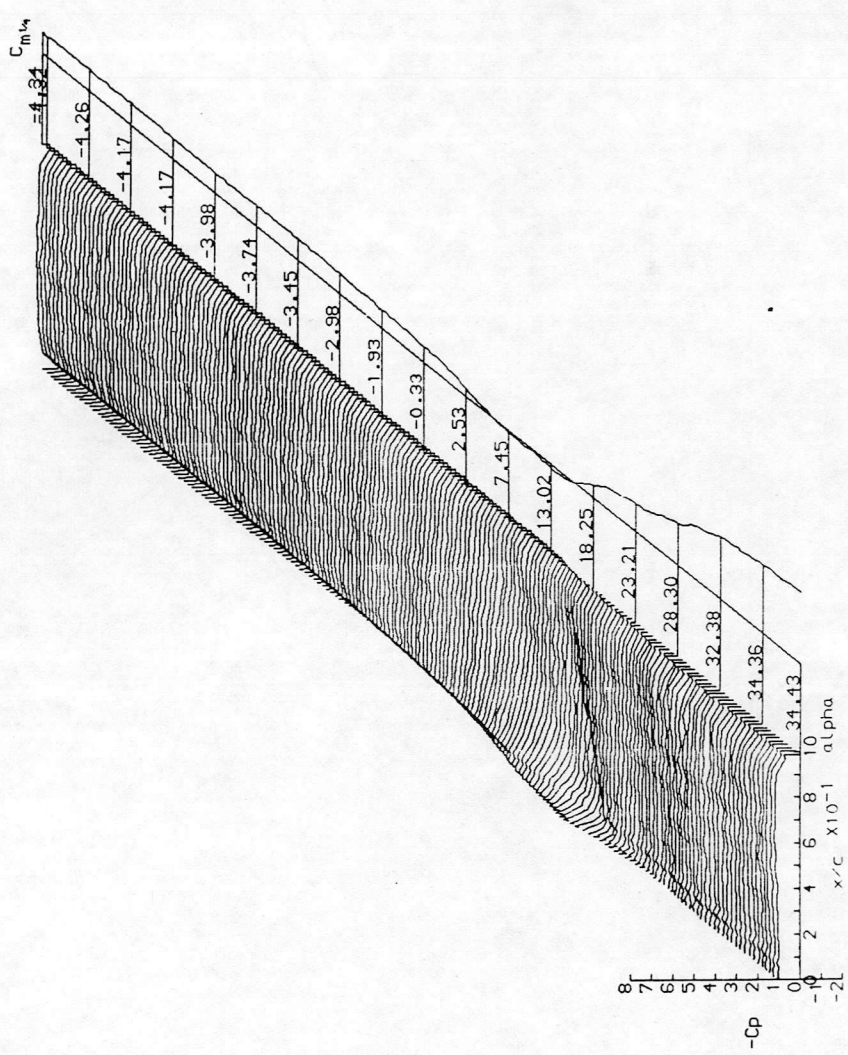
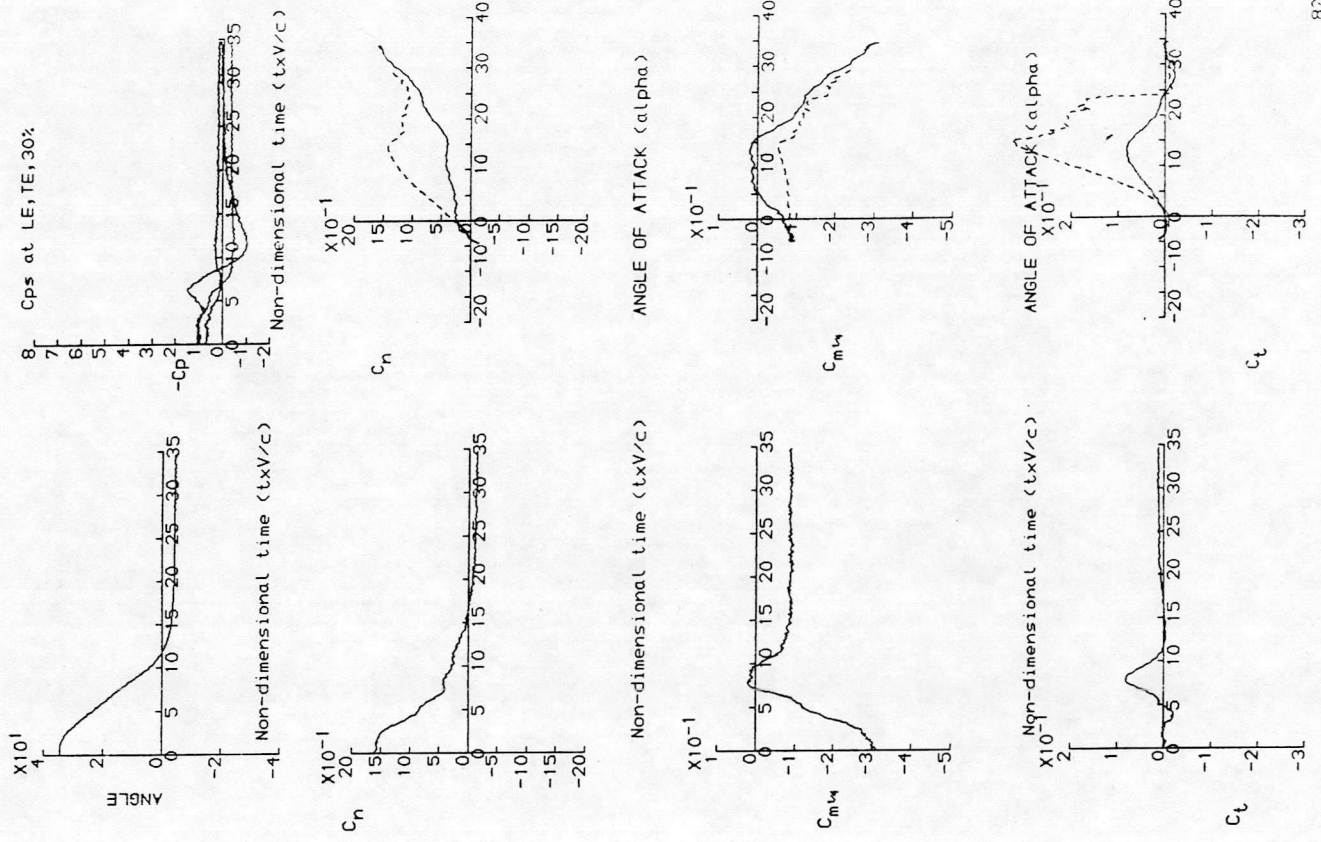
RUN REFERENCE NUMBER: 38211
 RETNOLDS NUMBER = 1477136.
 DYNAMIC PRESSURE = 1017.26 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 40.00°
 RAMP APC = -41.000°
 AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 30.2°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03139
 LINEAR PITCH RATE = -270.69°s⁻¹



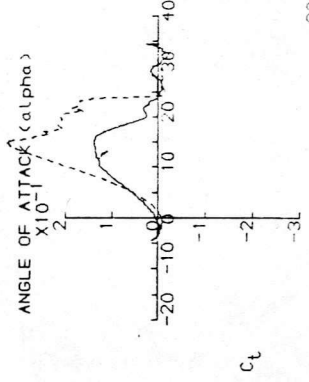
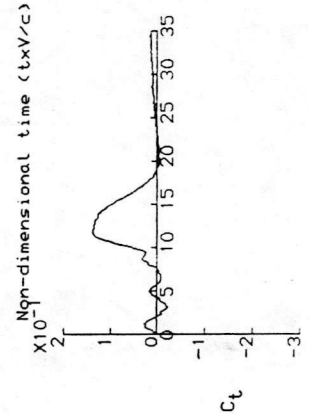
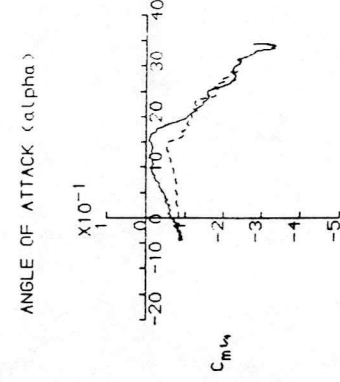
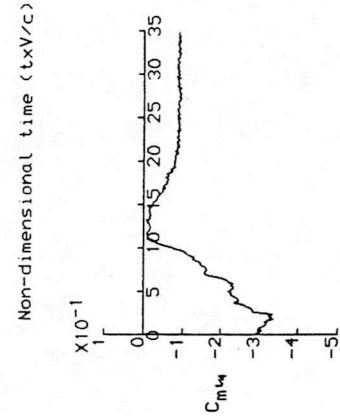
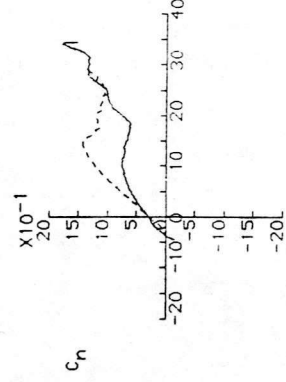
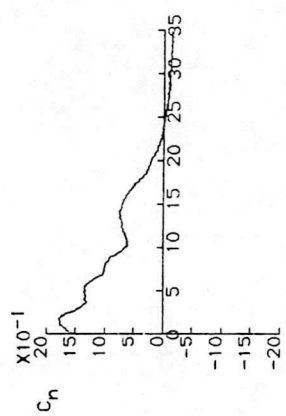
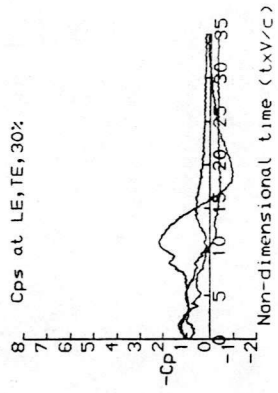
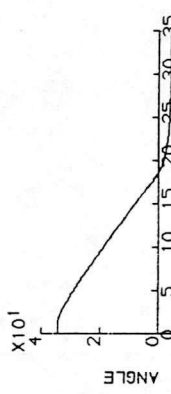
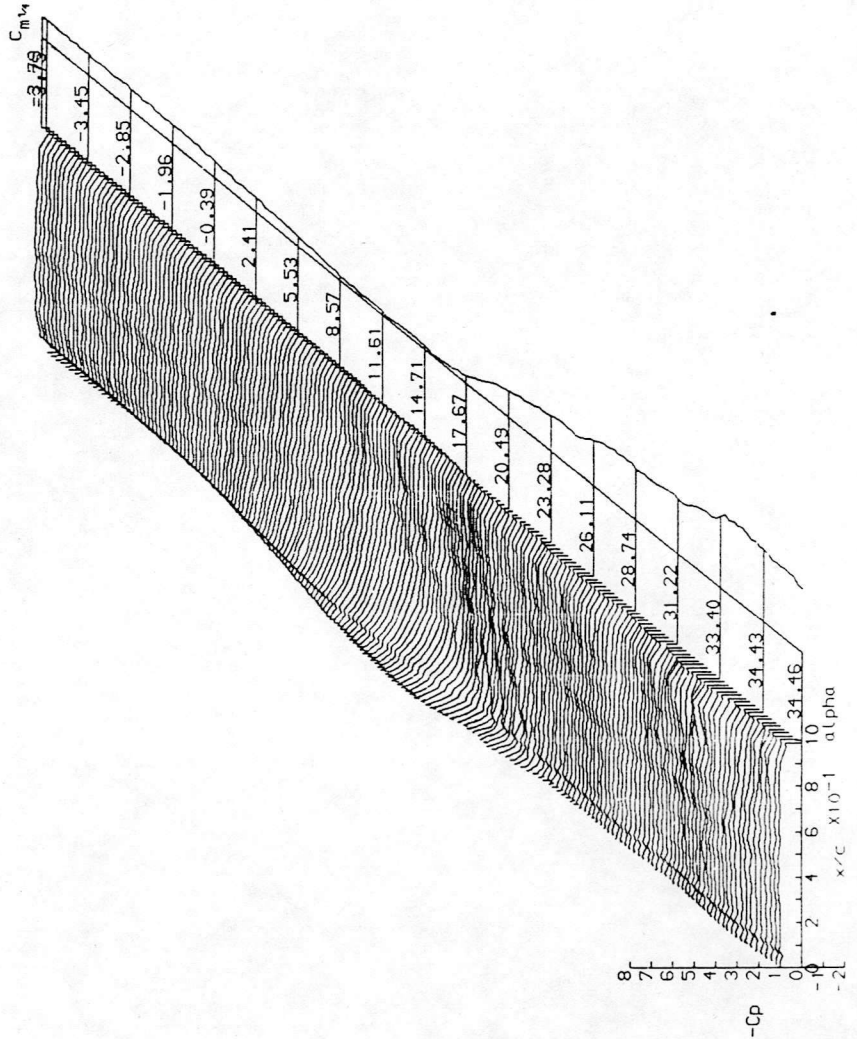
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38221
 REYNOLDS NUMBER = 1506650.
 DYNAMIC PRESSURE = 1021.22 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 35.00°
 RAMP ARC = -10.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 26.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03240
 LINEAR PITCH RATE = -278.07°S⁻¹



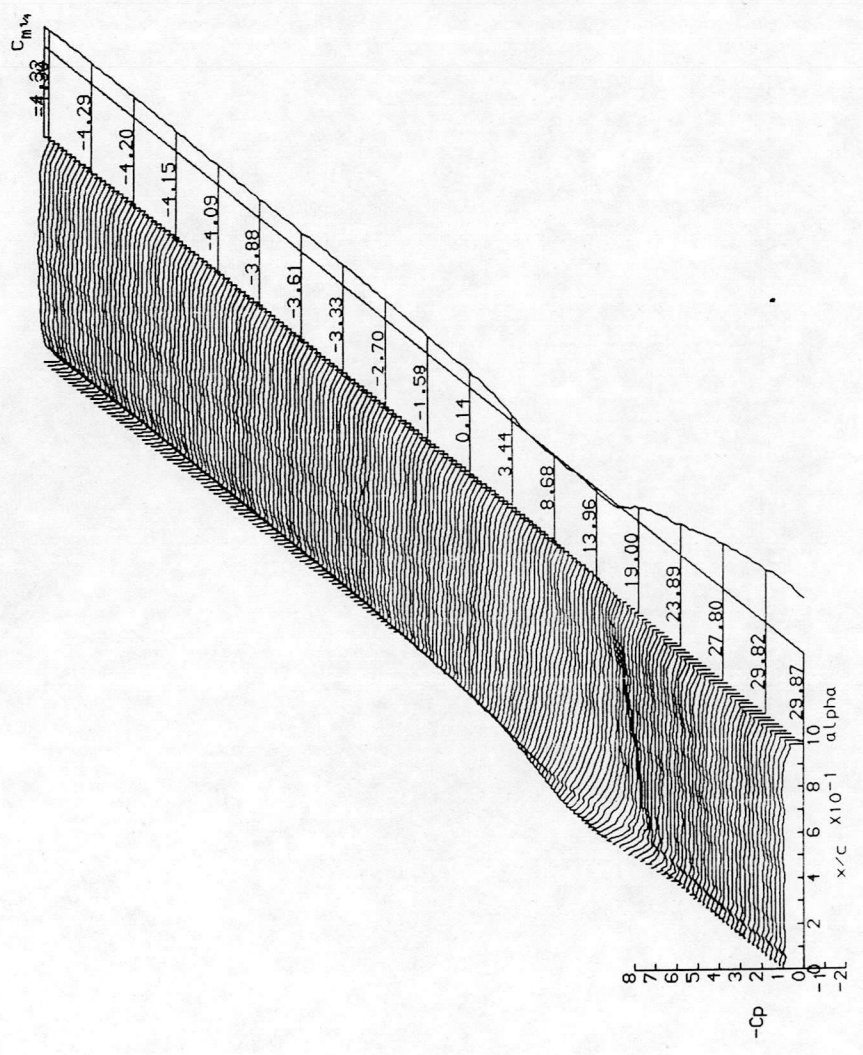
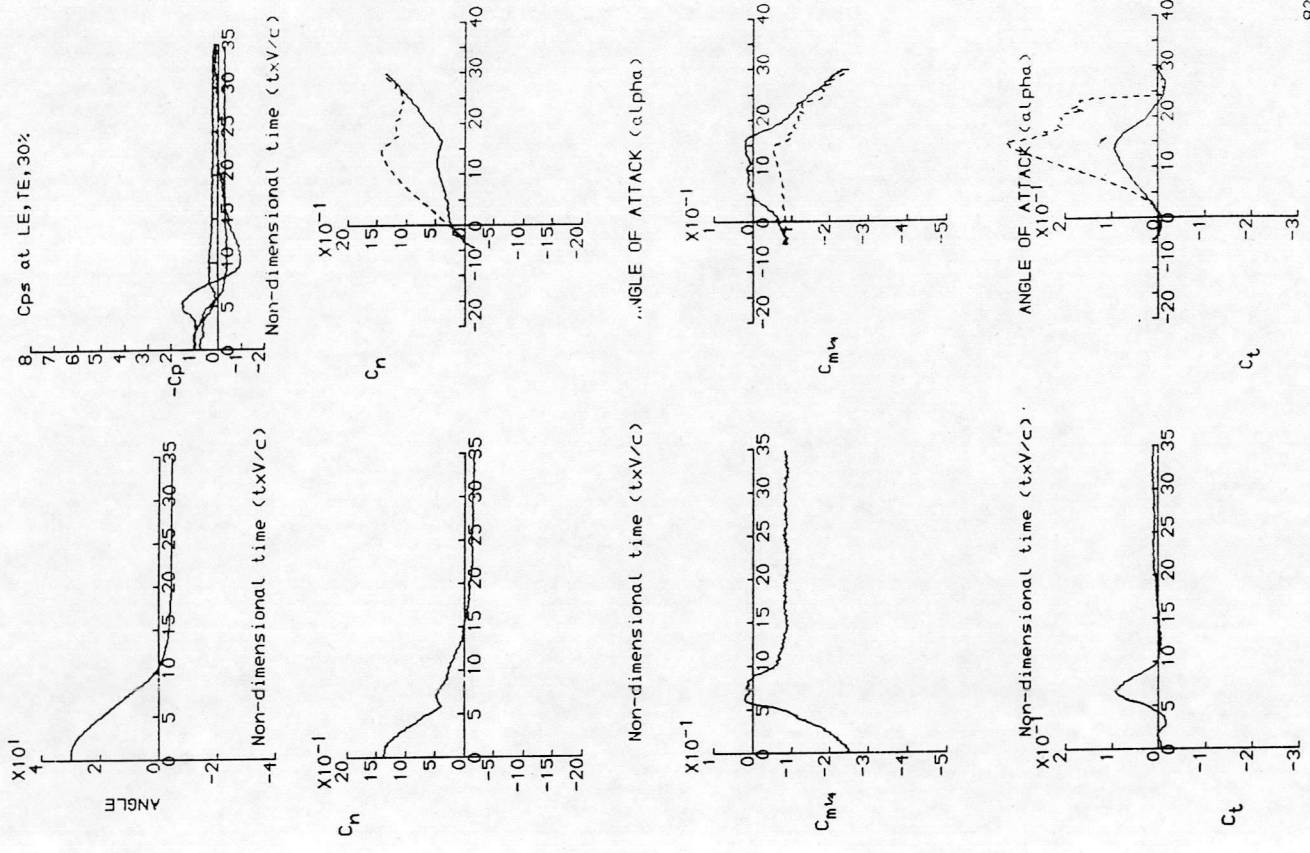
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38231
 RETNOLDS NUMBER = 1500223.
 DYNAMIC PRESSURE = 1021.22 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 35.00°
 RAMP ARC = -40.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 27.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01815
 LINEAR PITCH RATE = -155.99°s⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

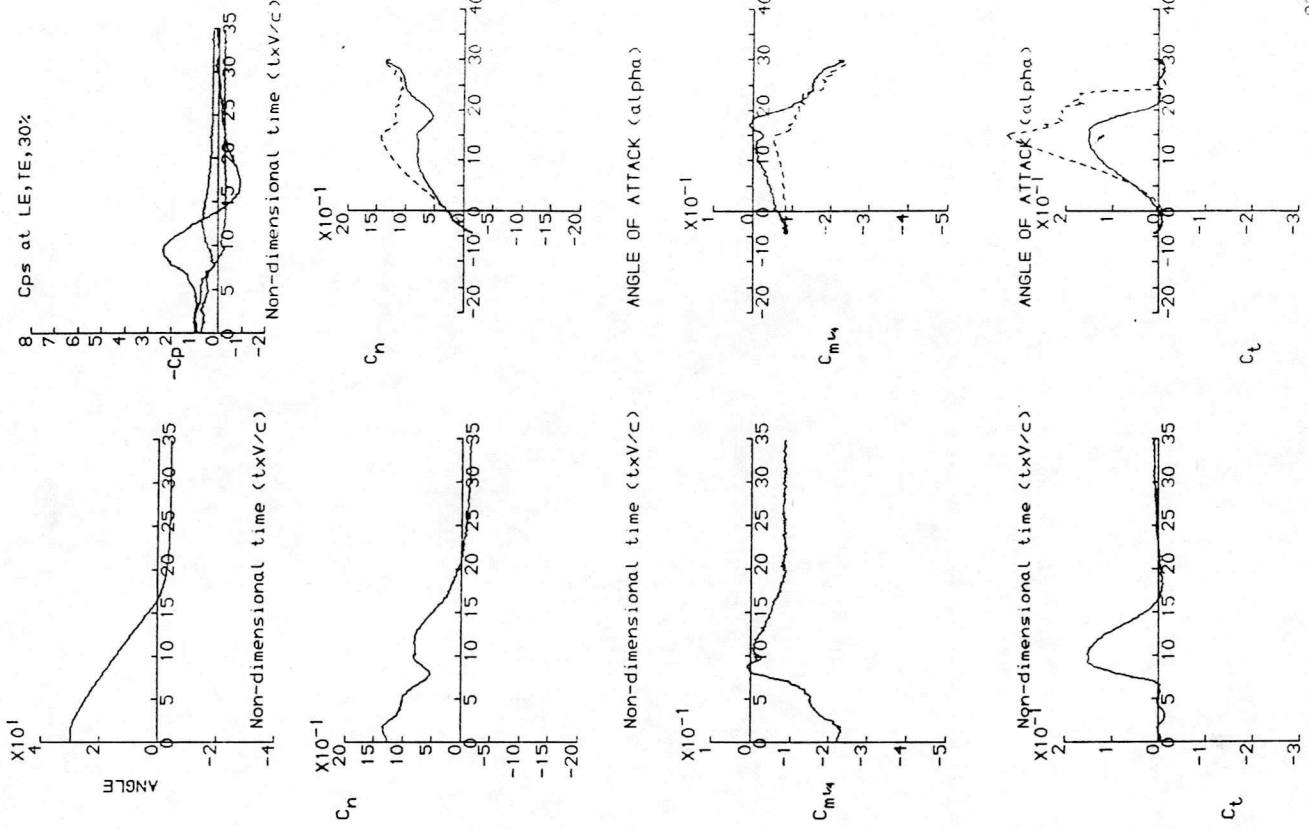
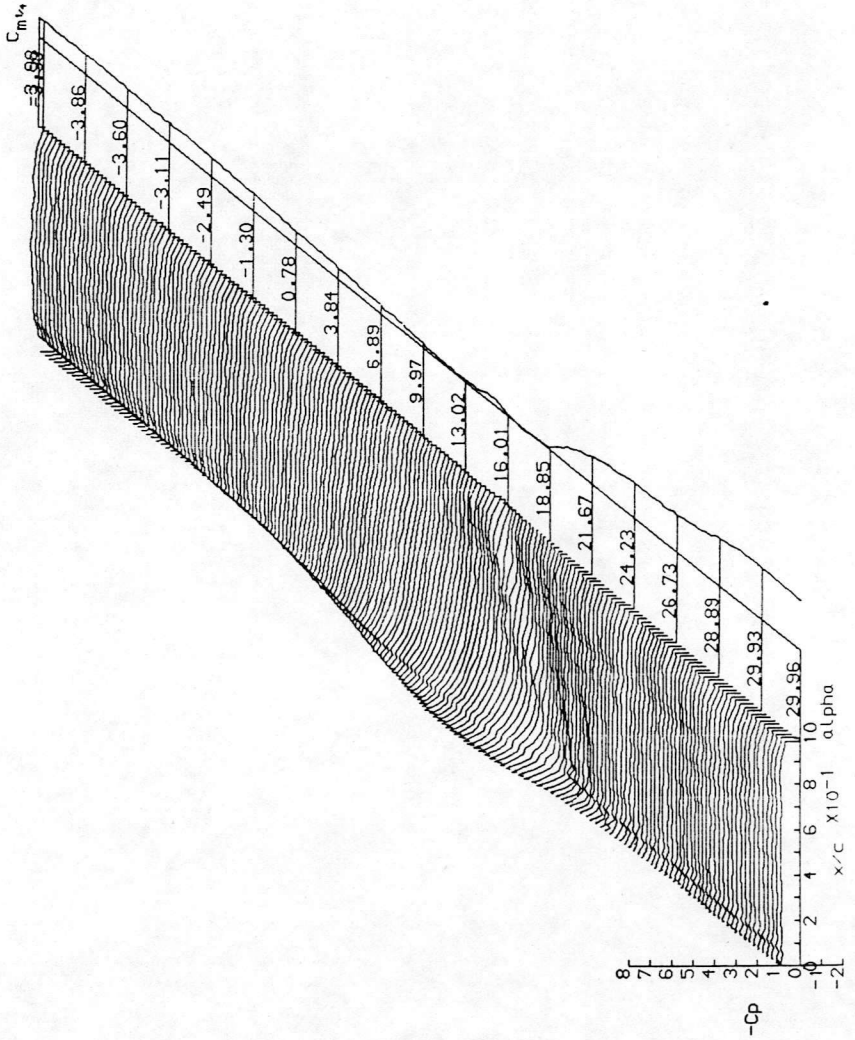
RUN REFERENCE NUMBER: 38241
 REYNOLDS NUMBER = 1497668.
 DYNAMIC PRESSURE = 1021.22 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -35.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 27.4°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03249
 LINEAR PITCH RATE = -279.45°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38251
 DATE OF TEST: 14/12/88
 REYNOLDS NUMBER = 1495756
 MACH NUMBER = 0.119
 DYNAMIC PRESSURE = 1021.22 Nm⁻²
 AIR TEMPERATURE = 27.7°C
 NUMBER OF CYCLES = 5
 SAMPLING FREQUENCY = 550.05 Hz.
 MOTION TYPE: RAMP DOWN
 REDUCED PITCH RATE = -0.01877
 START ANGLE = 30.00°
 LINEAR PITCH RATE = -161.52°S⁻¹
 RAMP ARC = -35.000°

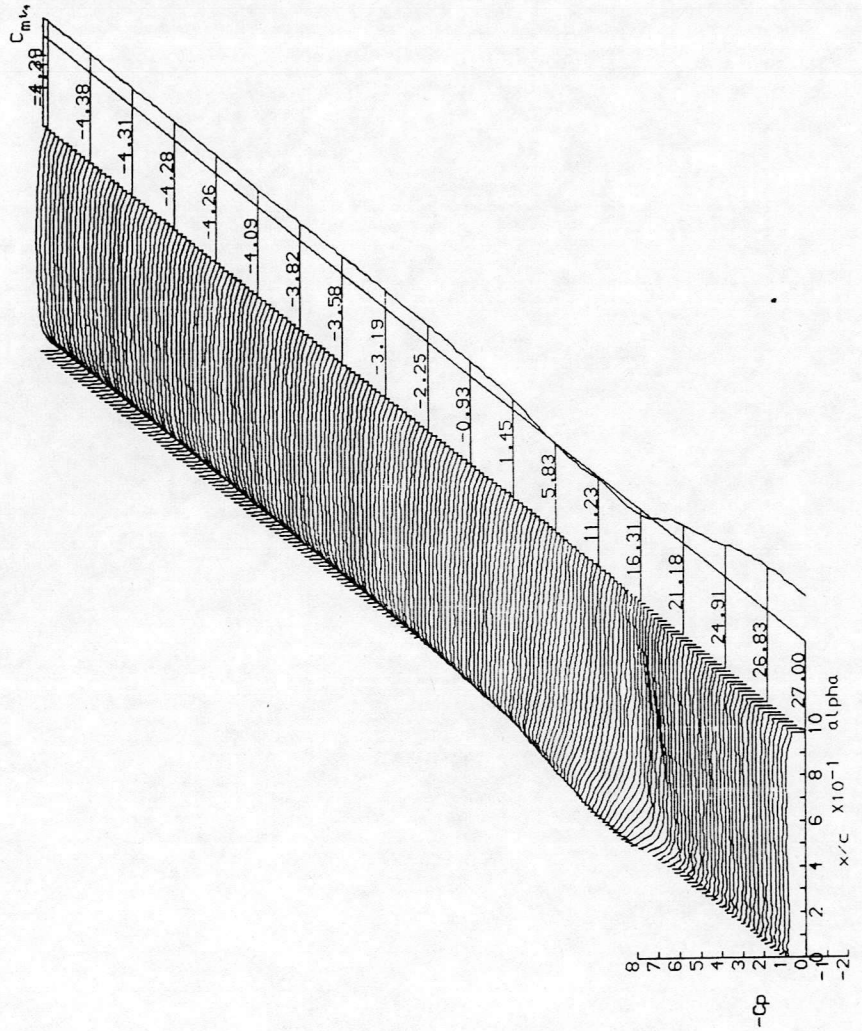
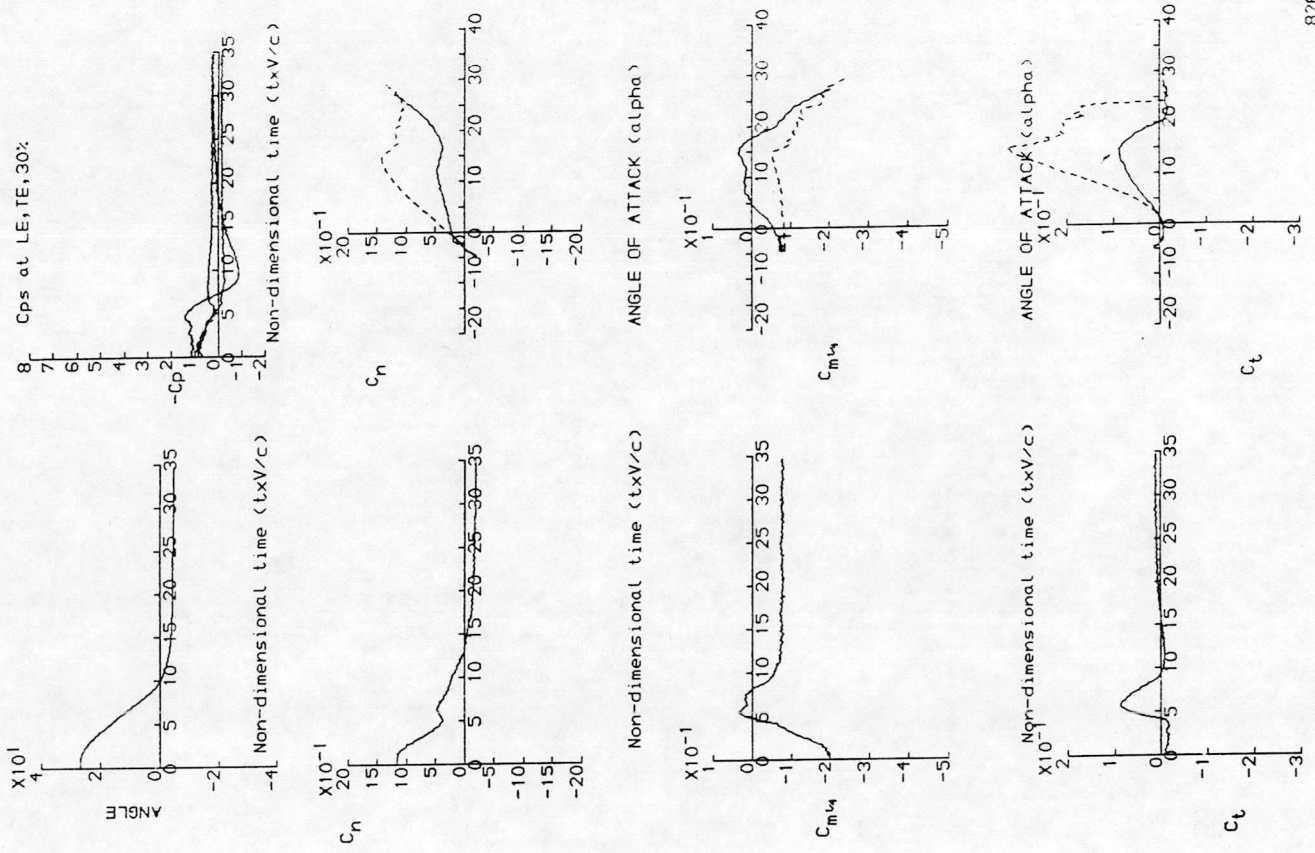
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38261
 REYNOLDS NUMBER = 1497168.
 DYNAMIC PRESSURE = 1017.06 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 27.00°
 RAMP ARC = -32.000°
 AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 27.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03262
 LINEAR PITCH RATE = -279.85°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38271
 RETNOLDS NUMBER = 149140.
 DYNAMIC PRESSURE = 1017.06 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 27.00°
 RAMP ARC = -32.000°
 AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 14/12/88

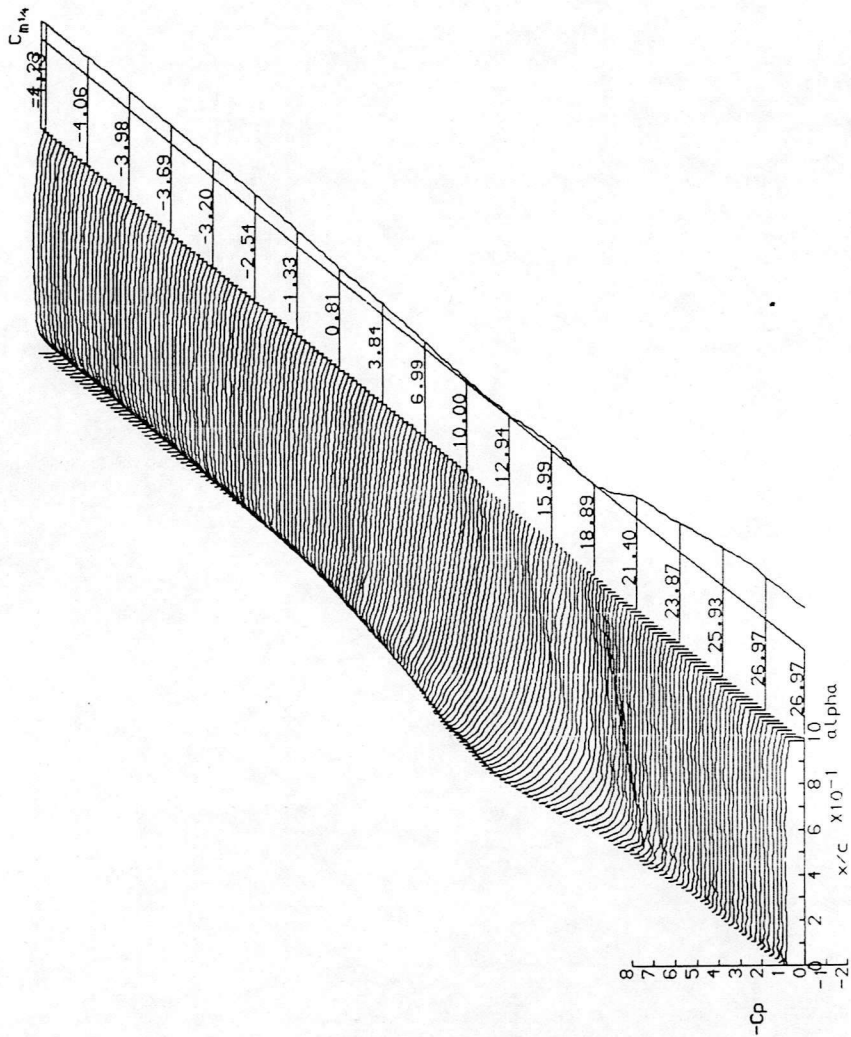
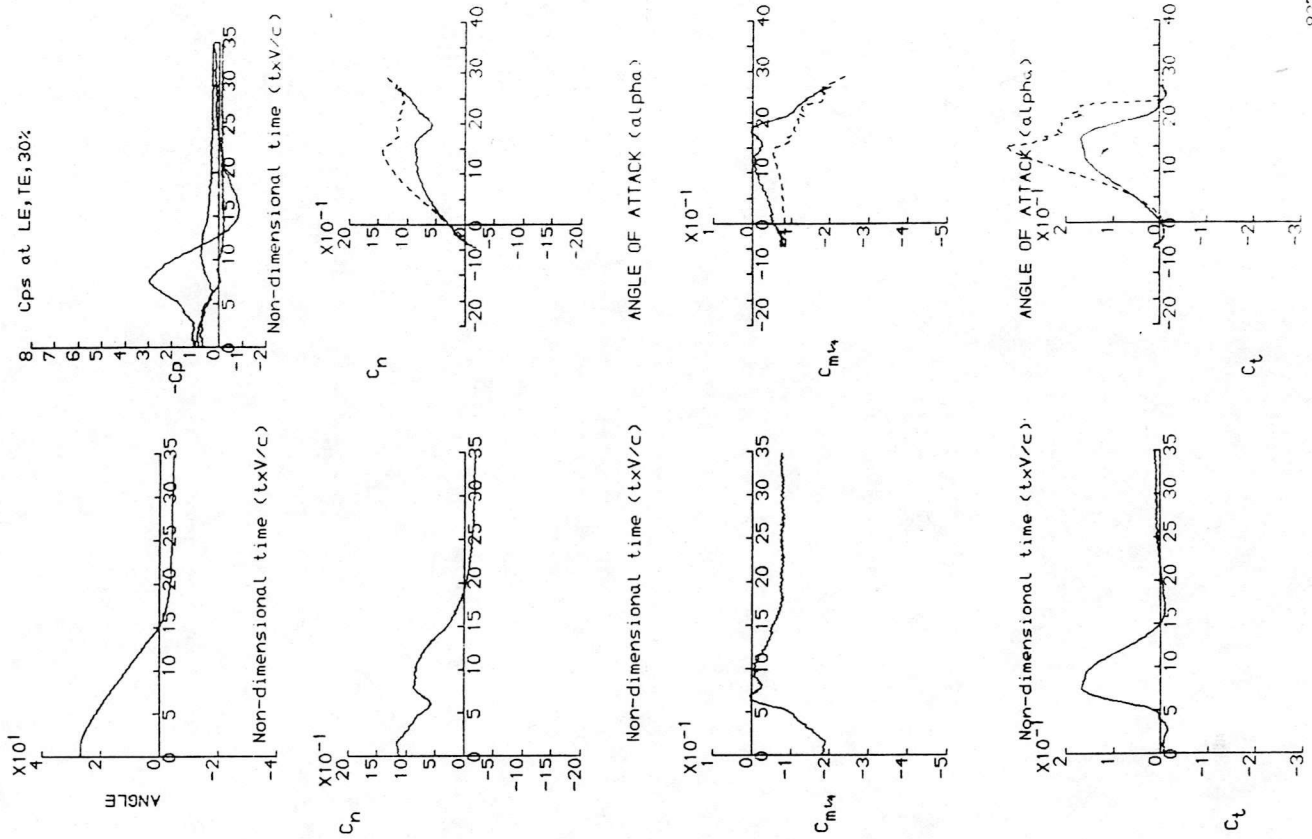
MACH NUMBER = 0.119

AIR TEMPERATURE = 27.9°C

SAMPLING FREQUENCY = 550.05 Hz.

REDUCED PITCH RATE = -0.01868

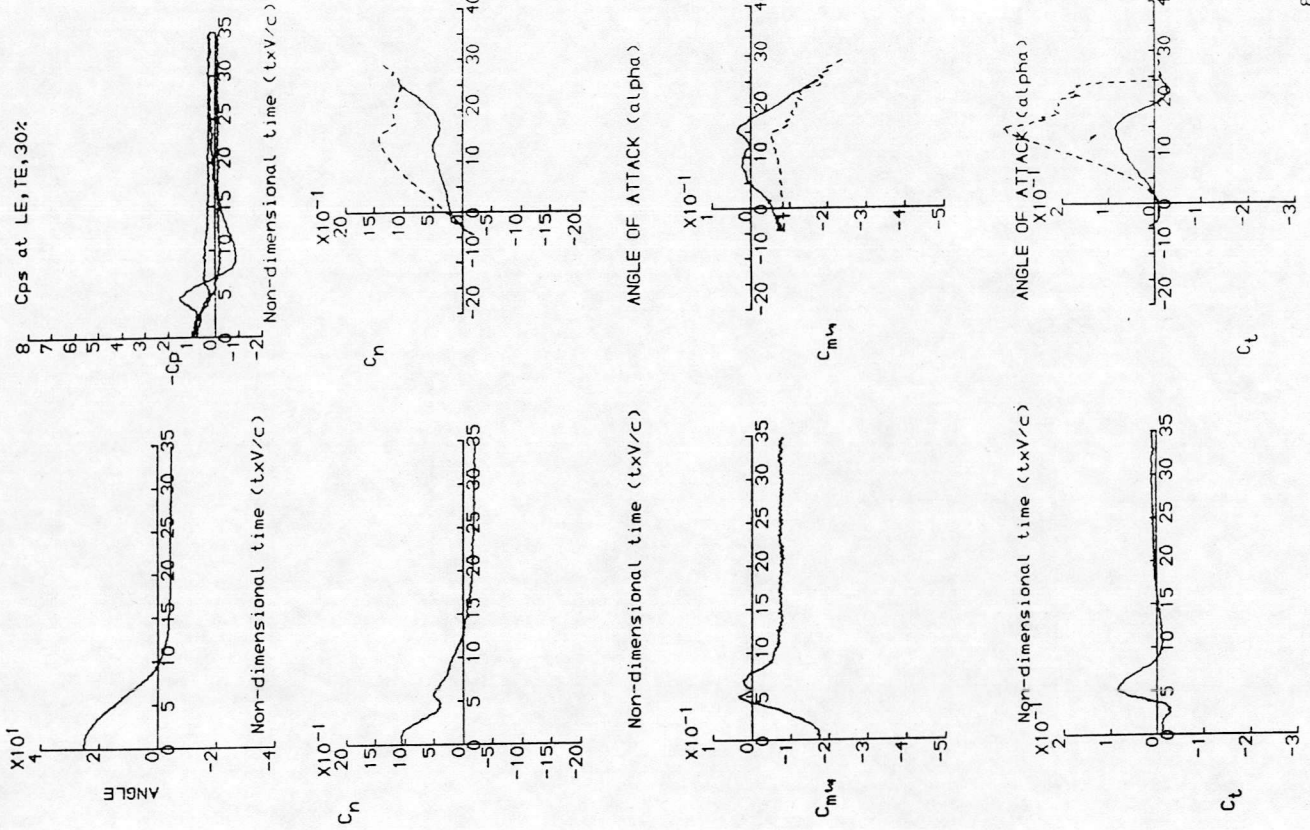
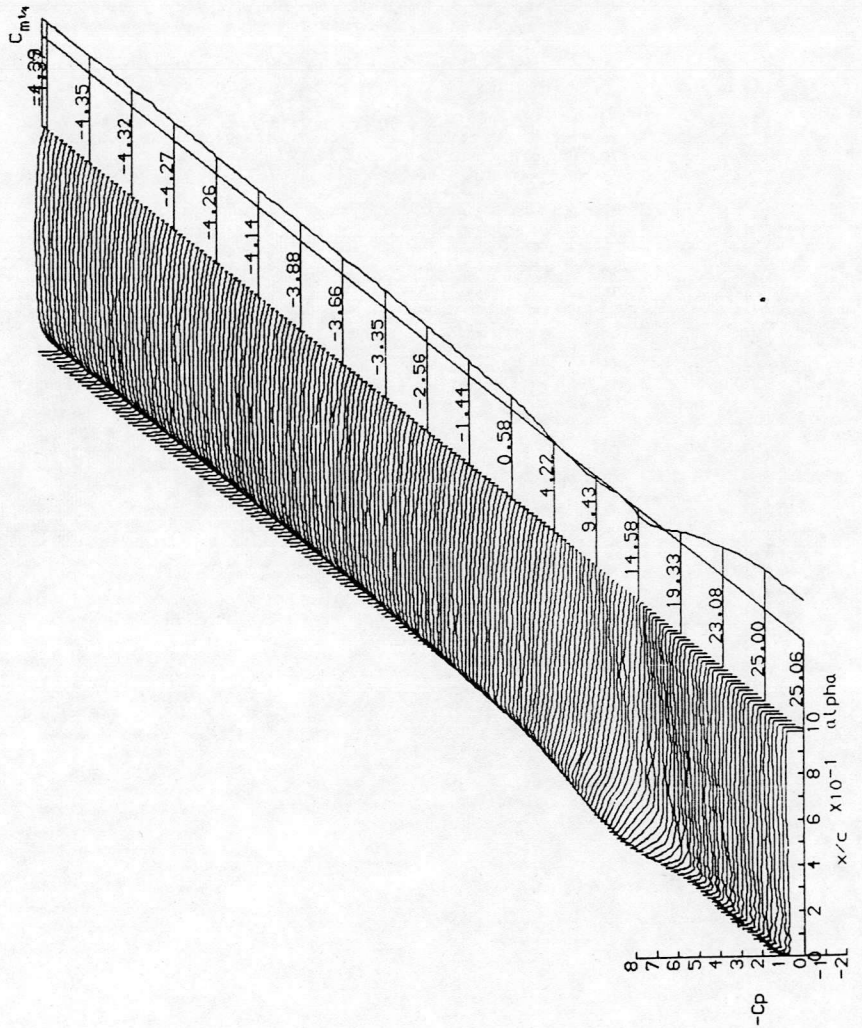
LINEAR PITCH RATE = -160.51°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

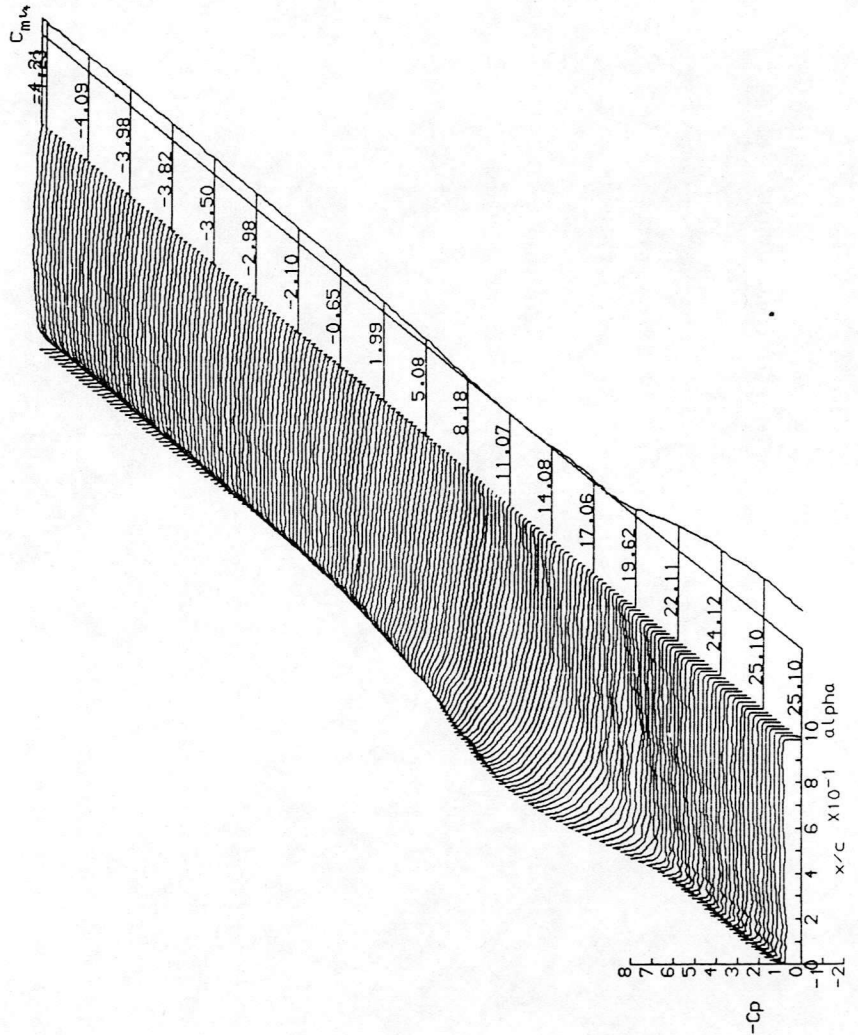
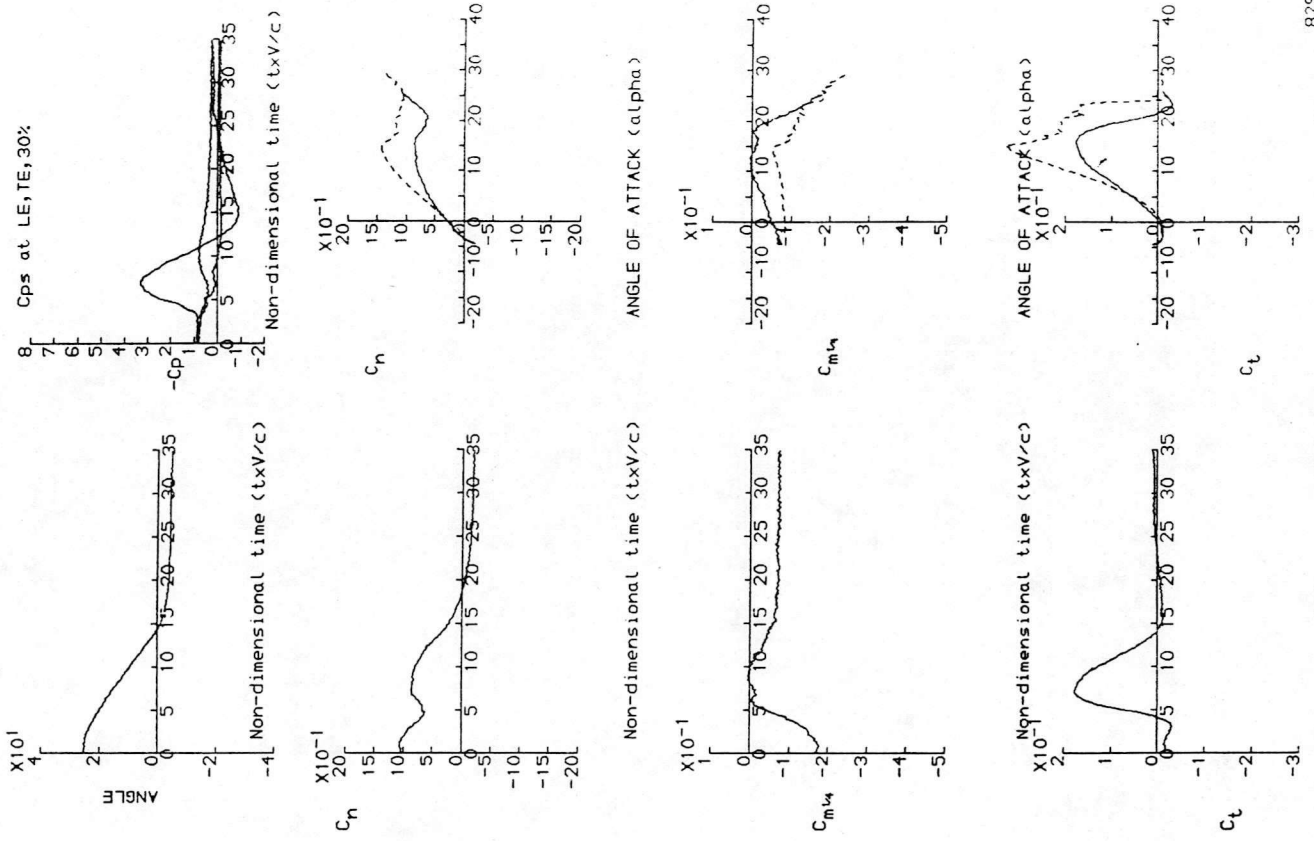
RUN REFERENCE NUMBER: 38281
 RETNOLDS NUMBER = 1488277.
 DYNAMIC PRESSURE = 1017.06 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 25.00°
 RAMP ARC = -30.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 28.4°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03233
 LINEAR PITCH RATE = -278.00°S⁻¹

AVERAGED DATA OF 5 CYCLES



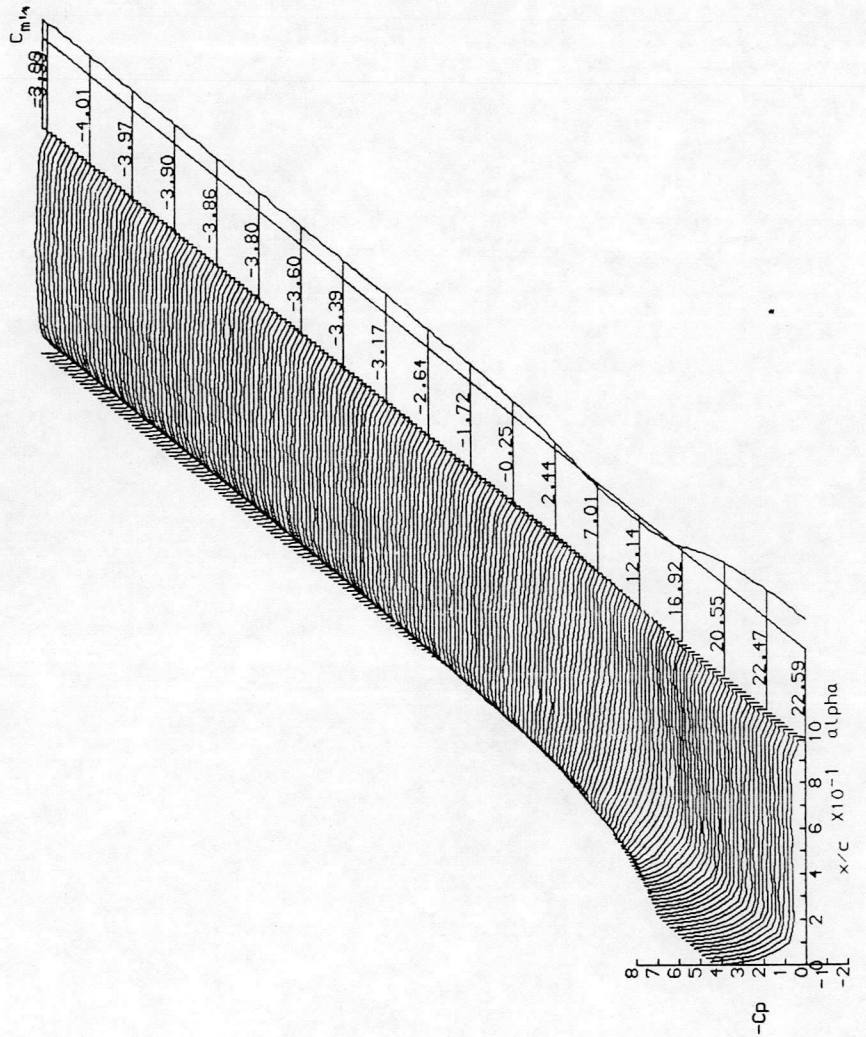
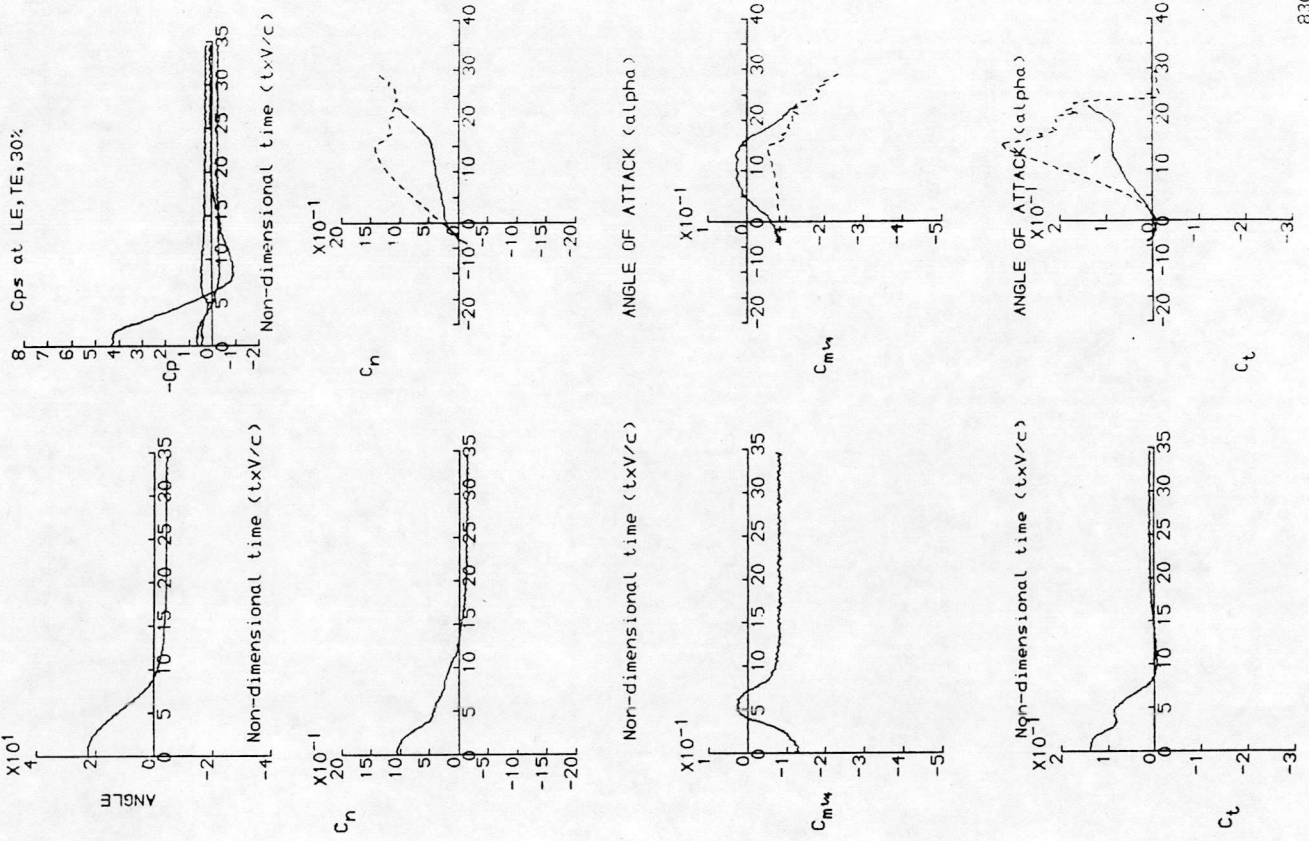
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38291
 REYNOLDS NUMBER = 1487014.
 DYNAMIC PRESSURE = 1017.06 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 25.00°
 RAMP ARC = -30.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.119
 AIR TEMPERATURE = 28.6°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01873
 LINEAR PITCH RATE = -161.06°s⁻¹



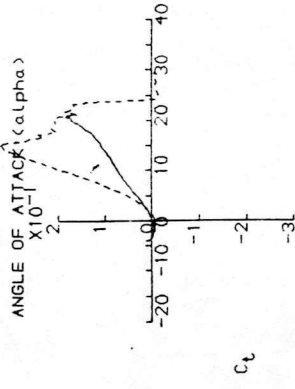
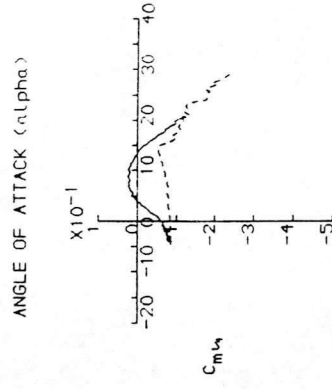
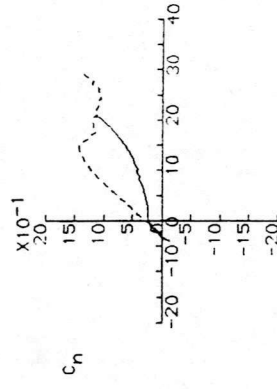
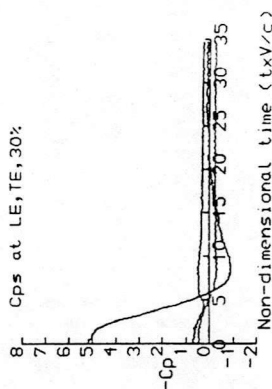
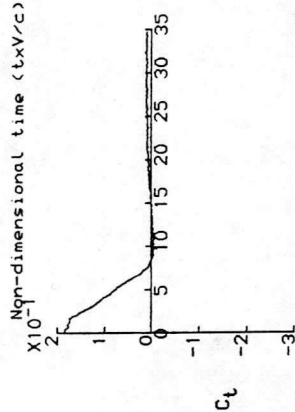
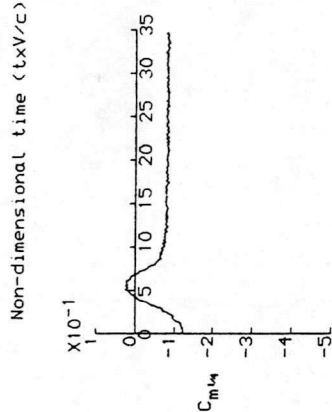
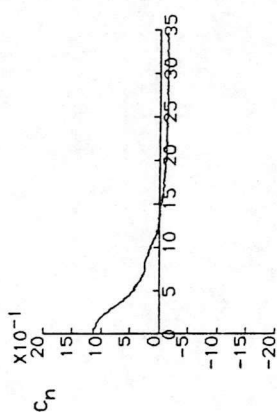
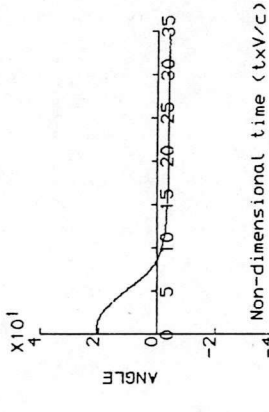
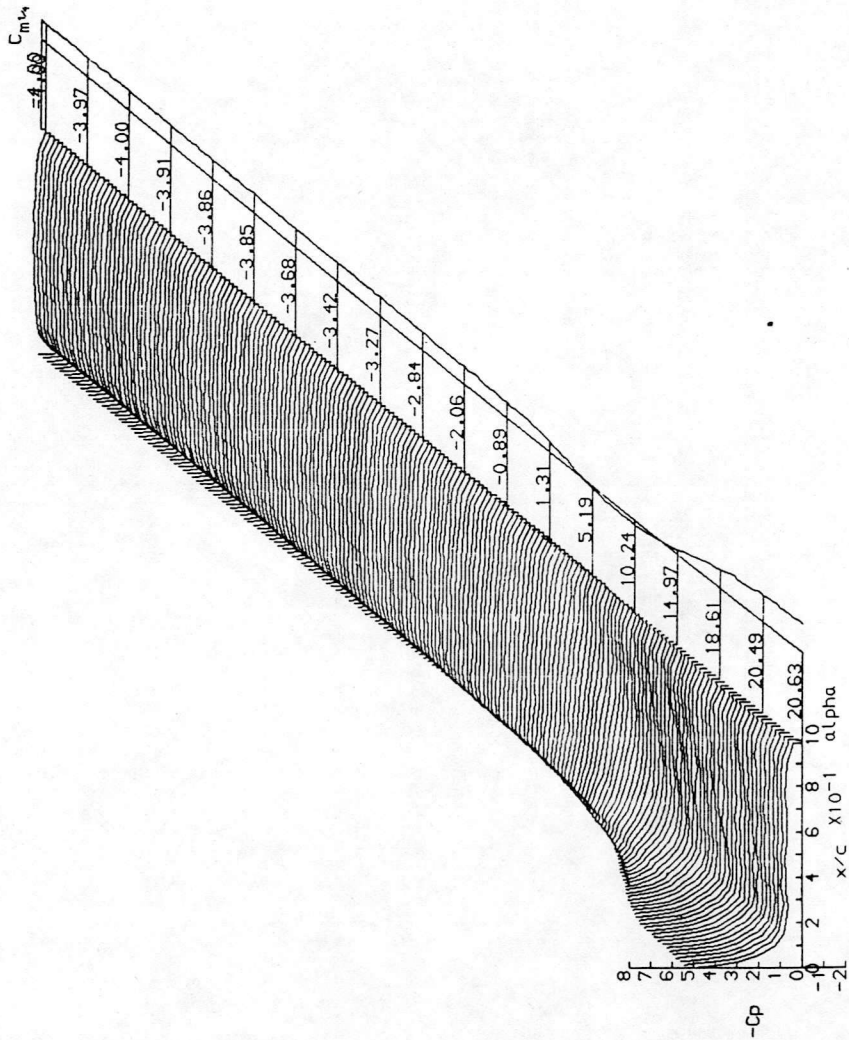
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38301
 REYNOLDS NUMBER = 1492822.
 DYNAMIC PRESSURE = 1011.17 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 22.00°
 RAMP ARC = -27.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03216
 LINEAR PITCH RATE = -275.10°s⁻¹
 AVERAGED DATA OF 5 CYCLES



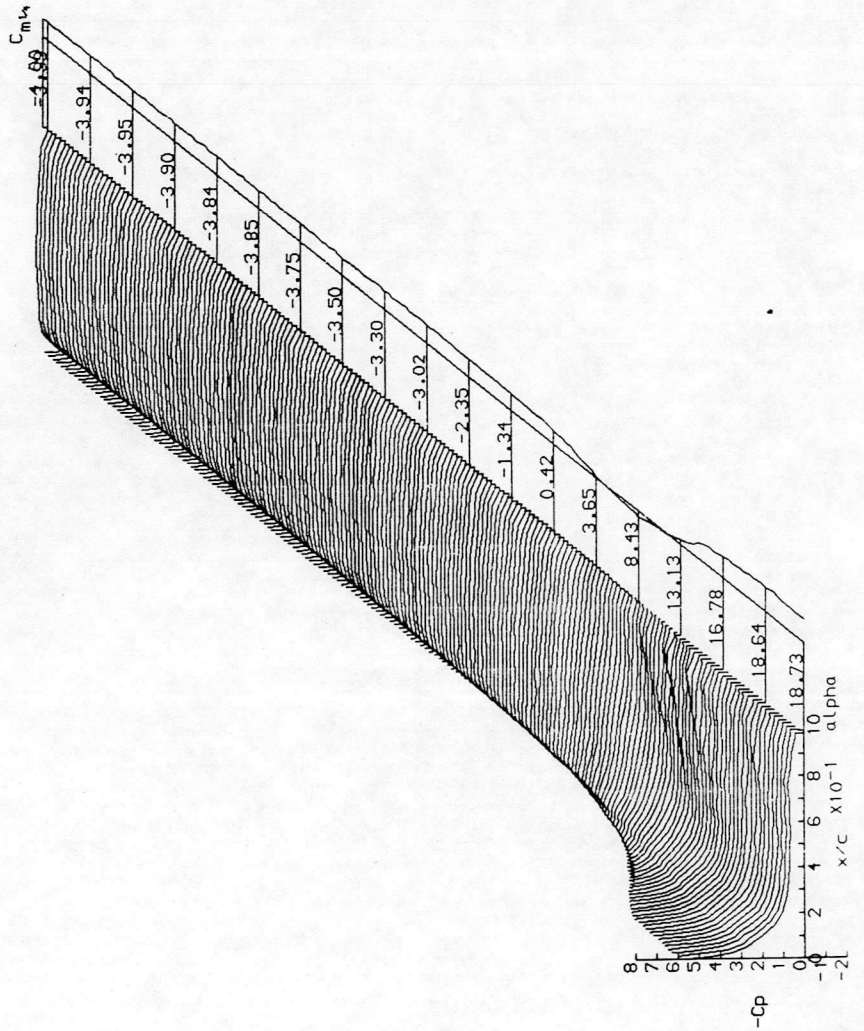
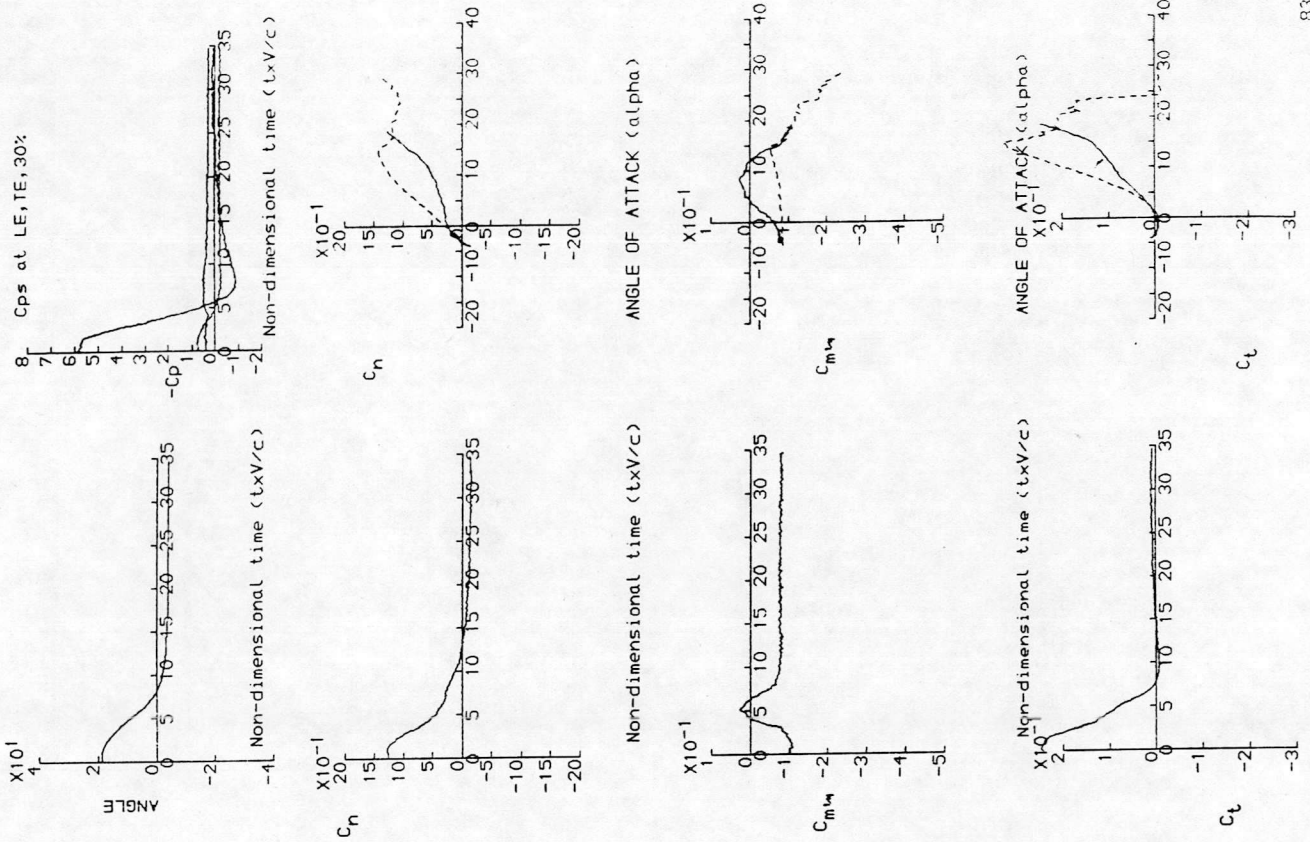
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38311
 REYNOLDS NUMBER = 1483327.
 DYNAMIC PRESSURE = 1011.17 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 20.00°
 RAMP ARC = -25.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.5°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03137
 LINEAR PITCH RATE = -269.00°S⁻¹



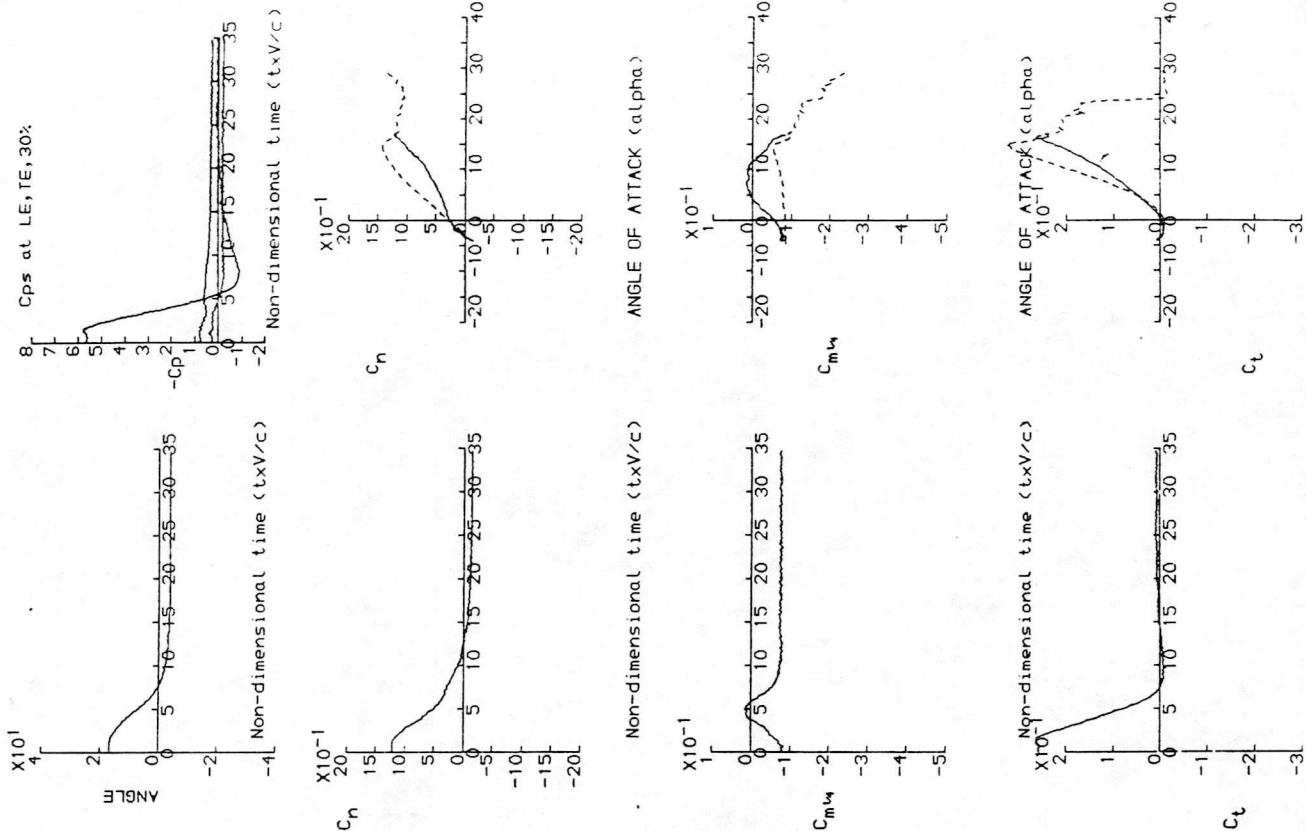
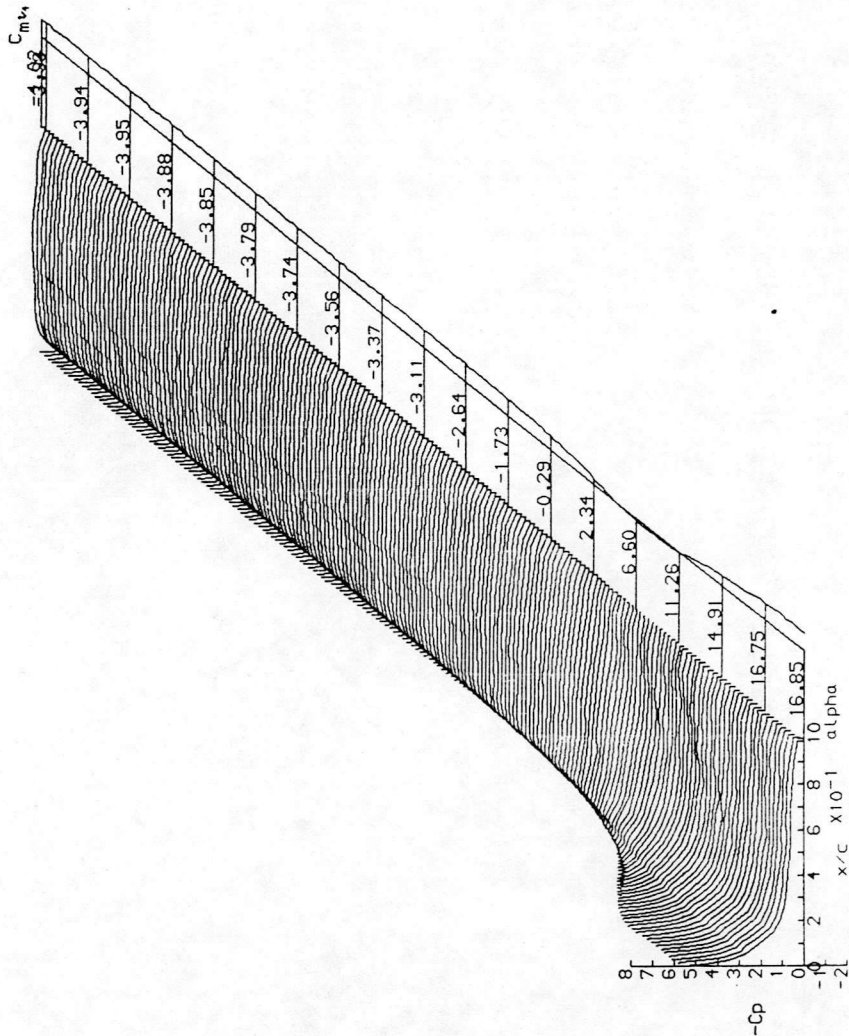
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38321
 DATE OF TEST: 14/12/88
 REYNOLDS NUMBER = 1481442.
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1011.17 Nm⁻²
 AIR TEMPERATURE = 28.8°C
 NUMBER OF CYCLES = 5
 SAMPLING FREQUENCY = 550.05 Hz.
 MOTION TYPE: RAMP DOWN
 REDUCED PITCH RATE = -0.03076
 START ANGLE = 18.00°
 LINEAR PITCH RATE = -263.89°S⁻¹
 RAMP ARC = -23.000°
 AVERAGED DATA OF 5 CYCLES



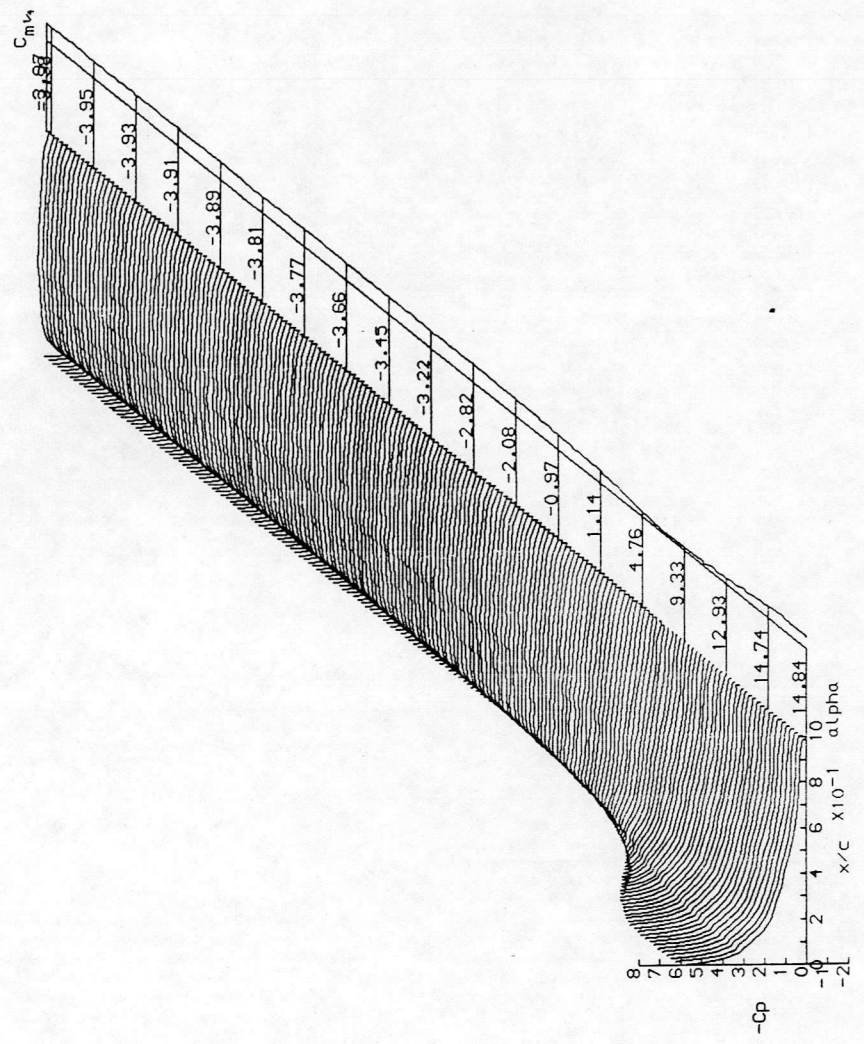
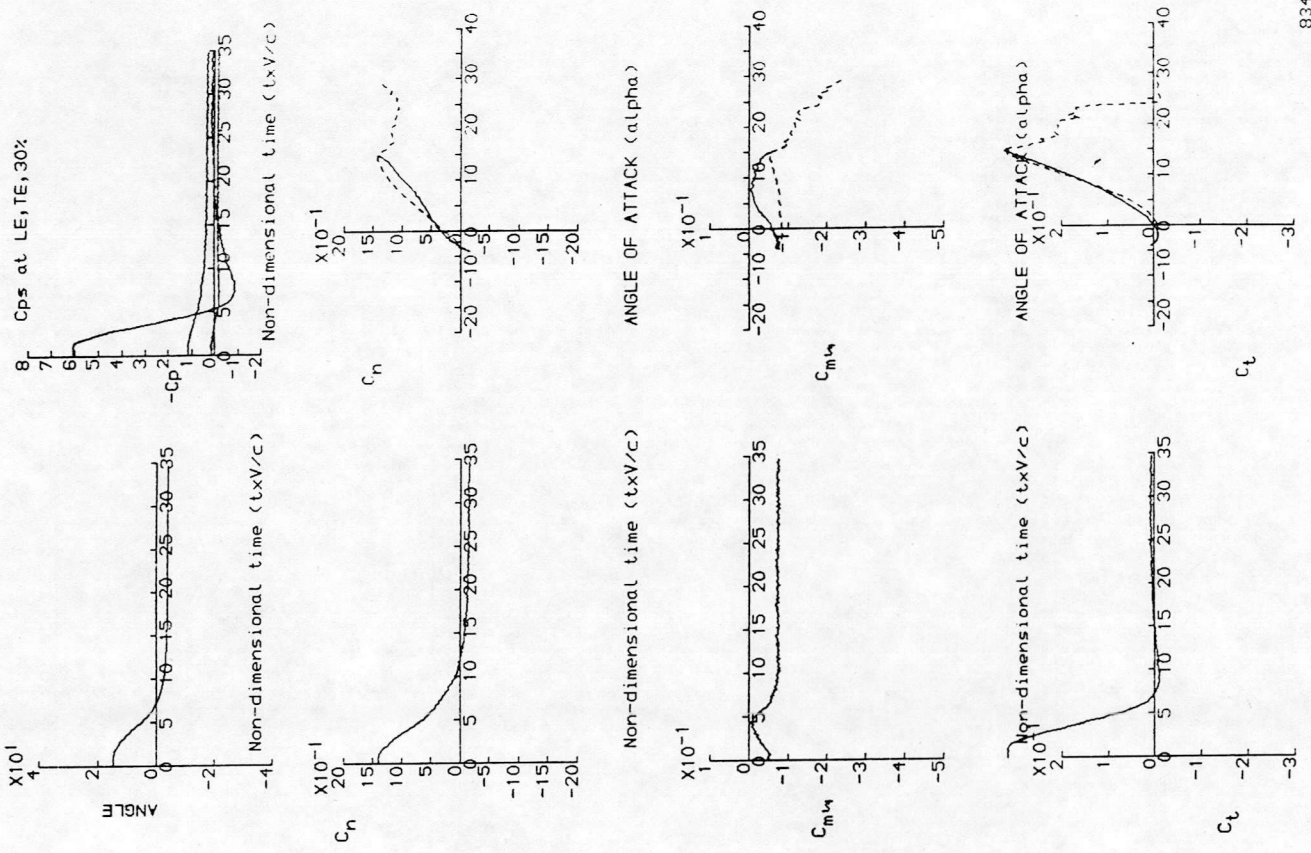
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38331
 REYNOLDS NUMBER = 1479561.
 DYNAMIC PRESSURE = 1011.17 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 16.00°
 RAMP ARC = -21.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.1°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02952
 LINEAR PITCH RATE = -253.40°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

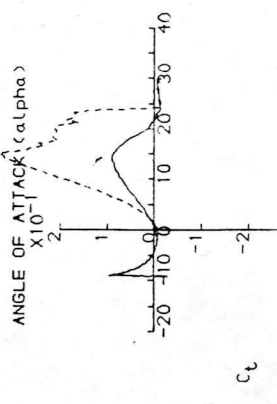
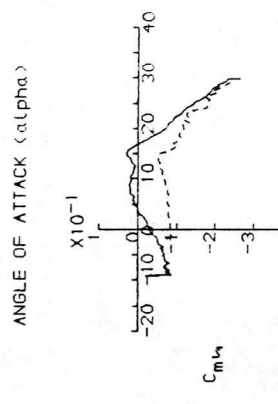
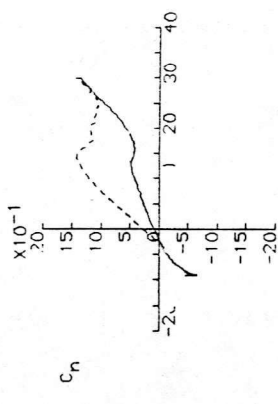
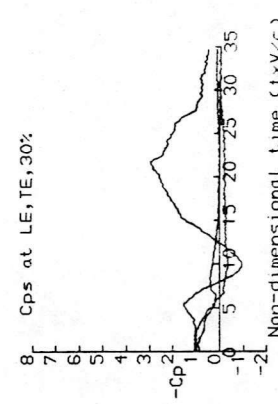
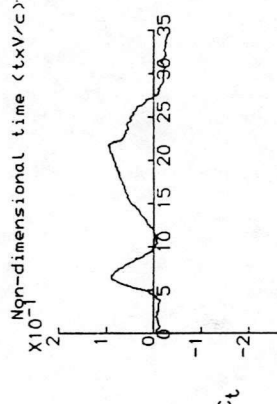
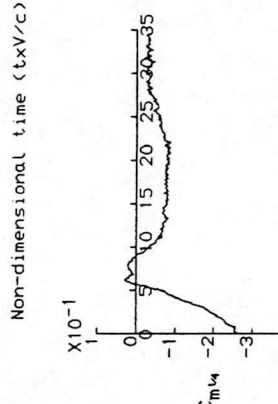
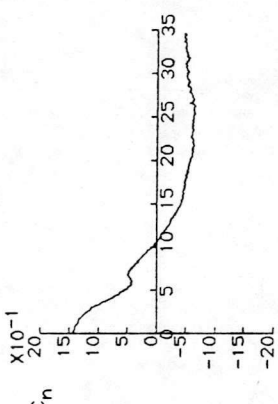
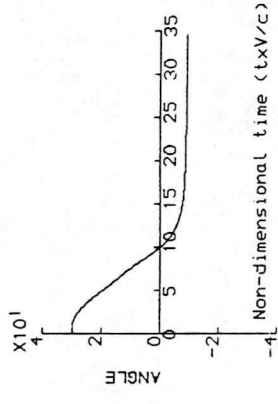
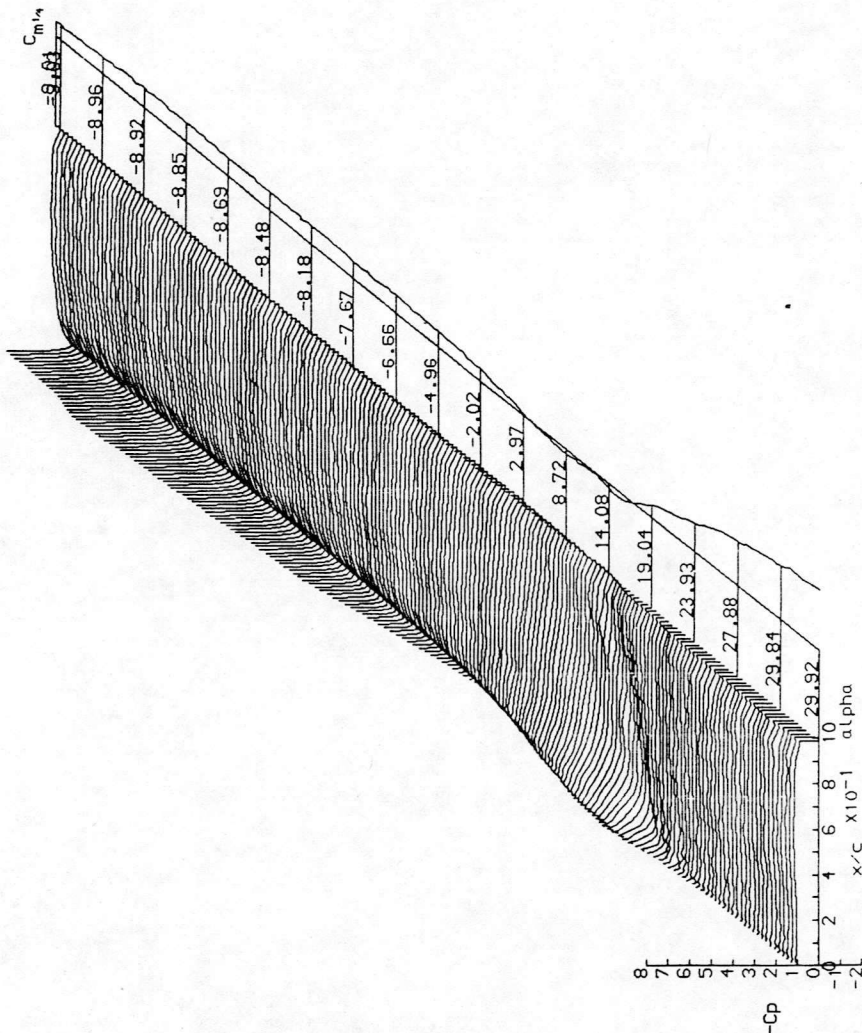
RUN REFERENCE NUMBER: 38341
 RETNOLDS NUMBER = 1478310.
 DYNAMIC PRESSURE = 1011.17 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 14.00°
 RAMP ARC = -19.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.3°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02895
 LINEAR PITCH RATE = -248.58°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

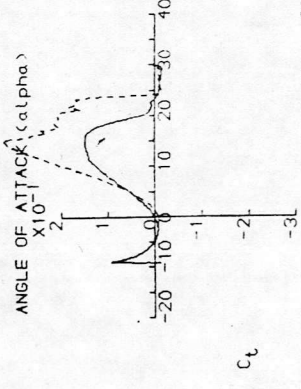
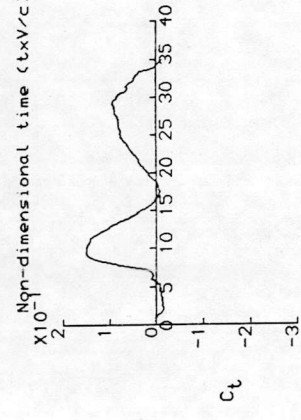
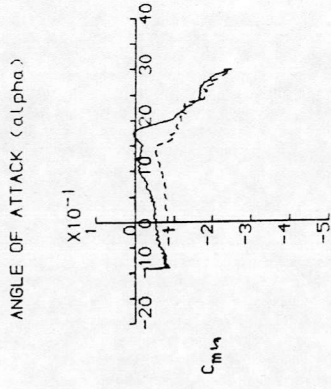
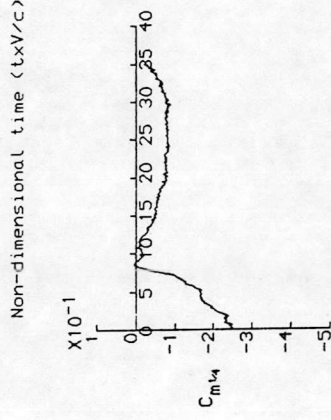
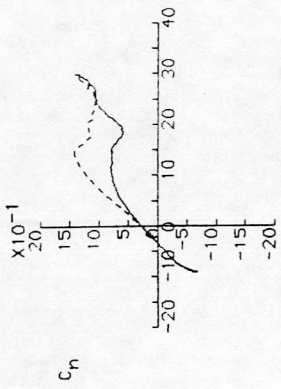
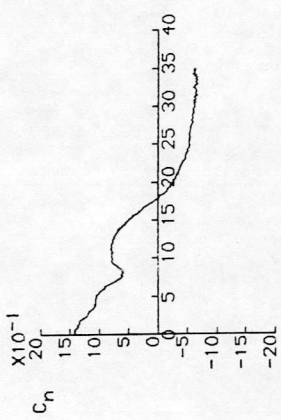
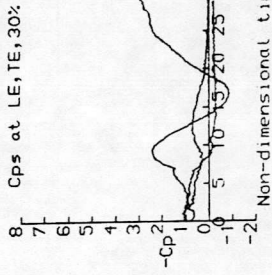
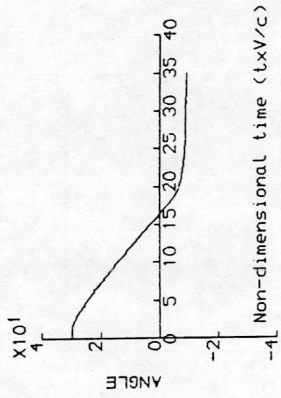
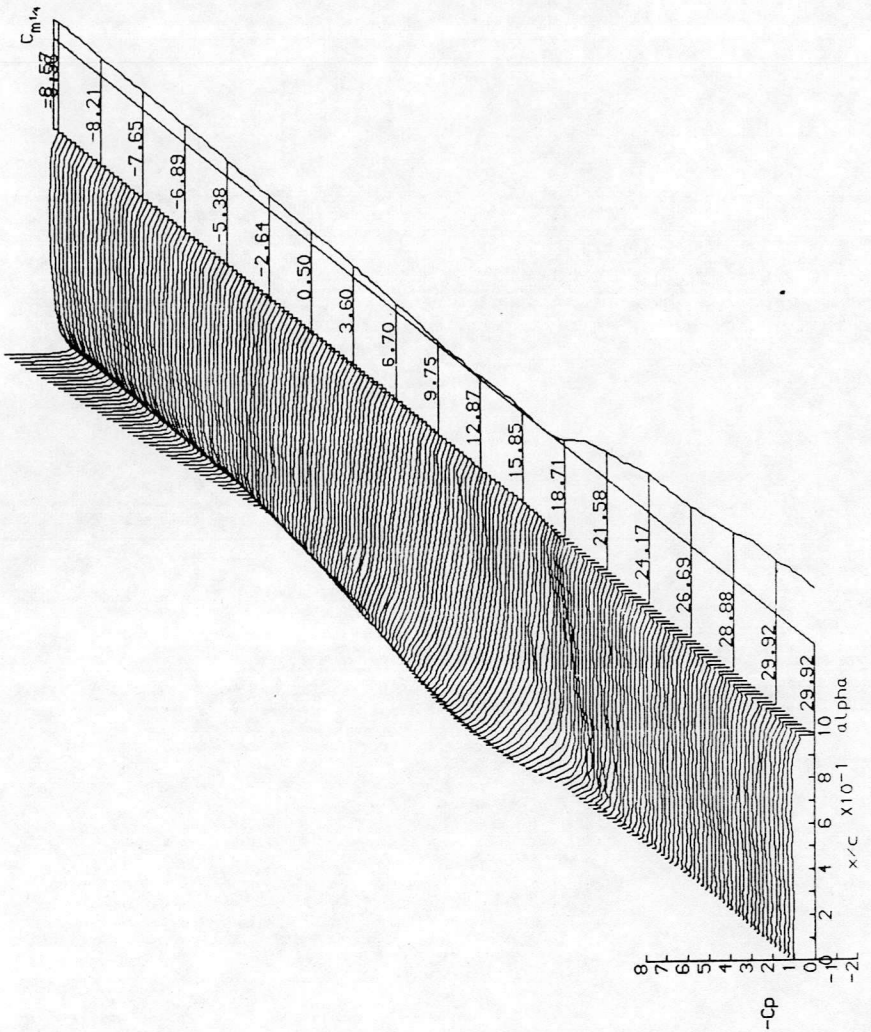
RUN REFERENCE NUMBER: 38351
 RETNOLDS NUMBER = 1184715.
 DYNAMIC PRESSURE = 1008.77 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -40.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03296
 LINEAR PITCH RATE = -282.01°s⁻¹

AVERAGED DATA OF 5 CYCLES



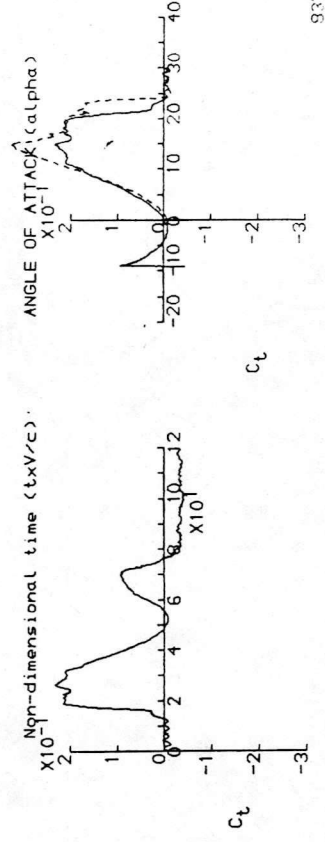
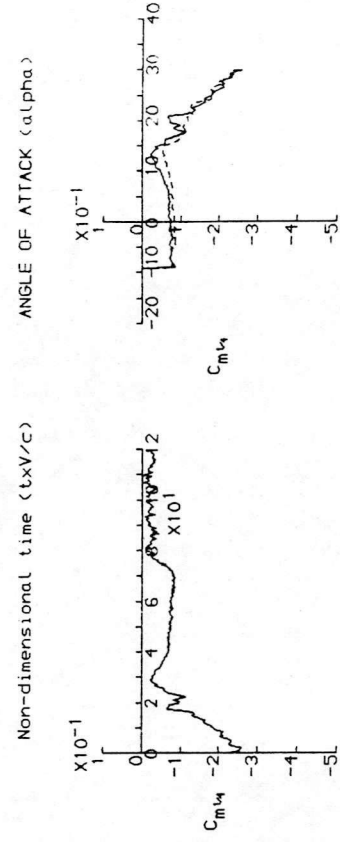
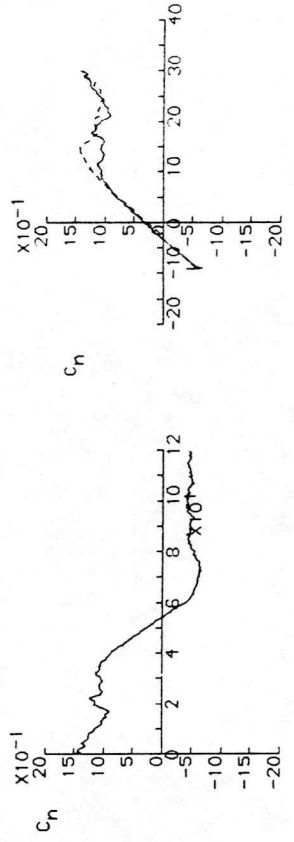
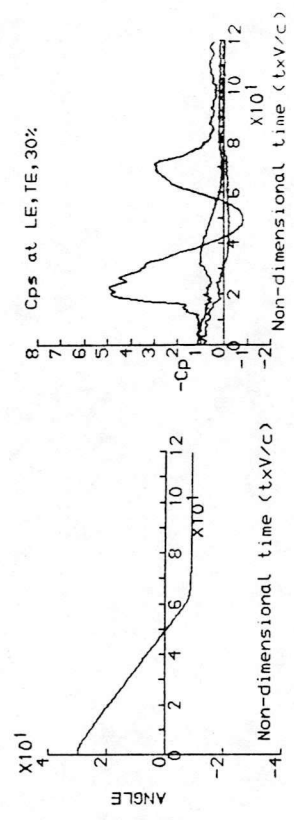
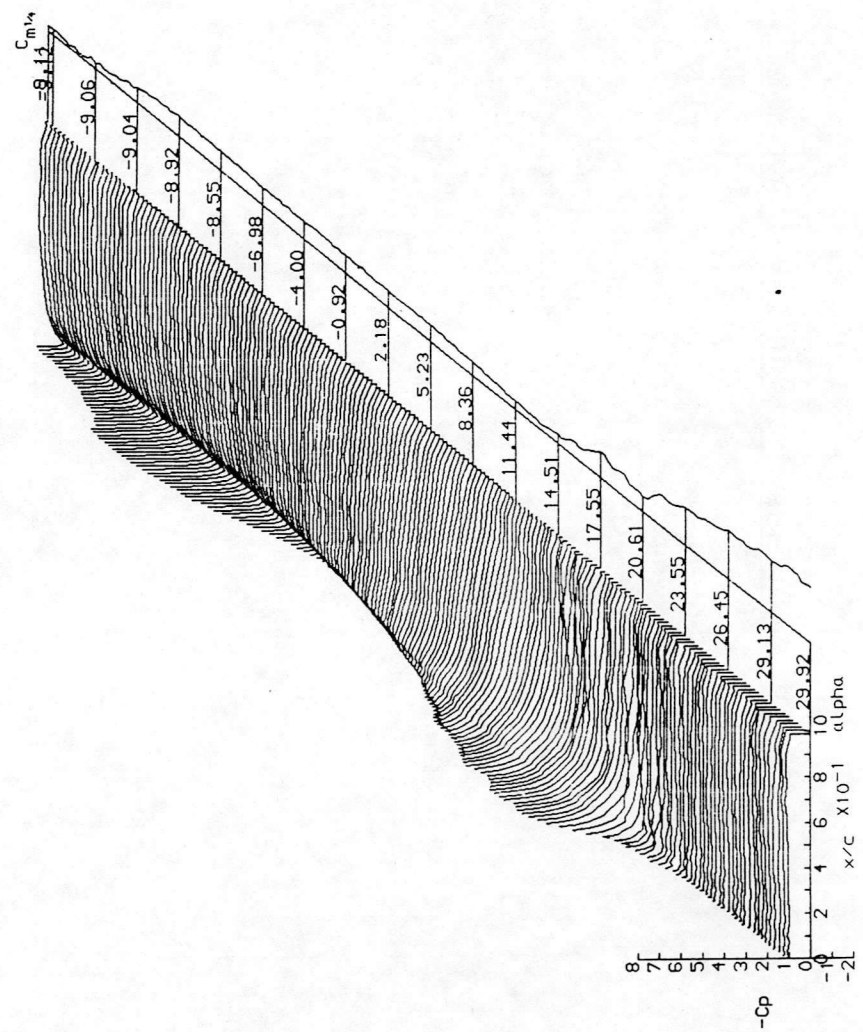
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38361
 REYNOLDS NUMBER = 1477805.
 DYNAMIC PRESSURE = 1008.77 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -40.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.1°C
 SAMPLING FREQUENCY = 544.96 Hz.
 REDUCED PITCH RATE = -0.01893
 LINEAR PITCH RATE = -162.26°S⁻¹



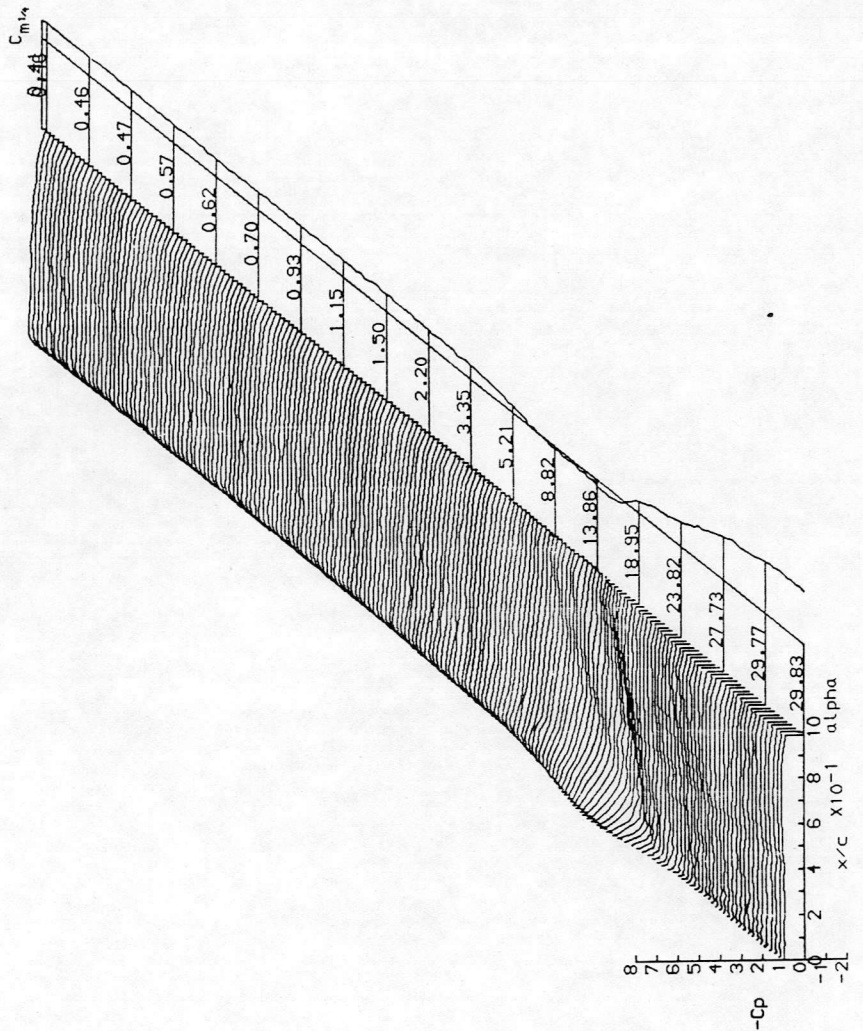
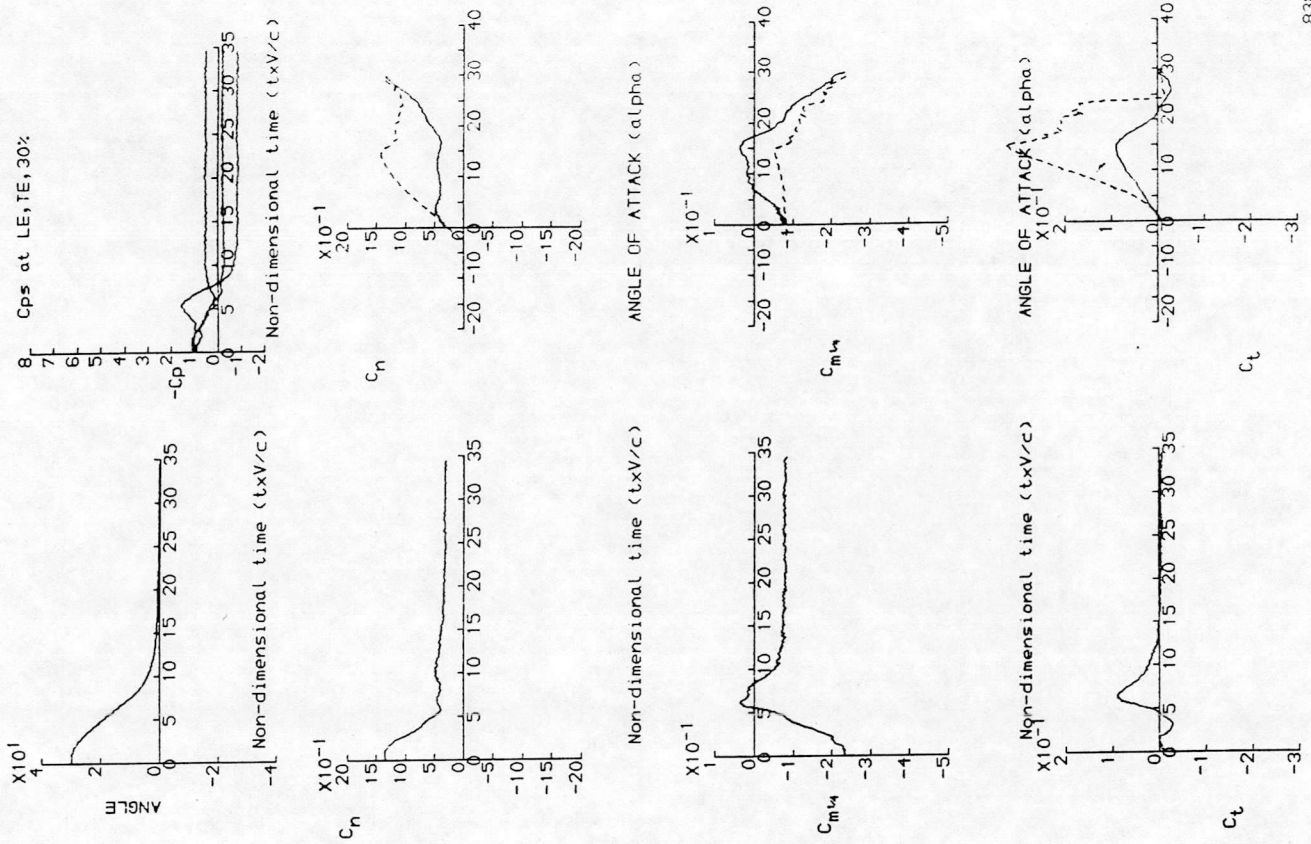
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38371
 REYNOLDS NUMBER = 1476535.
 DYNAMIC PRESSURE = 1008.77 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -10.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.3°C
 SAMPLING FREQUENCY = 160.00 Hz.
 REDUCED PITCH RATE = -0.00569
 LINEAR PITCH RATE = -48.76°s⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

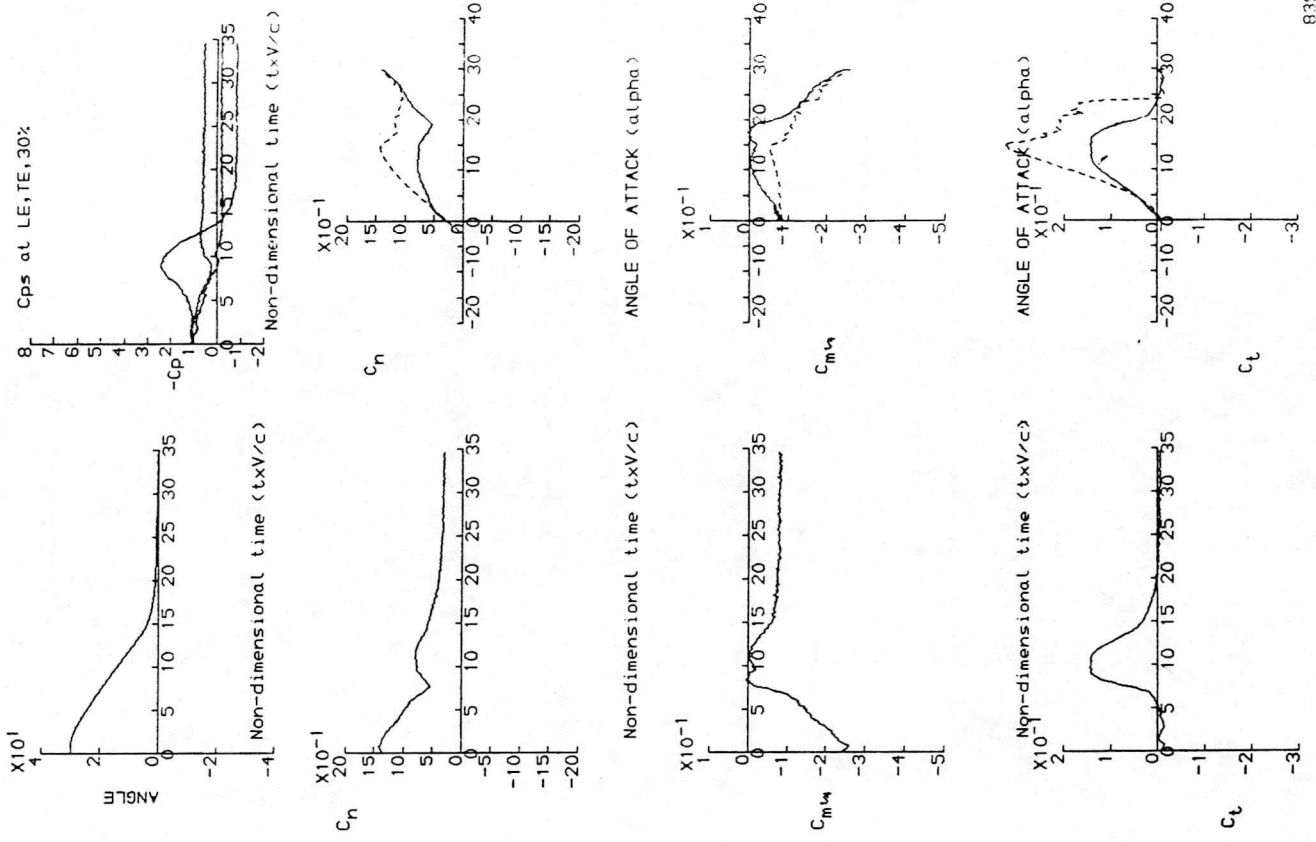
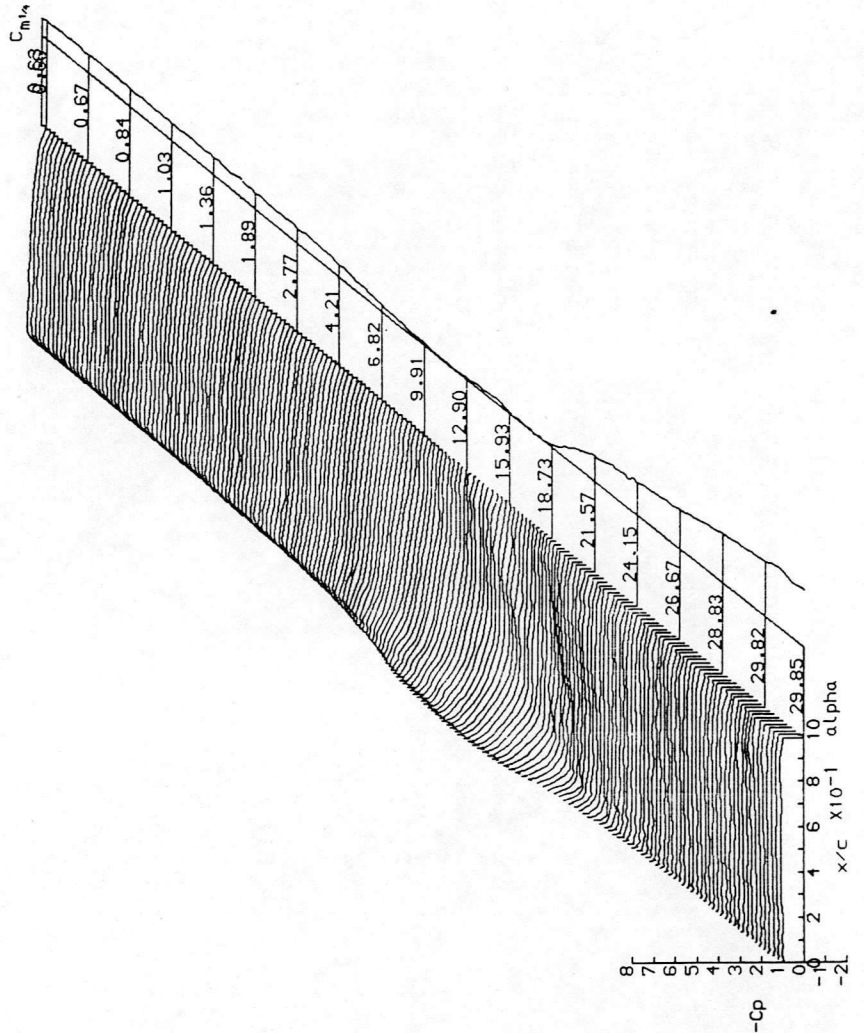
RUN REFERENCE NUMBER: 38381
 RETNOLDS NUMBER = 1473282.
 DYNAMIC PRESSURE = 1000.06 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -30.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.8°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03209
 LINEAR PITCH RATE = -273.78°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

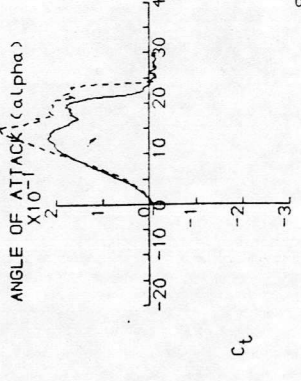
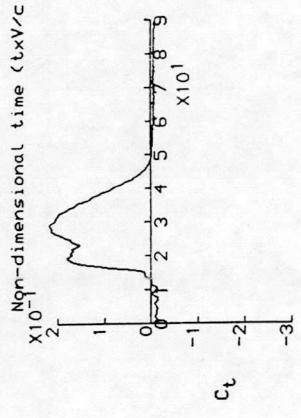
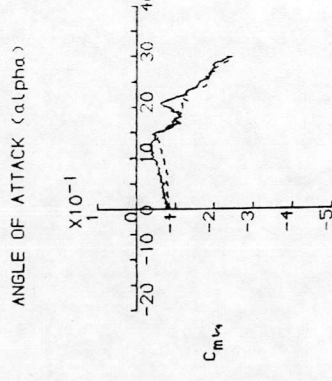
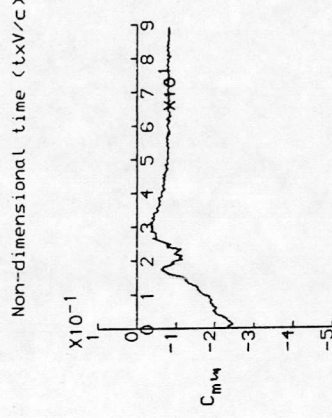
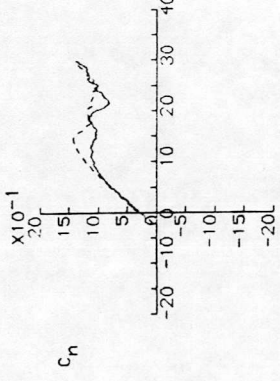
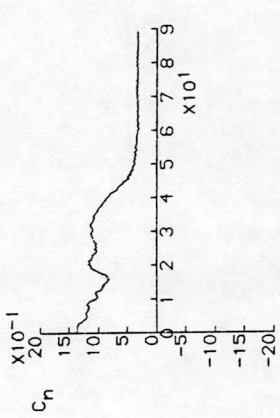
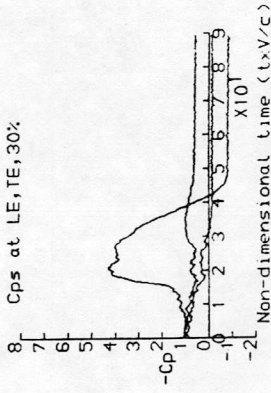
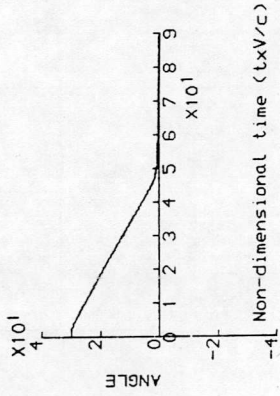
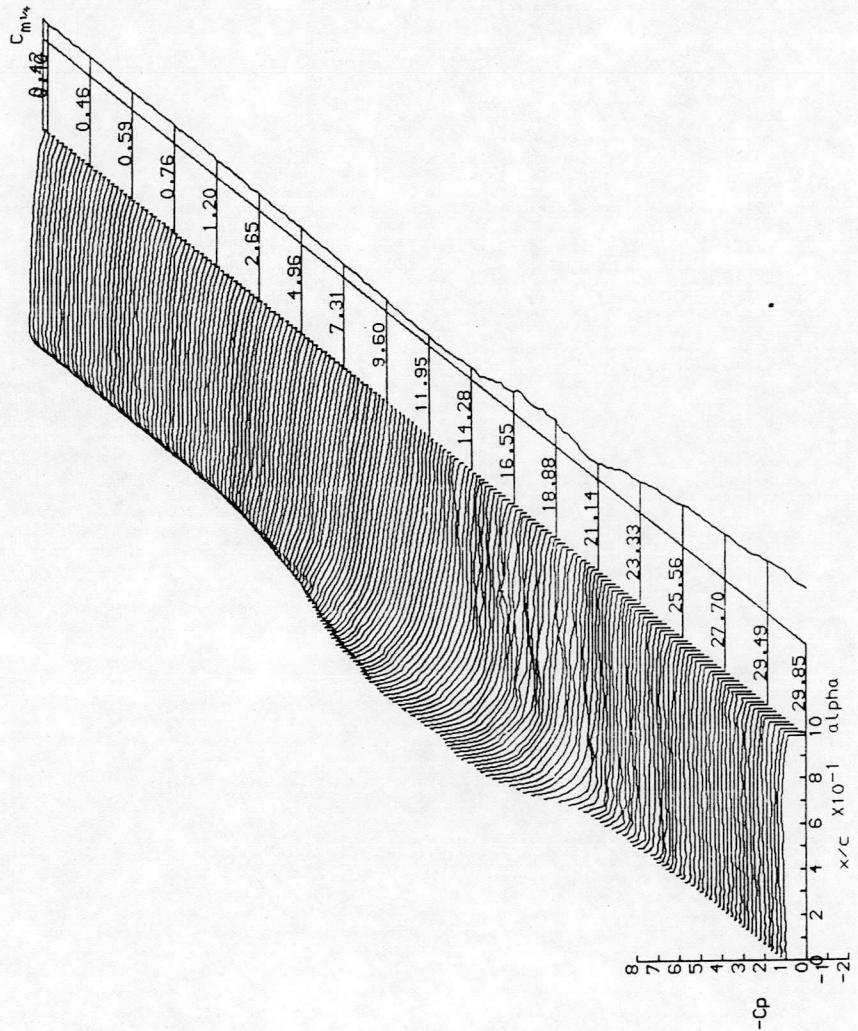
RUN REFERENCE NUMBER: 38391
 REYNOLDS NUMBER = 1469546.
 DYNAMIC PRESSURE = 1000.06 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -30.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.4°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01845
 LINEAR PITCH RATE = -157.60°s⁻¹

AVERAGED DATA OF 5 CYCLES



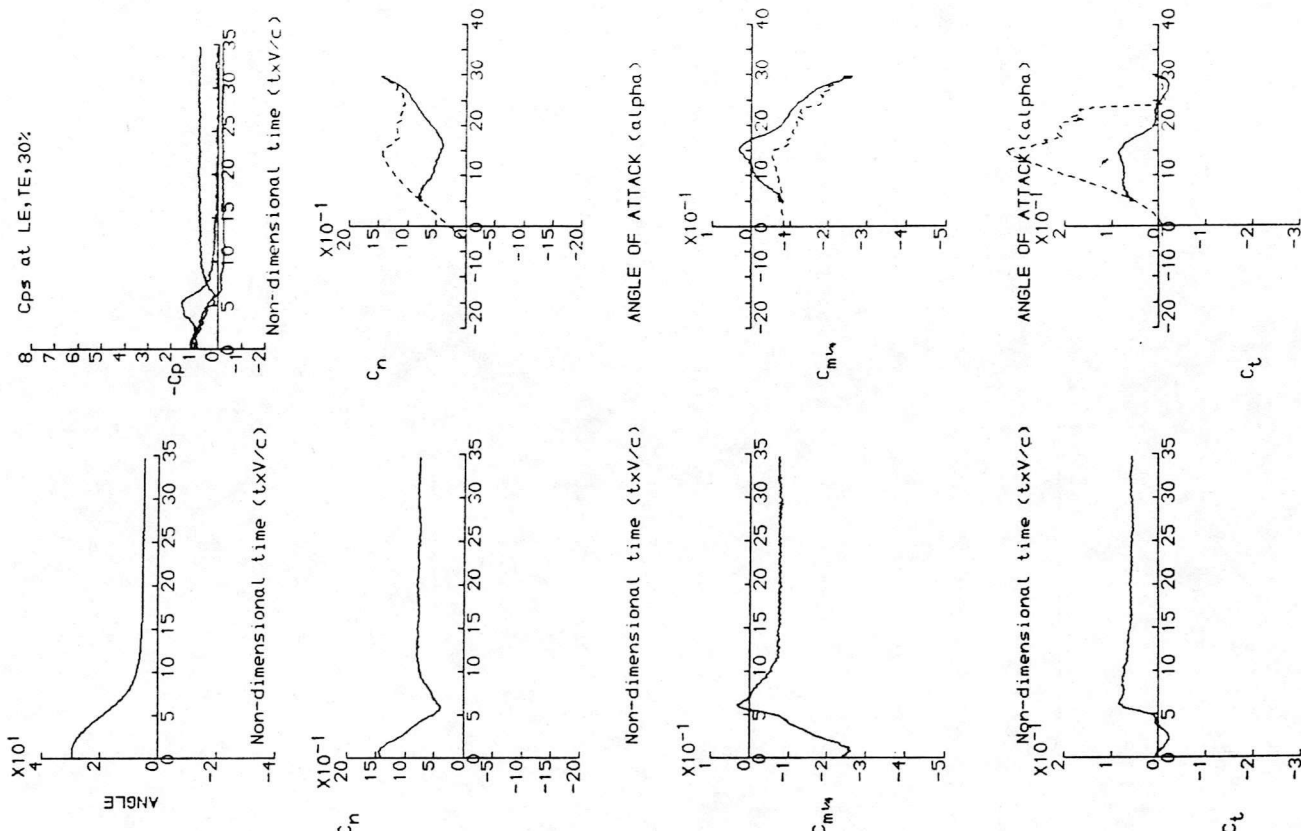
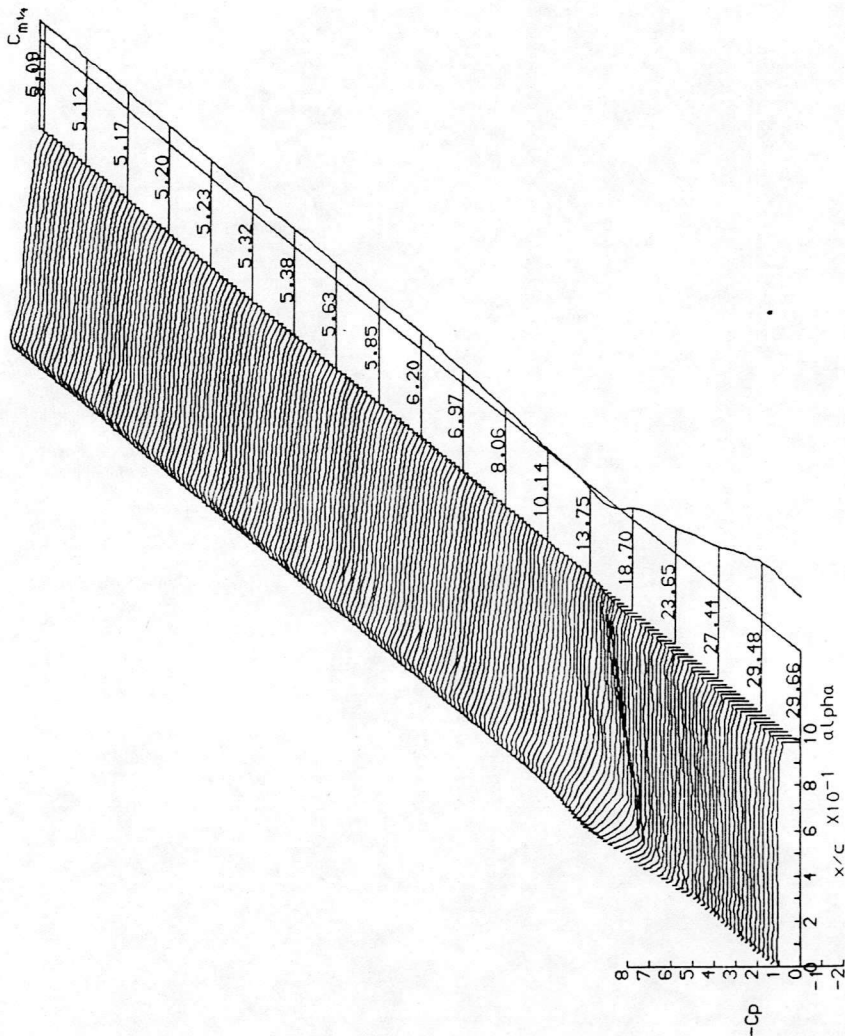
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38401
 REYNOLDS NUMBER = 1467684.
 DYNAMIC PRESSURE = 1000.06 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -30.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.7°C
 SAMPLING FREQUENCY = 212.99 Hz.
 REDUCED PITCH RATE = -0.00568
 LINEAR PITCH RATE = -48.51°s⁻¹



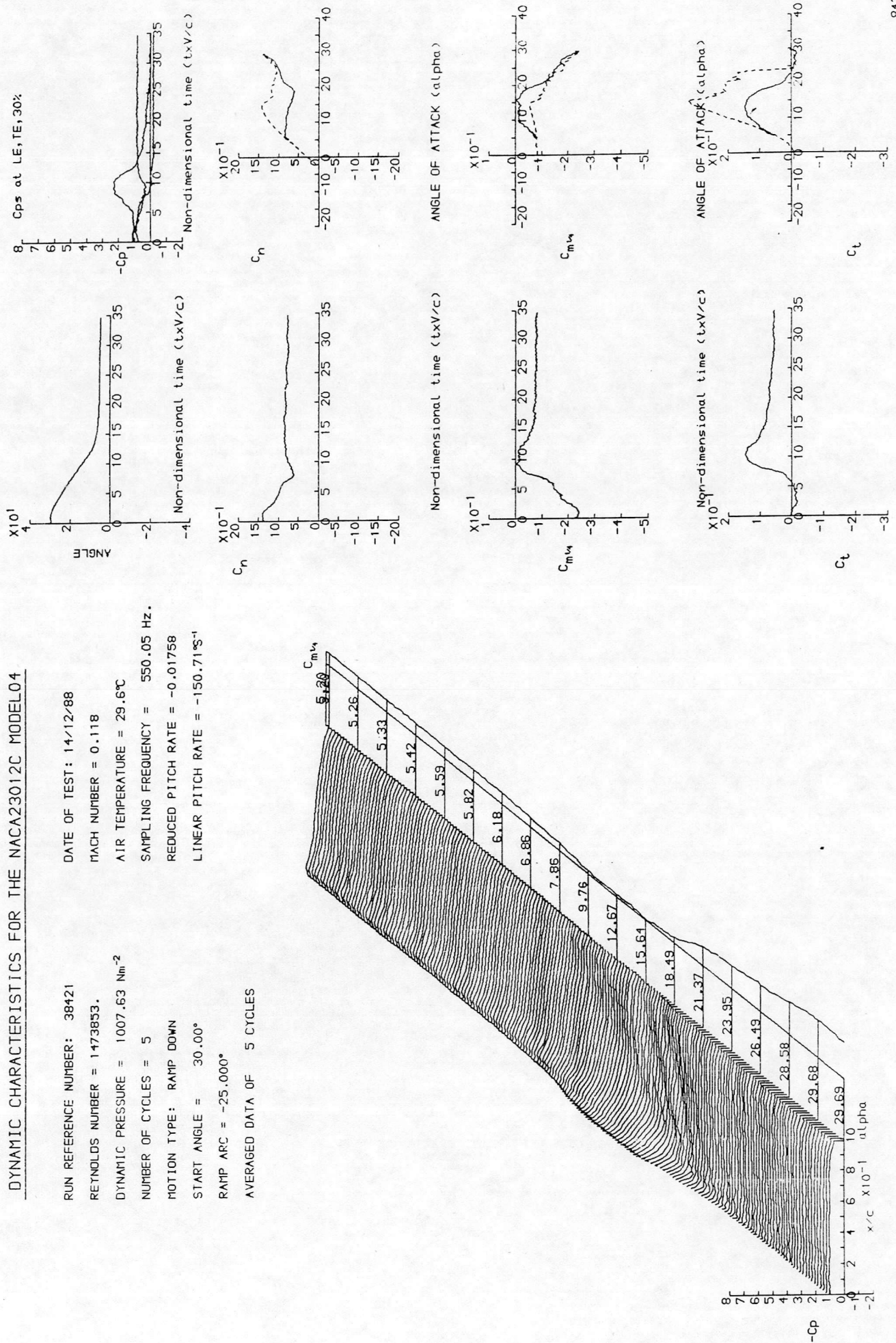
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38411
 REYNOLDS NUMBER = 1478849.
 DYNAMIC PRESSURE = 1007.63 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -25.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.8°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03151
 LINEAR PITCH RATE = -269.87°s⁻¹
 AVERAGED DATA OF 5 CYCLES



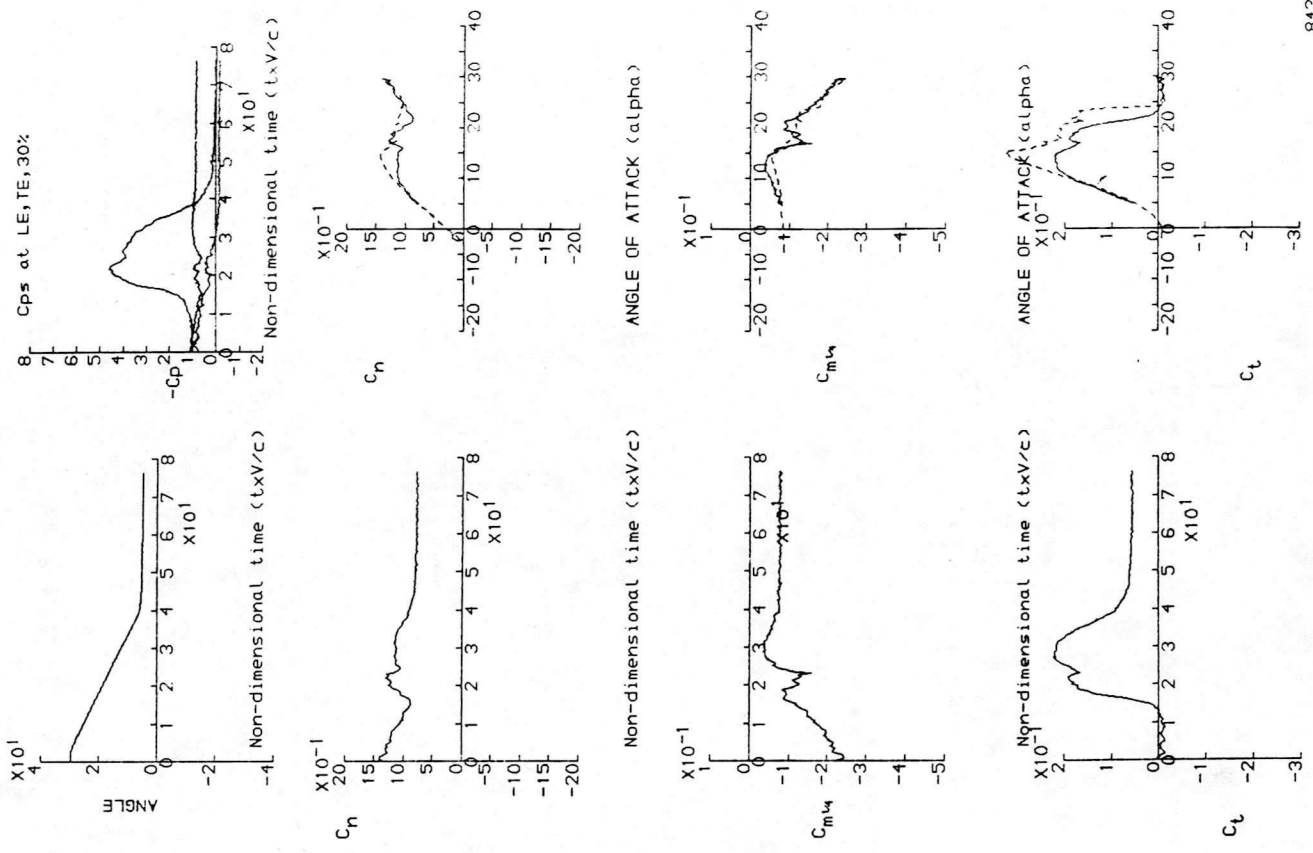
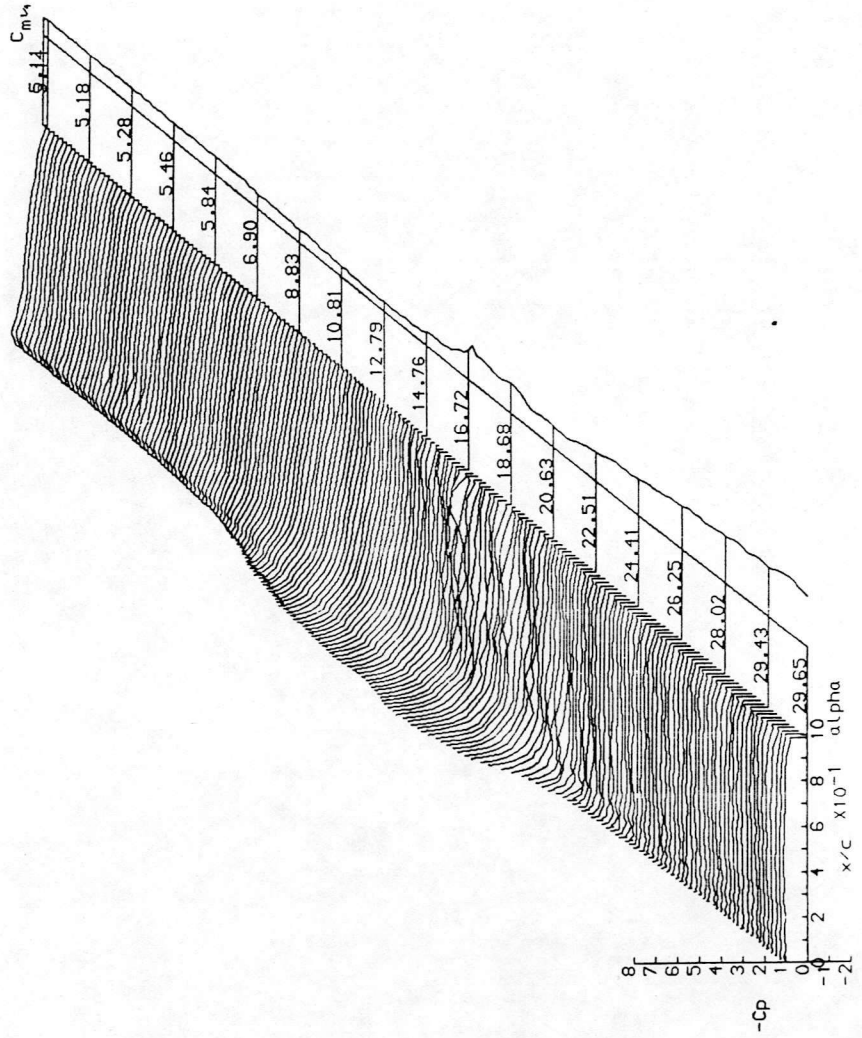
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38421
 RETNOLDS NUMBER = 1473853.
 DYNAMIC PRESSURE = 1007.63 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -25.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.6°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01758
 LINEAR PITCH RATE = -150.71°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

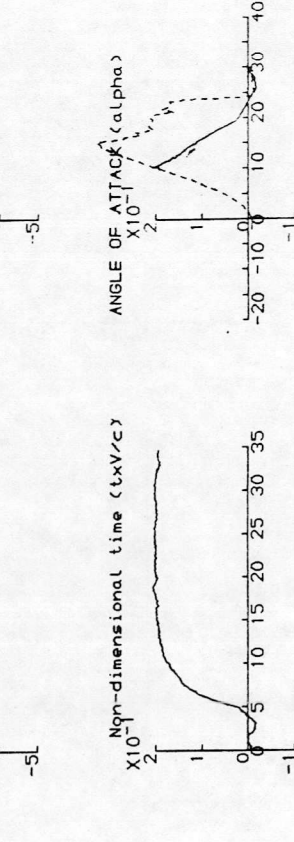
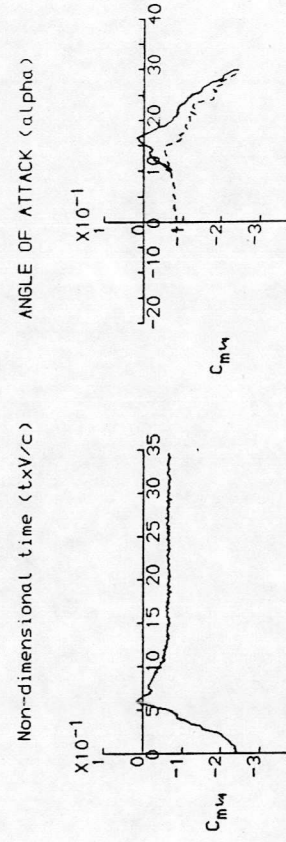
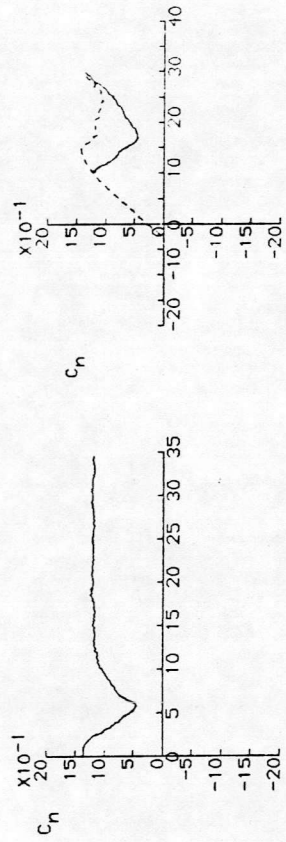
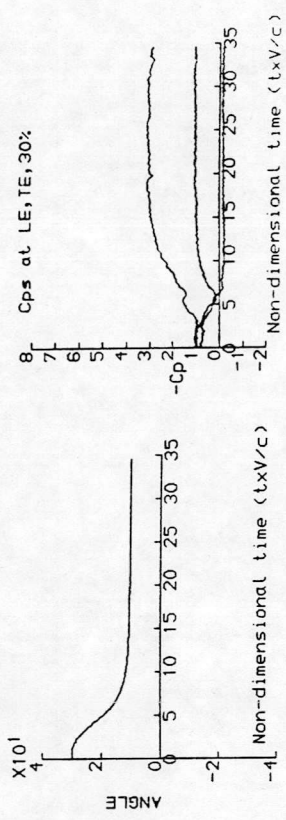
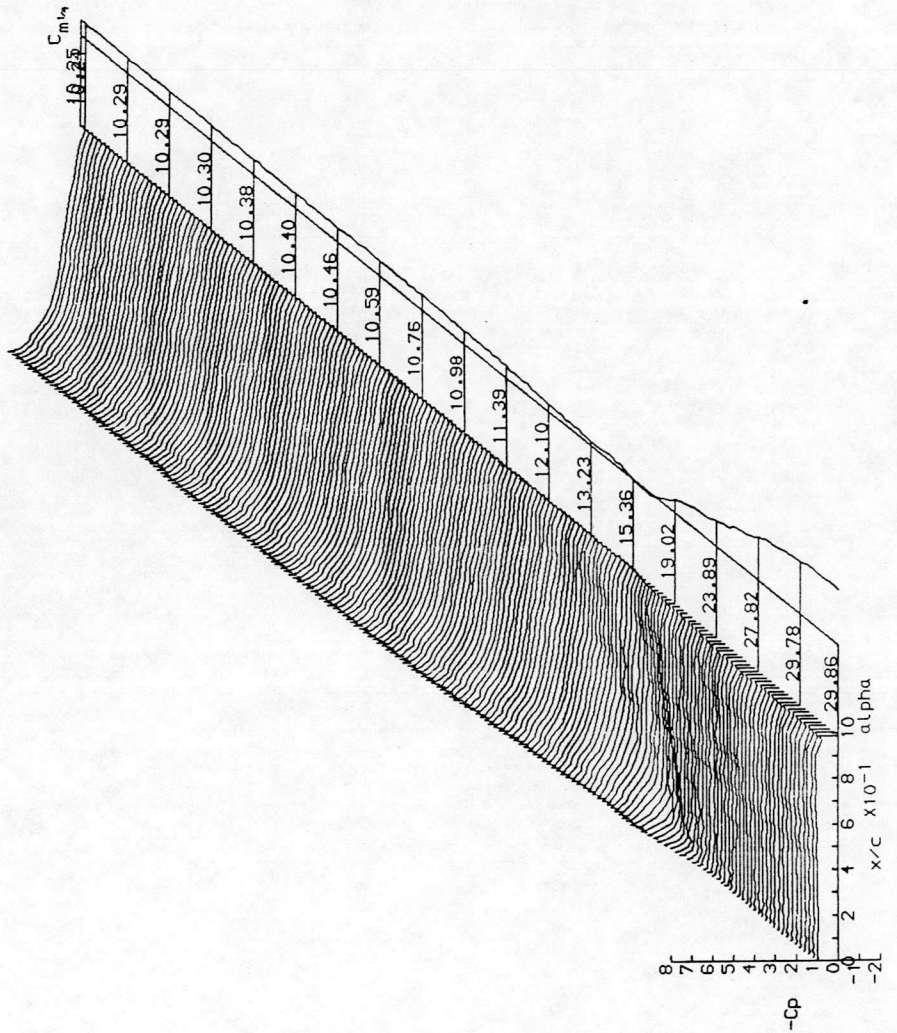
RUN REFERENCE NUMBER: 38431
 REYNOLDS NUMBER = 1471988.
 DYNAMIC PRESSURE = 1007.63 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -25.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.9°C
 SAMPLING FREQUENCY = 250.00 Hz.
 REDUCED PITCH RATE = -0.00562
 LINEAR PITCH RATE = -48.22°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

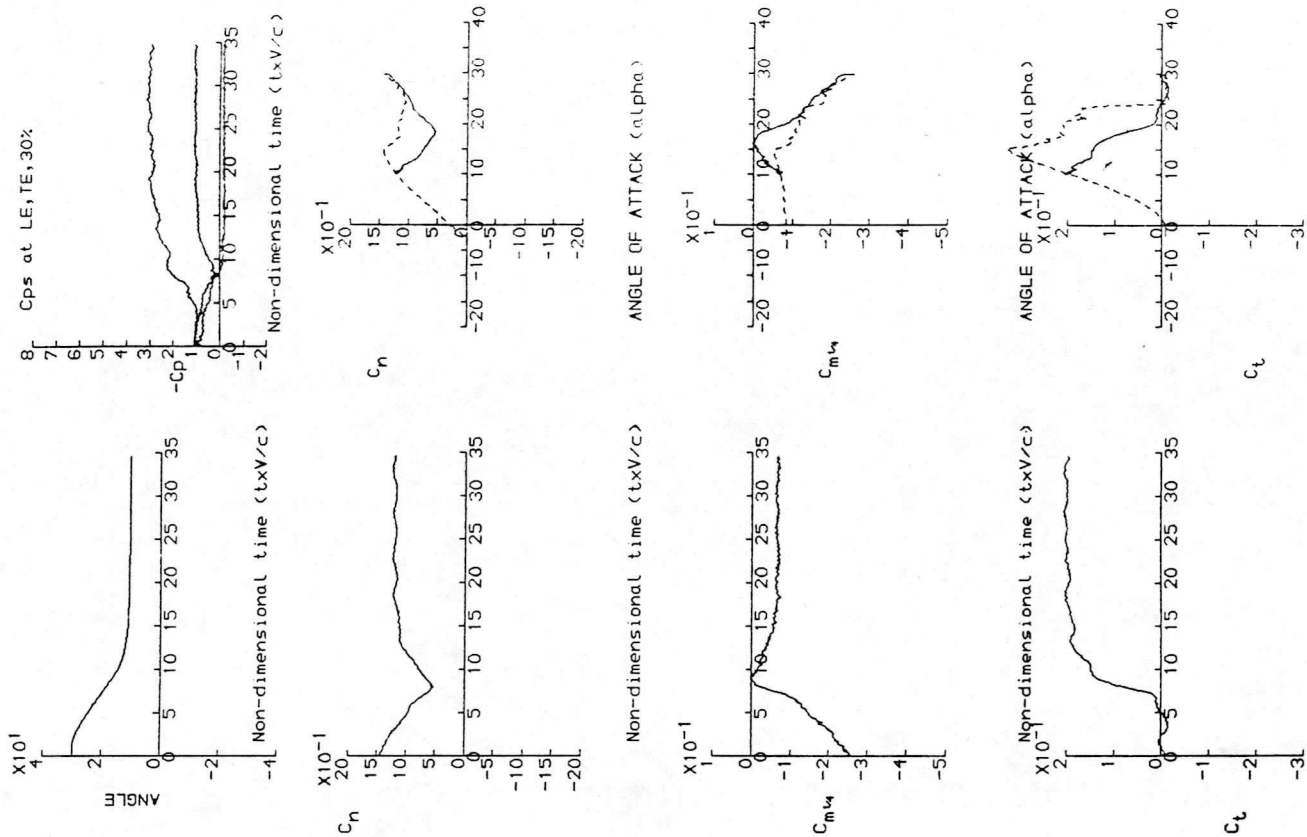
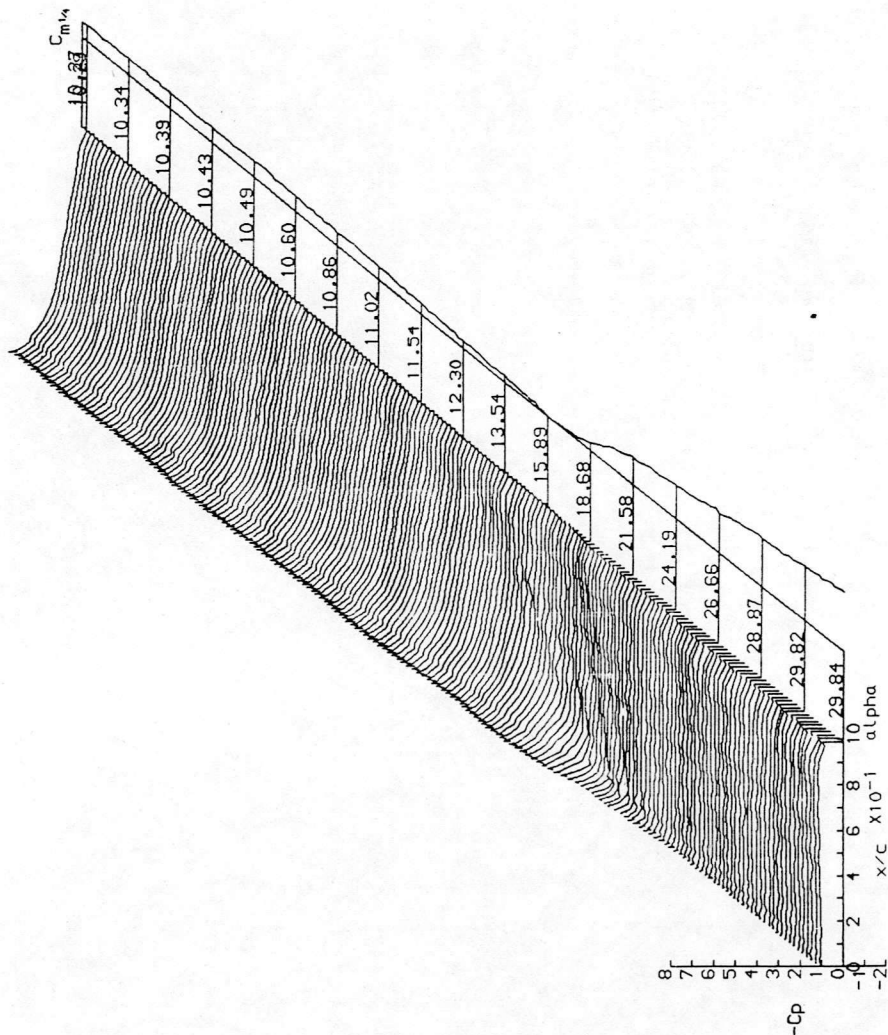
RUN REFERENCE NUMBER: 38441
 REYNOLDS NUMBER = 1474422.
 DYNAMIC PRESSURE = 1003.30 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -20.000°
 AVERAGED DATA OF 5 CYCLES

DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.03080
 LINEAR PITCH RATE = -264.10°s⁻¹



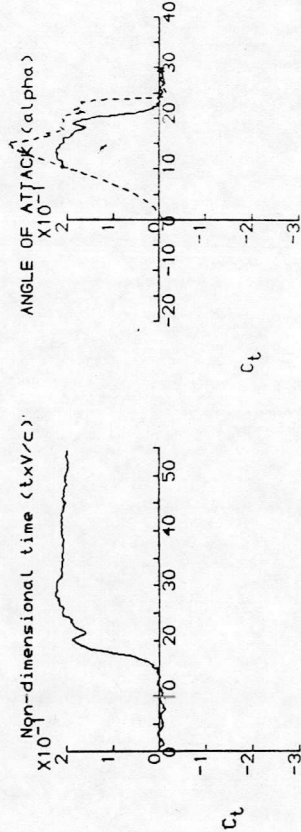
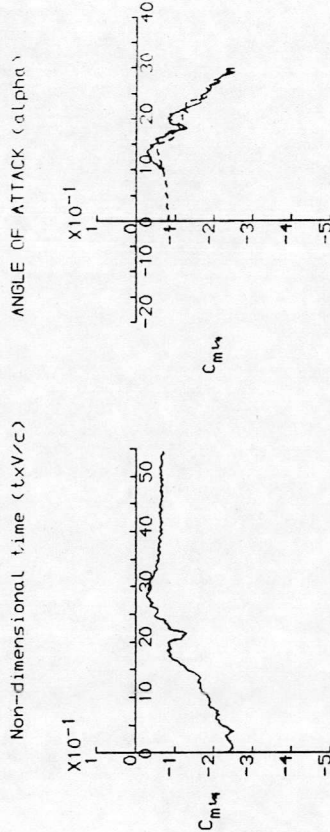
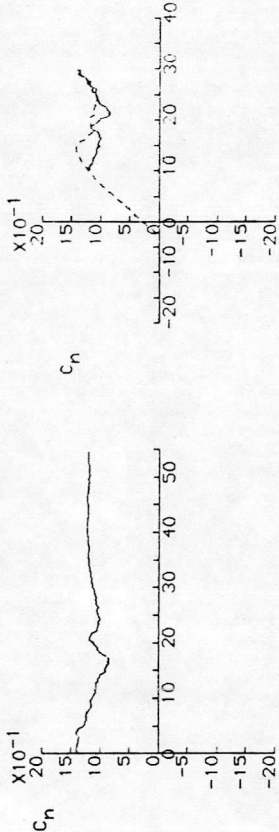
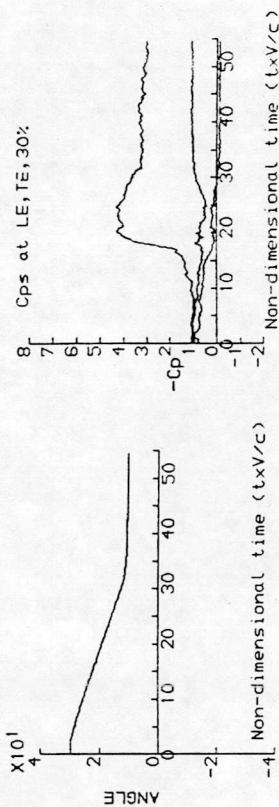
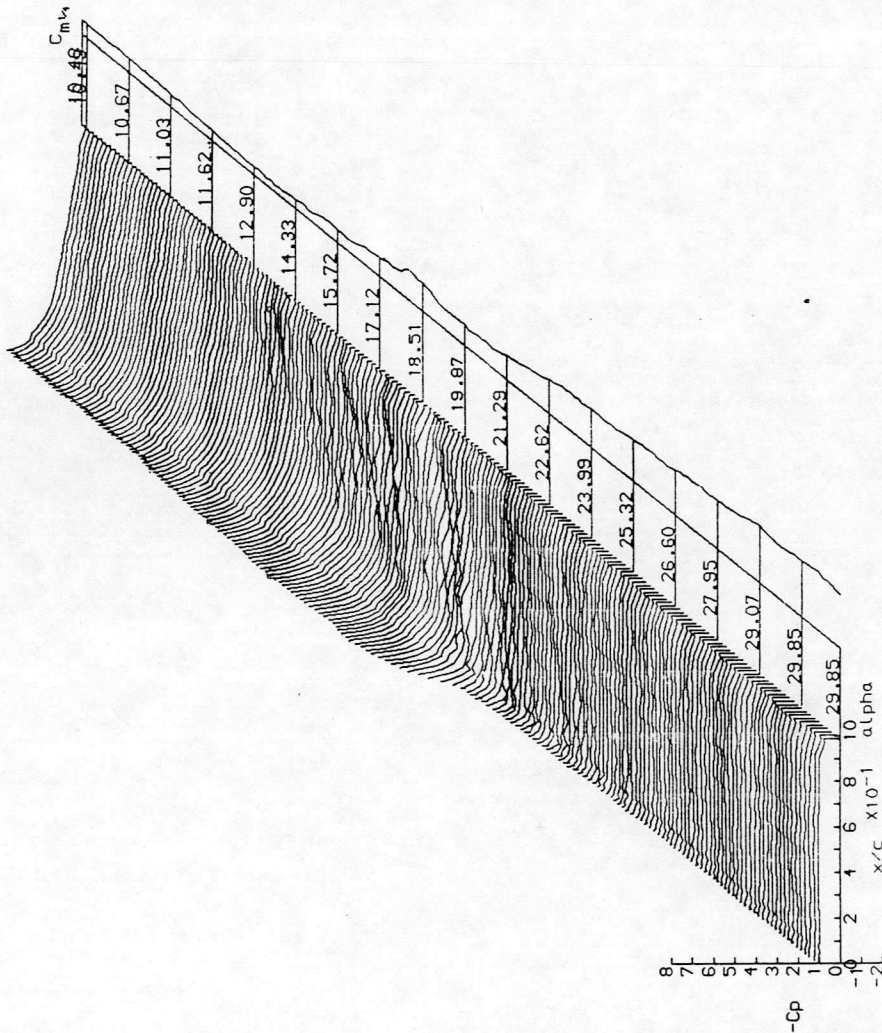
DYNAMIC CHARACTERISTICS FOR THE NACA23012C_MODEL04

RUN REFERENCE NUMBER: 38451
 REYNOLDS NUMBER = 1470065.
 DYNAMIC PRESSURE = 1003.30 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -20.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.7°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01753
 LINEAR PITCH RATE = -150.03°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

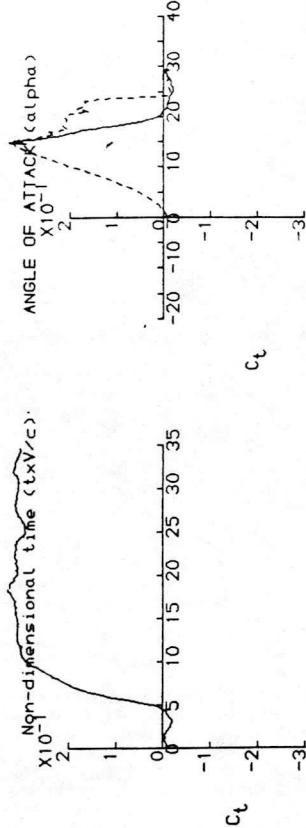
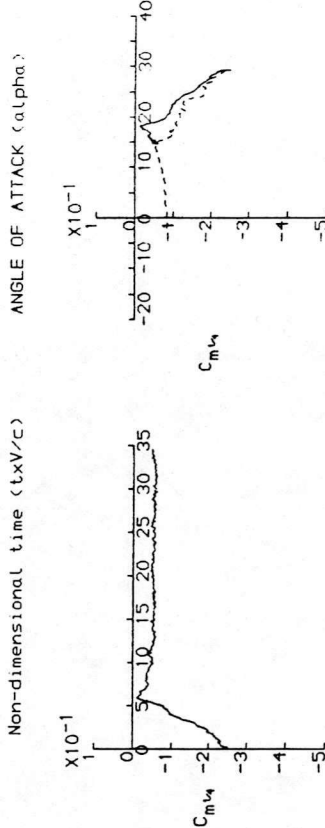
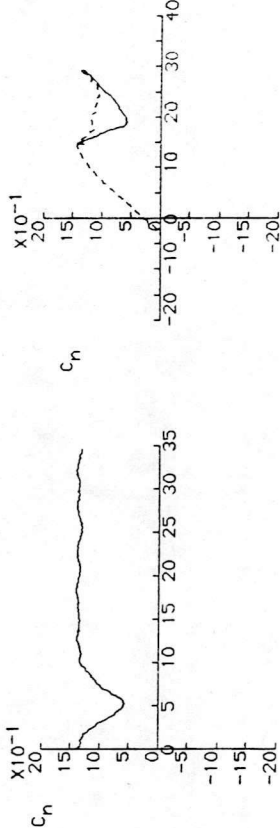
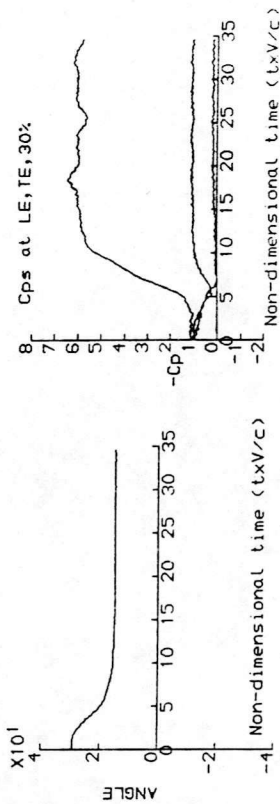
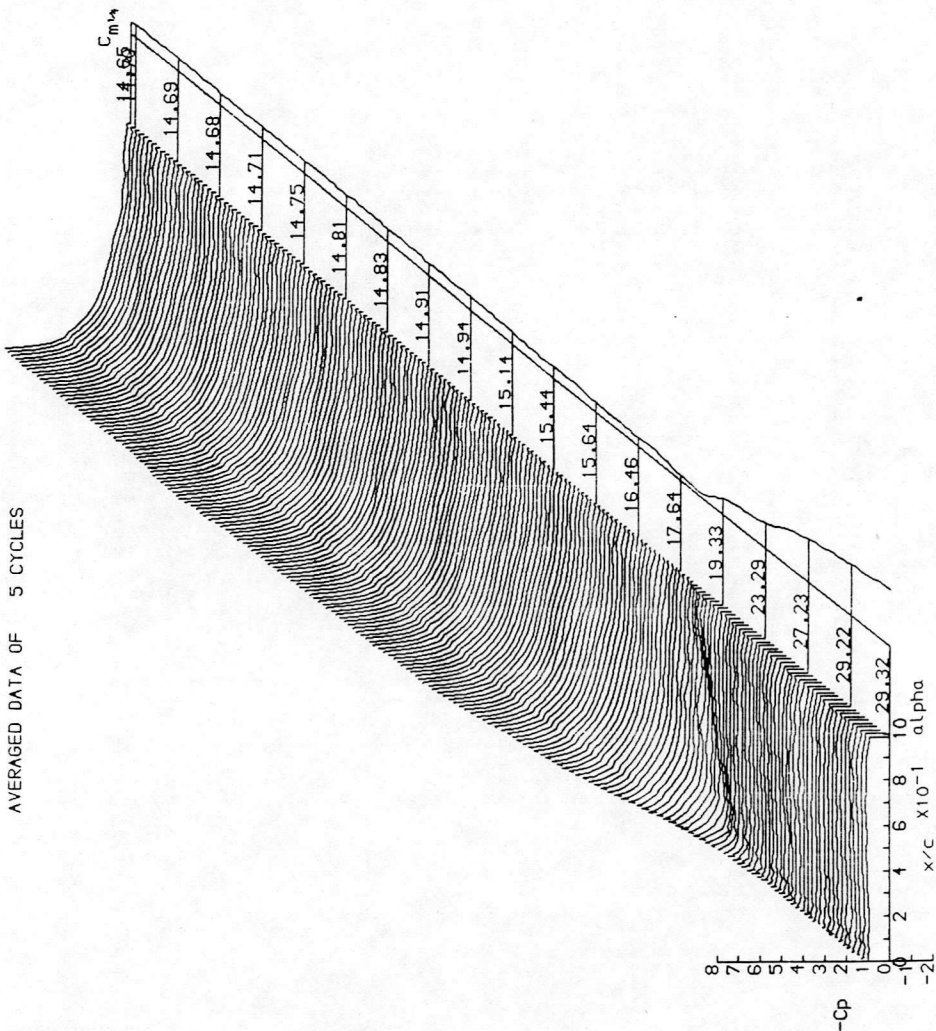
RUN REFERENCE NUMBER: 38461
 REYNOLDS NUMBER = 1468205.
 DYNAMIC PRESSURE = 1003.30 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -20.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.0°C
 SAMPLING FREQUENCY = 350.02 Hz.
 REDUCED PITCH RATE = -0.00548
 LINEAR PITCH RATE = -46.89°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

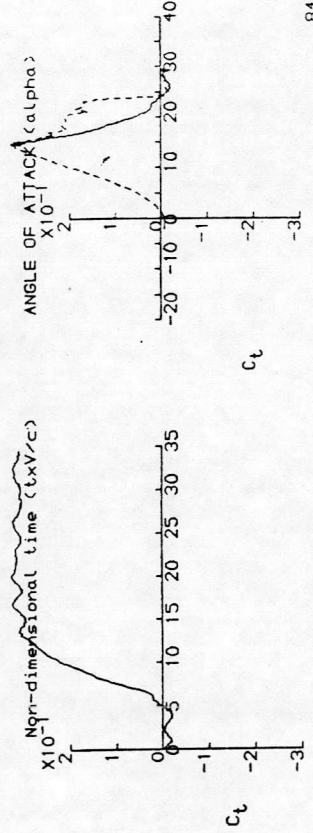
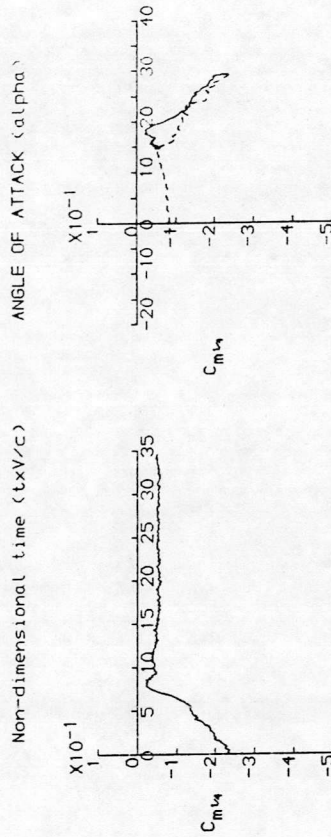
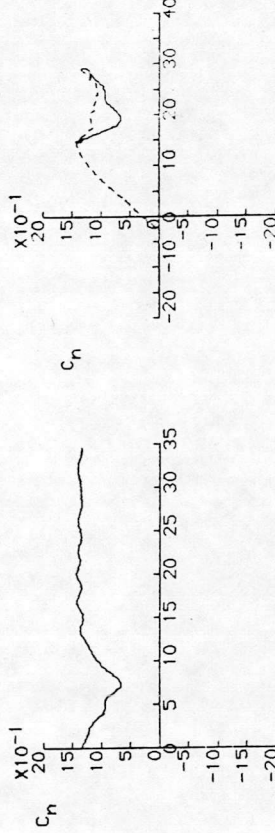
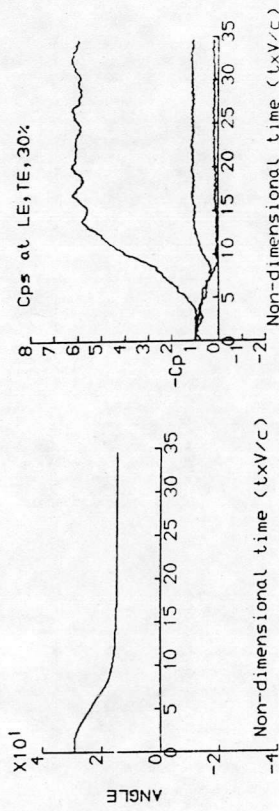
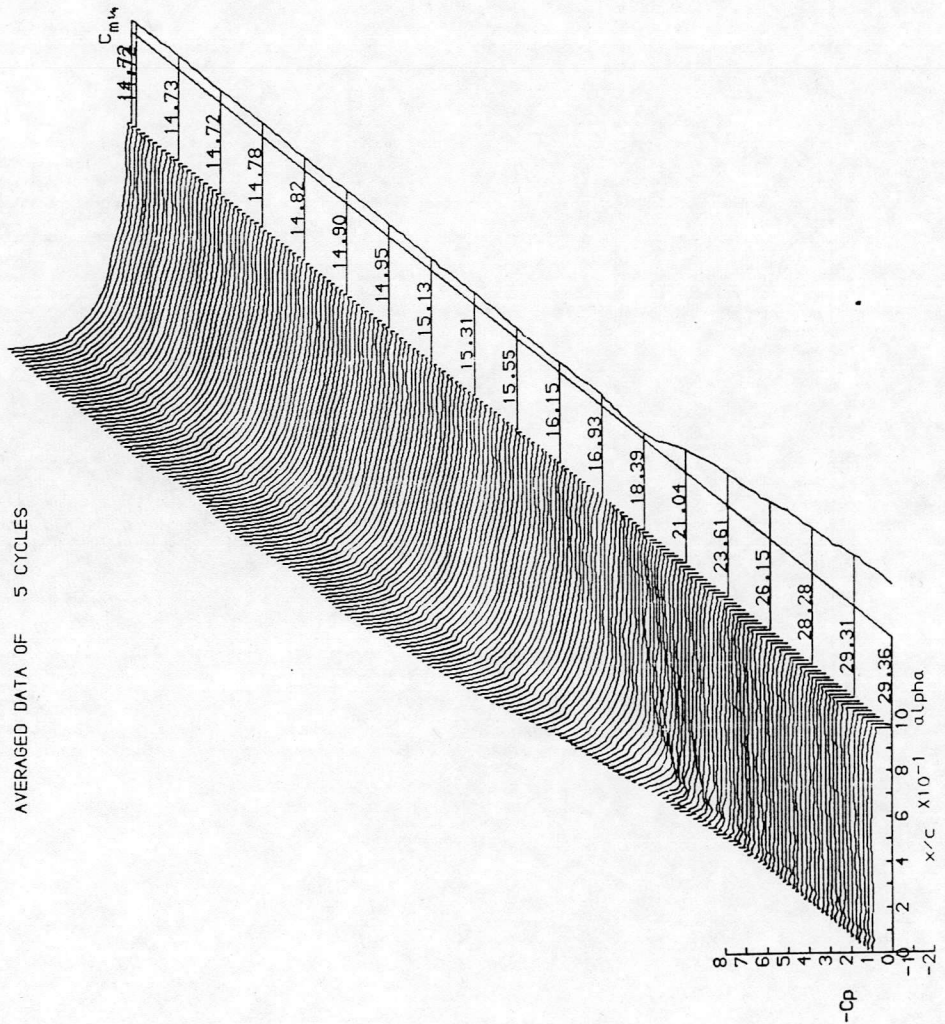
RUN REFERENCE NUMBER: 38471
 REYNOLDS NUMBER = 1472078.
 DYNAMIC PRESSURE = 1000.12 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -15.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02789
 LINEAR PITCH RATE = -238.05°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

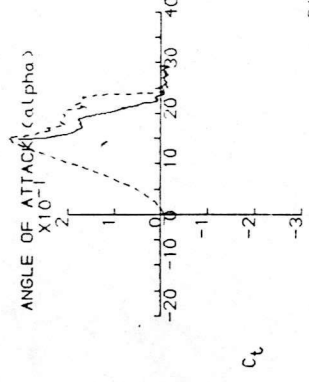
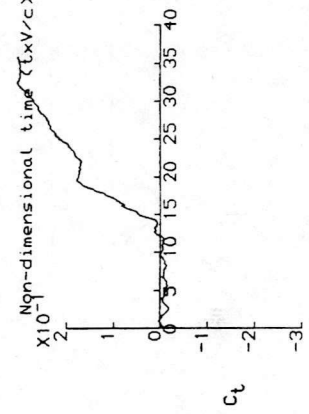
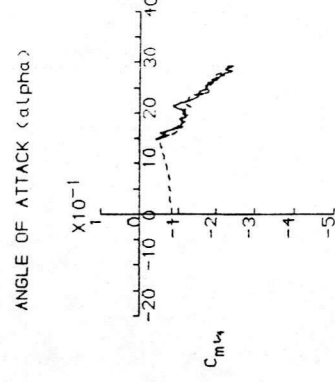
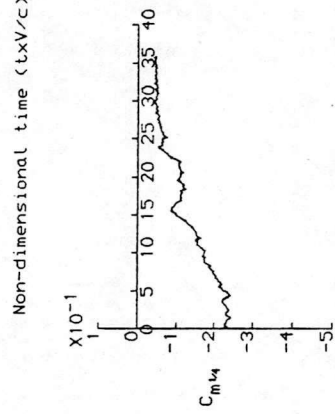
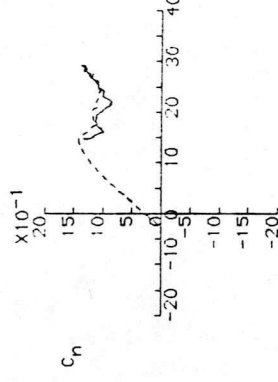
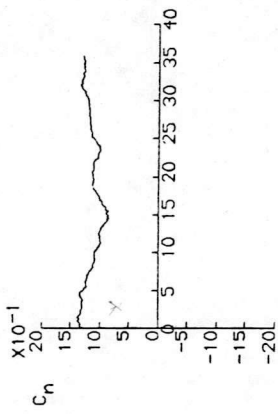
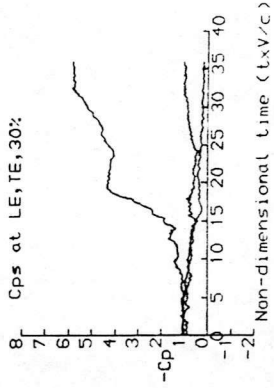
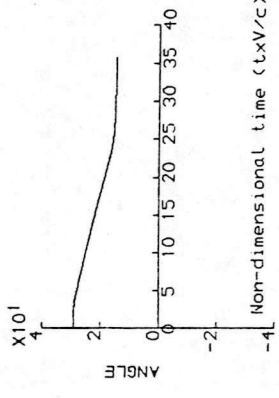
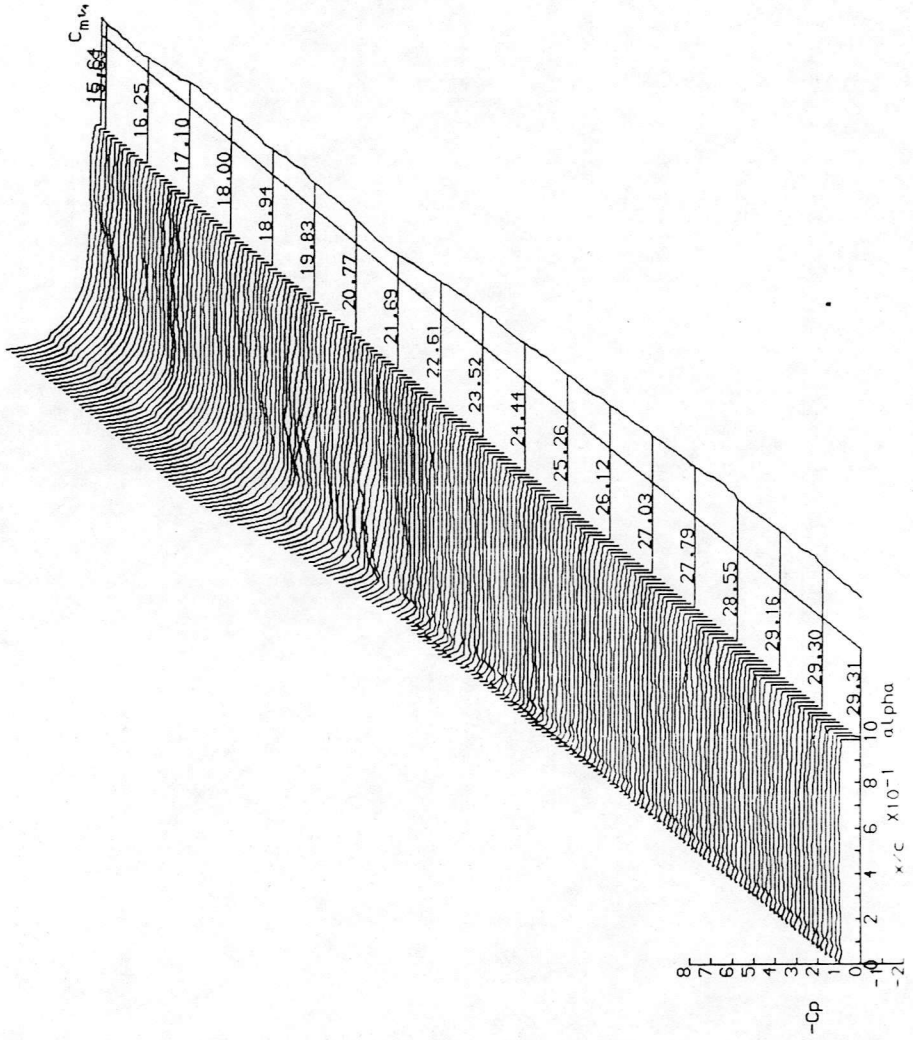
RUN REFERENCE NUMBER: 38481
 REYNOLDS NUMBER = 1467728.
 DYNAMIC PRESSURE = 1000.12 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -15.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 29.7°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01608
 LINEAR PITCH RATE = -137.43°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

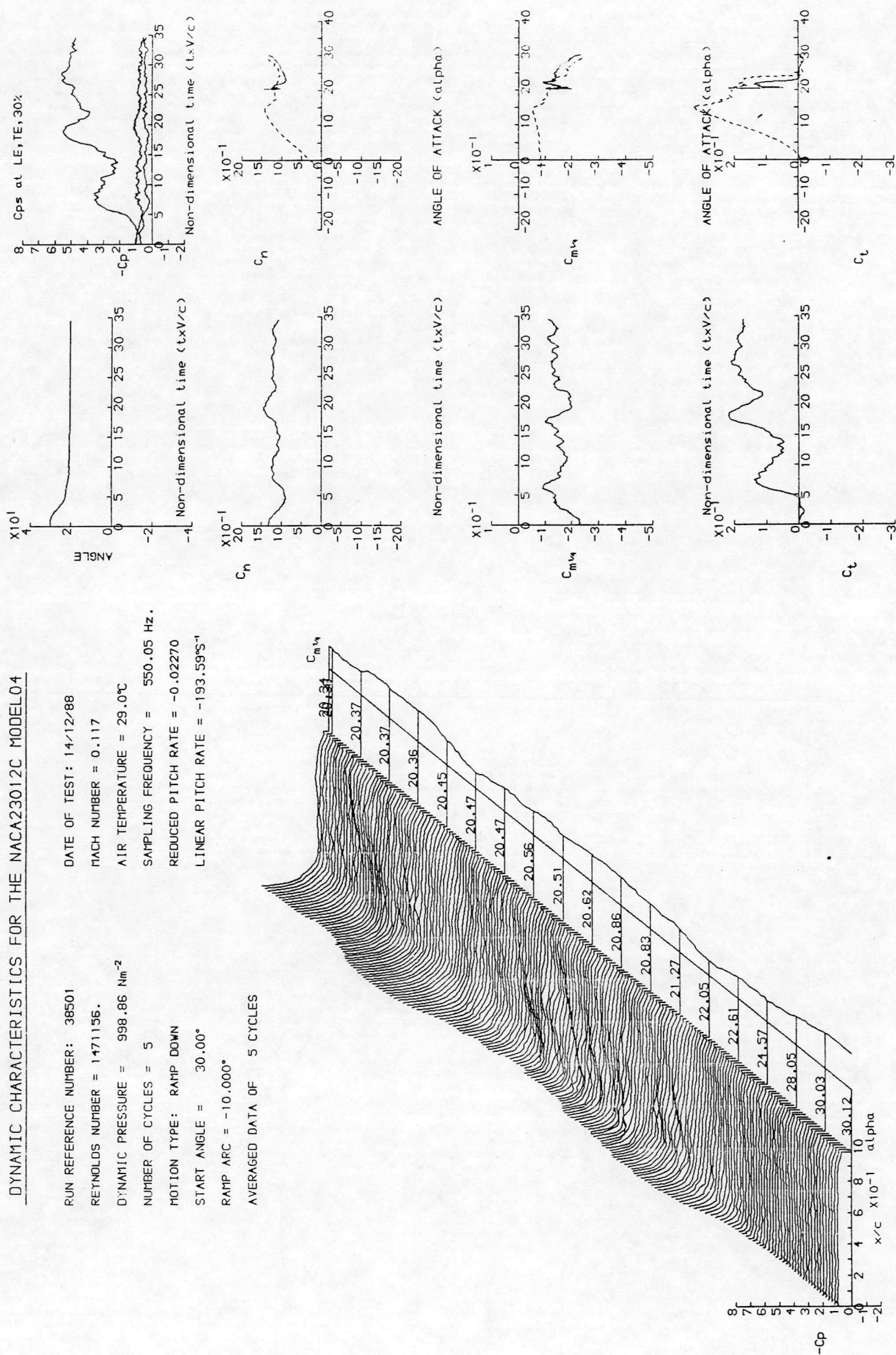
RUN REFERENCE NUMBER: 38491
 REYNOLDS NUMBER = 1165871.
 DYNAMIC PRESSURE = 1000.12 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -15.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 30.0°C
 SAMPLING FREQUENCY = 529.94 Hz.
 REDUCED PITCH RATE = -0.00596
 LINEAR PITCH RATE = -45.85°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C_MODEL04

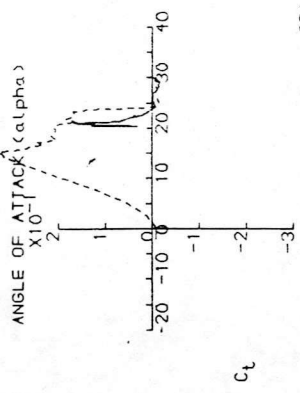
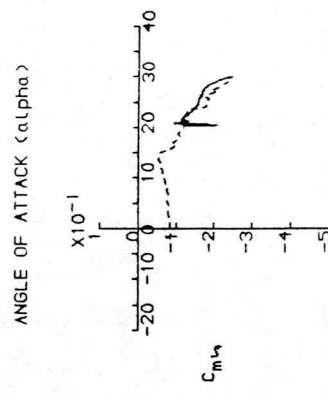
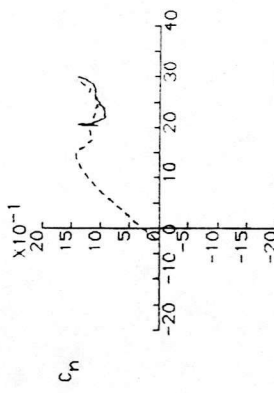
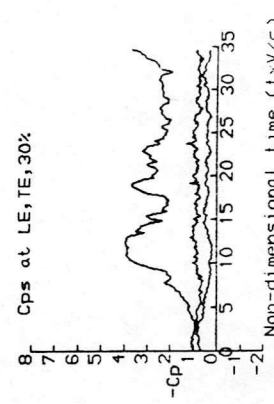
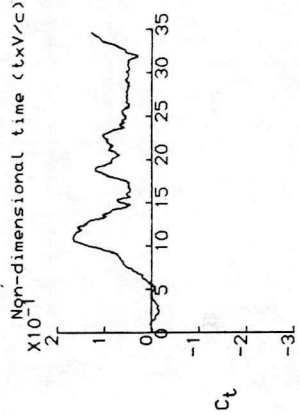
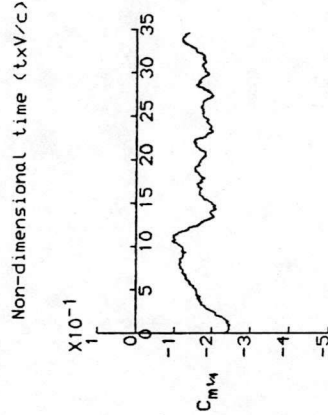
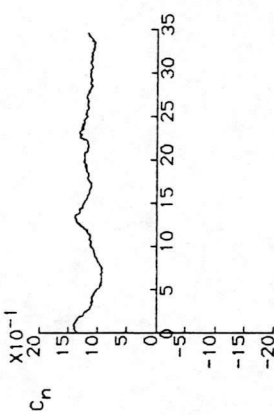
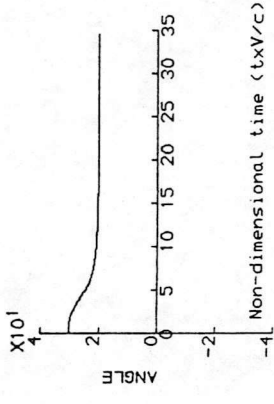
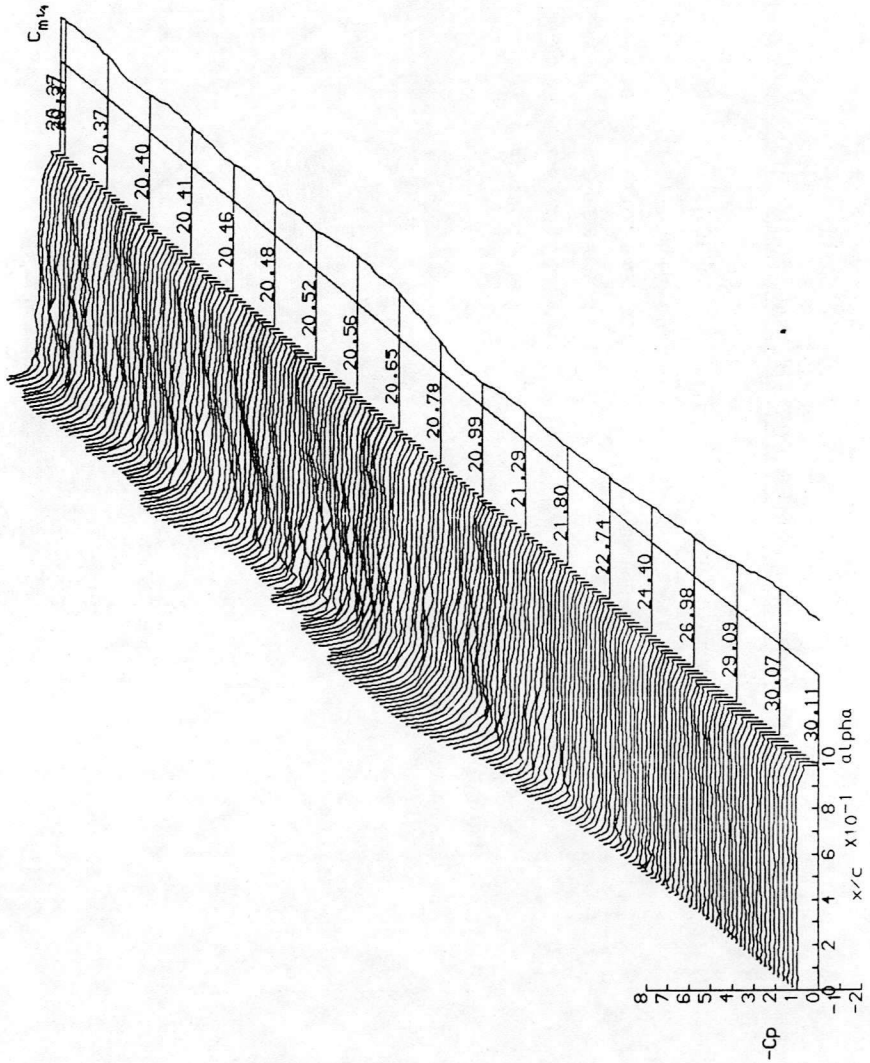
RUN REFERENCE NUMBER: 38501
 REYNOLDS NUMBER = 1471156.
 DYNAMIC PRESSURE = 998.86 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -10.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.117
 AIR TEMPERATURE = 29.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.02270
 LINEAR PITCH RATE = -193.59°s⁻¹
 AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

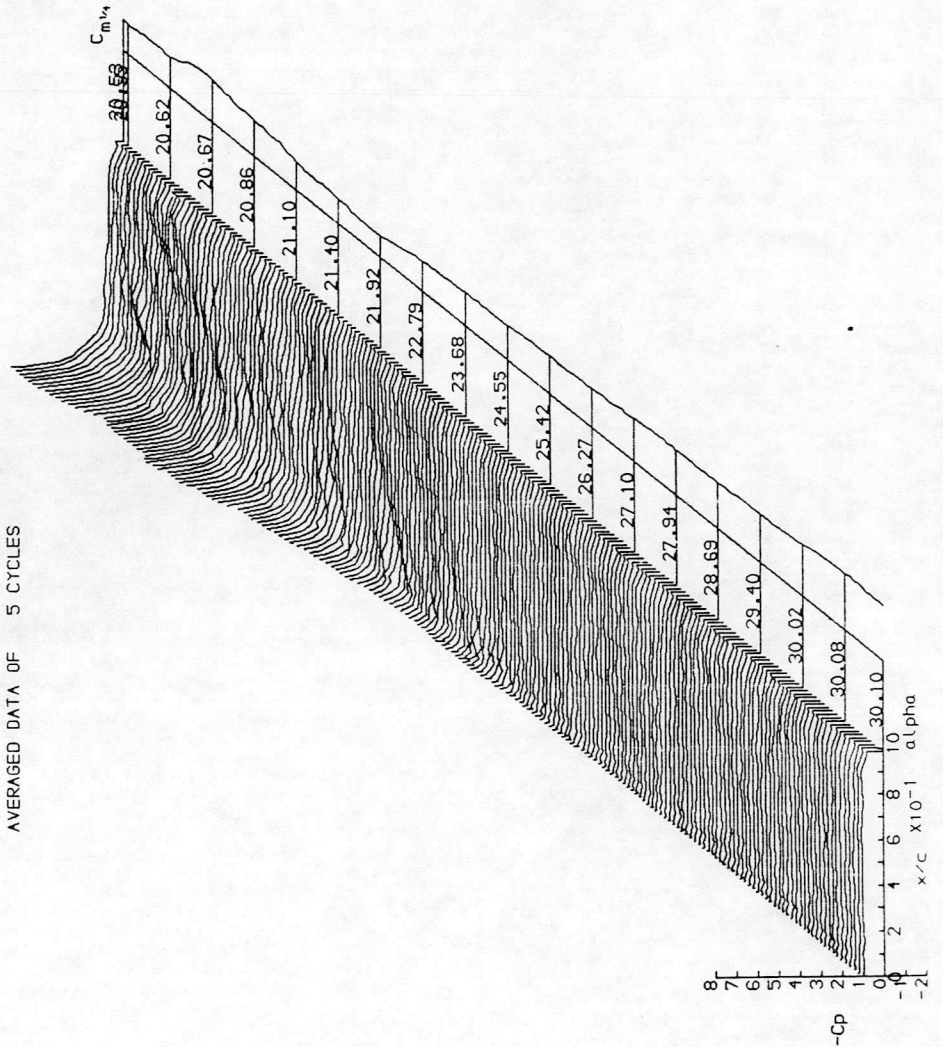
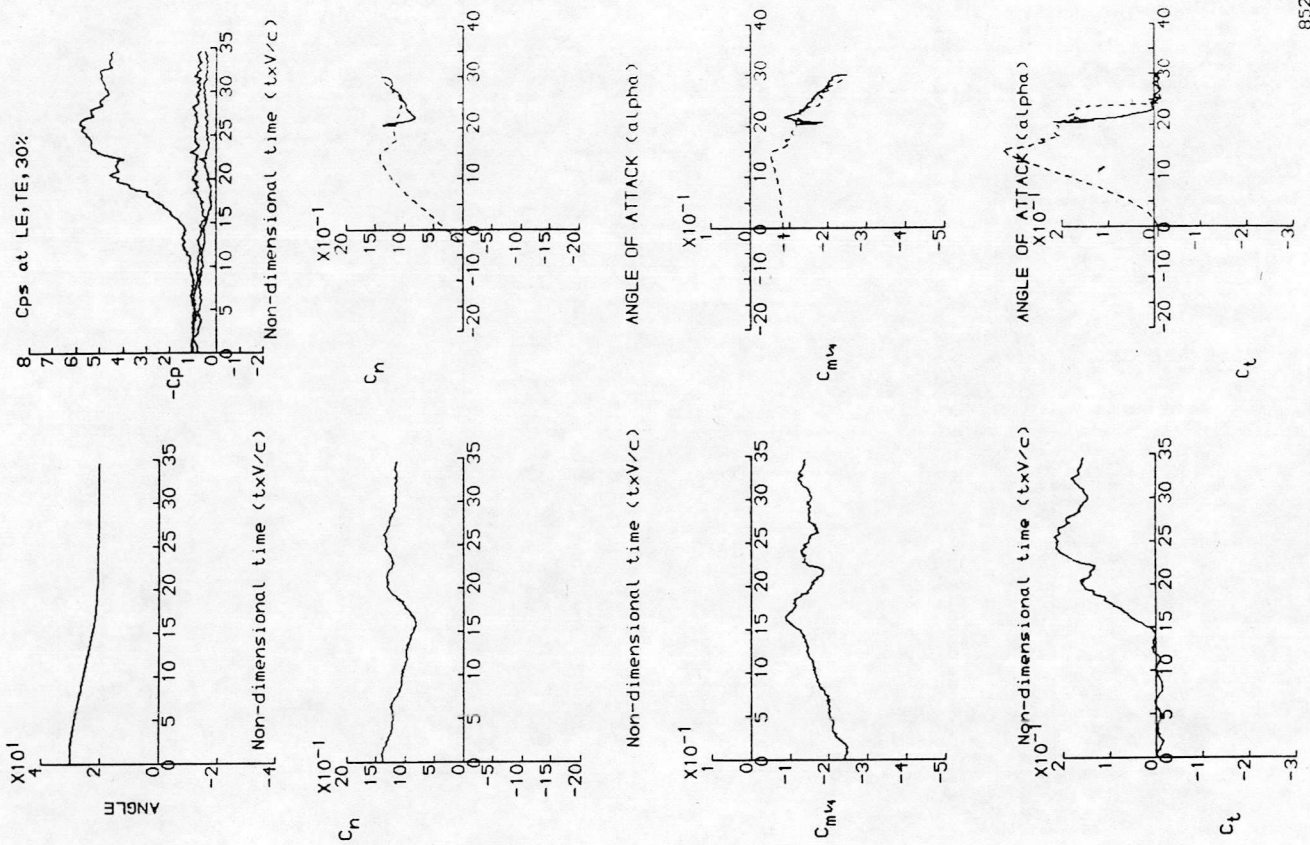
RUN REFERENCE NUMBER: 38511
 REYNOLDS NUMBER = 1465571.
 DYNAMIC PRESSURE = 998.86 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -10.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.117
 AIR TEMPERATURE = 29.9°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01681
 LINEAR PITCH RATE = -143.55°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

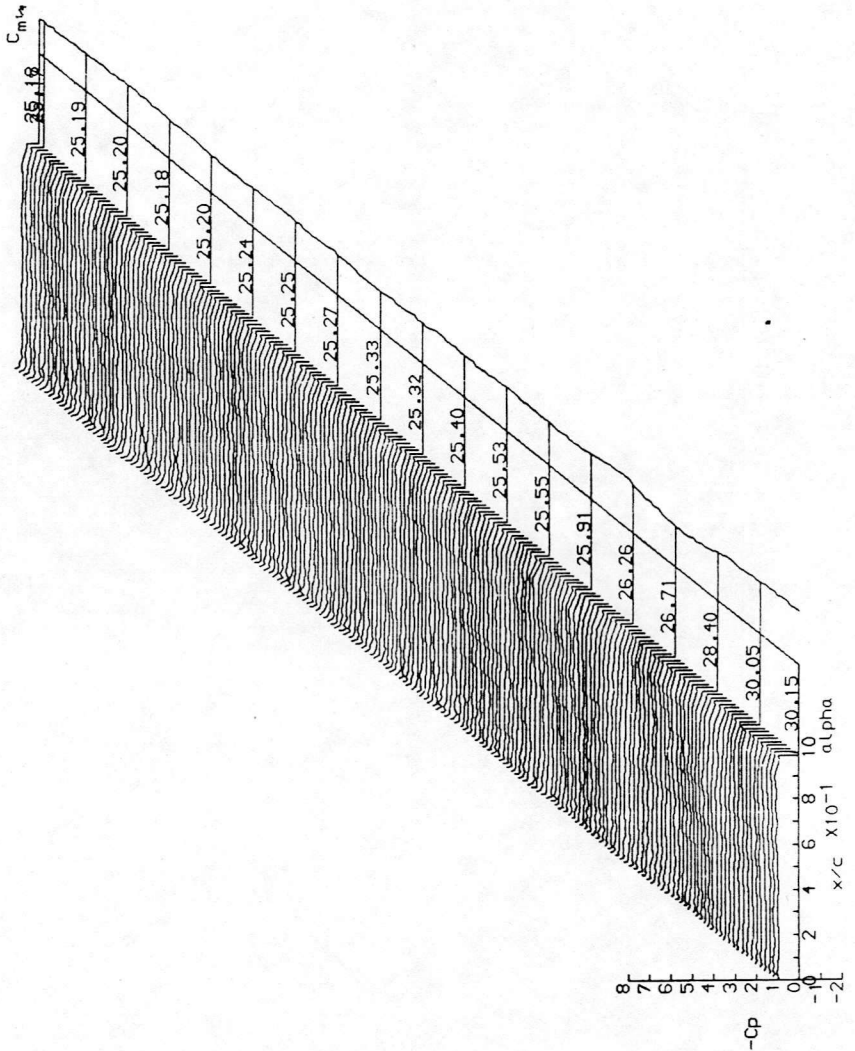
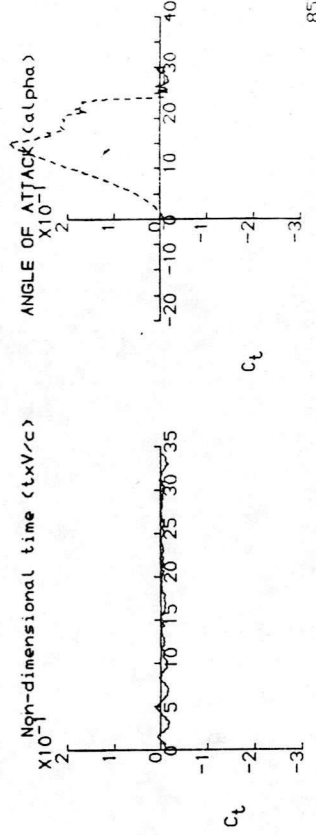
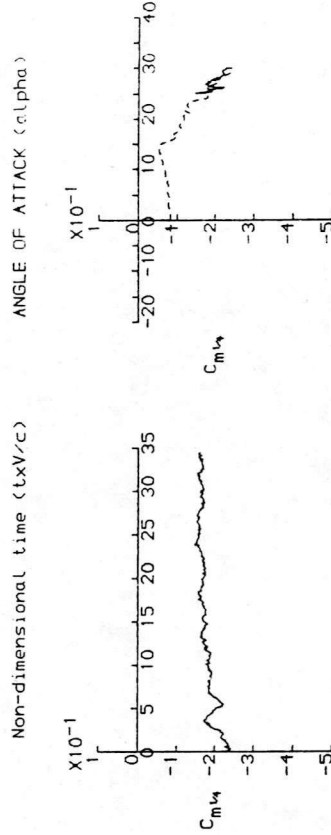
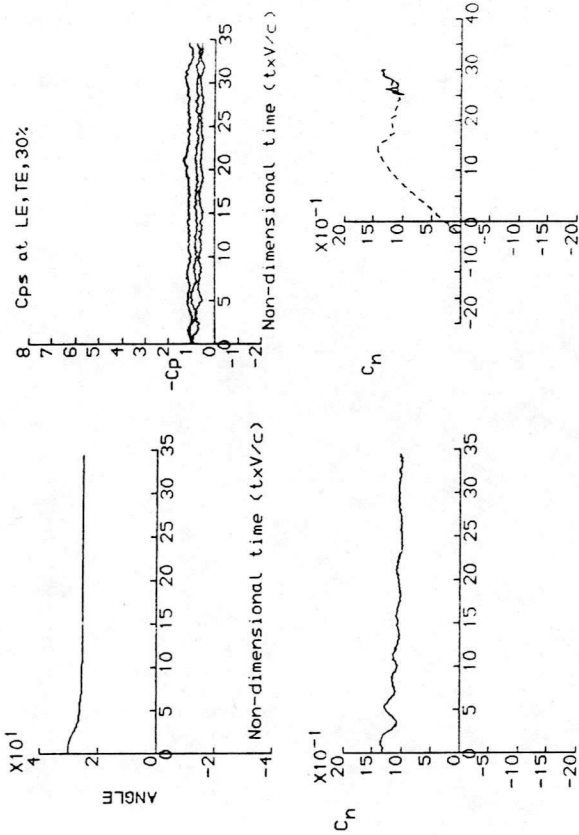
RUN REFERENCE NUMBER: 38521
 REYNOLDS NUMBER = 1461953.
 DYNAMIC PRESSURE = 998.86 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -10.000°
 AVERAGED DATA OF 5 CYCLES
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.117
 AIR TEMPERATURE = 30.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.00560
 LINEAR PITCH RATE = -47.86°s⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38531
 REYNOLDS NUMBER = 1469952.
 DYNAMIC PRESSURE = 998.92 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -5.000°
 AVERAGED DATA OF 5 CYCLES

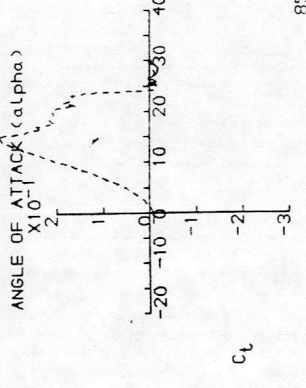
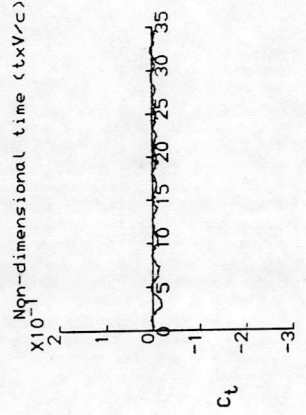
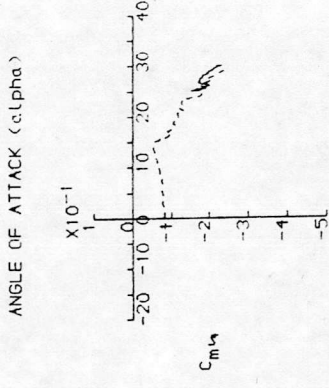
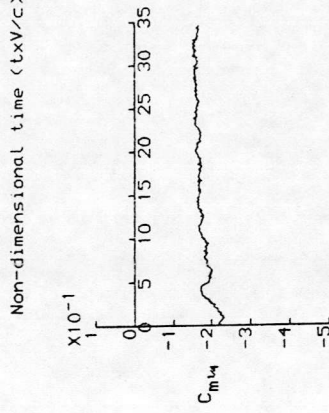
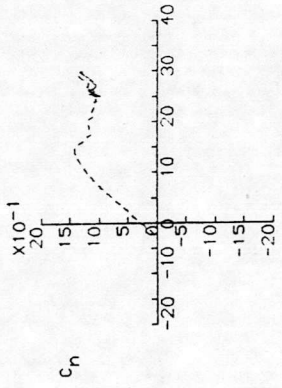
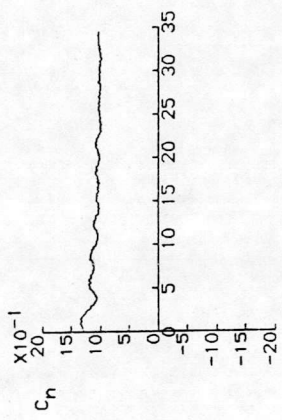
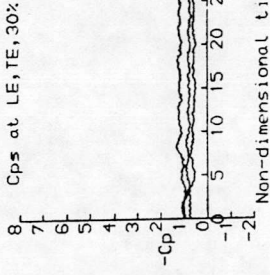
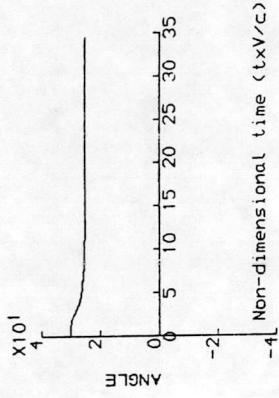
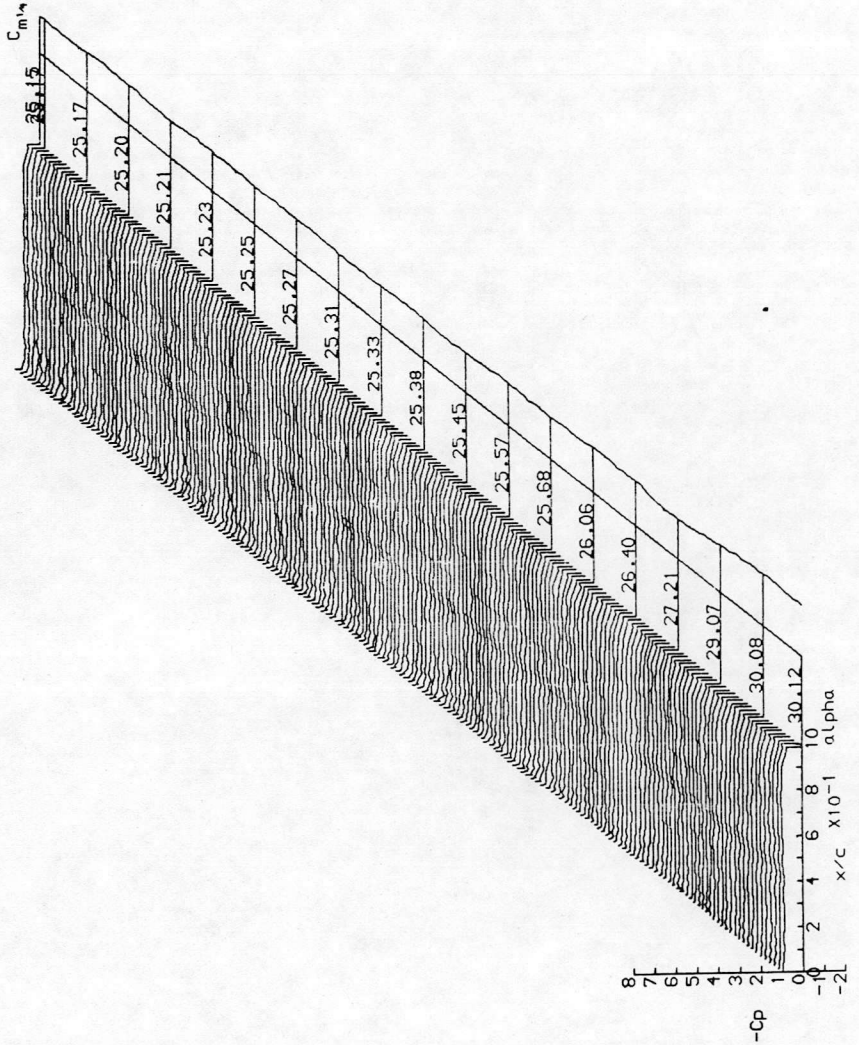
DATE OF TEST: 14/12/88
 MACH NUMBER = 0.1117
 AIR TEMPERATURE = 29.2°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01408
 LINEAR PITCH RATE = -120.17°S⁻¹



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 38541
 REYNOLDS NUMBER = 1461991.
 DYNAMIC PRESSURE = 998.92 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -5.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.117
 AIR TEMPERATURE = 30.0°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.01122
 LINEAR PITCH RATE = -95.89°s⁻¹

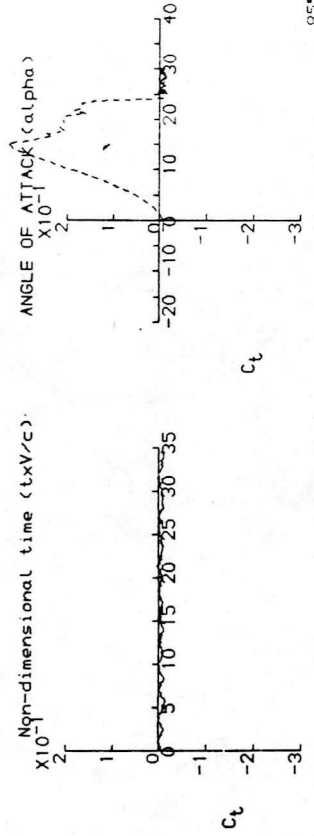
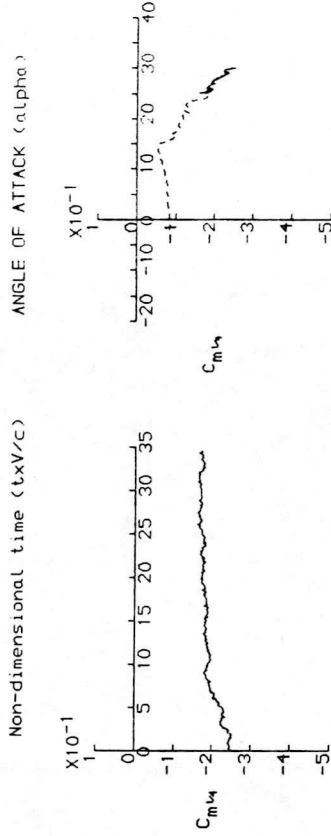
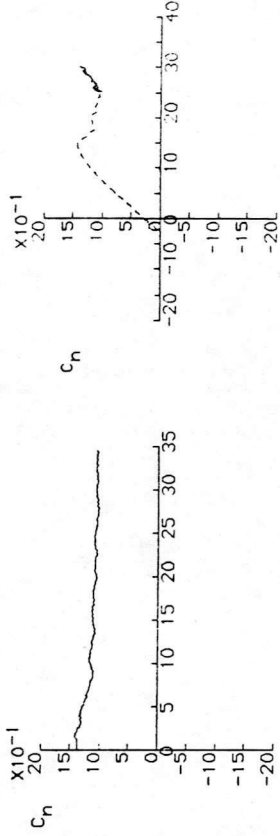
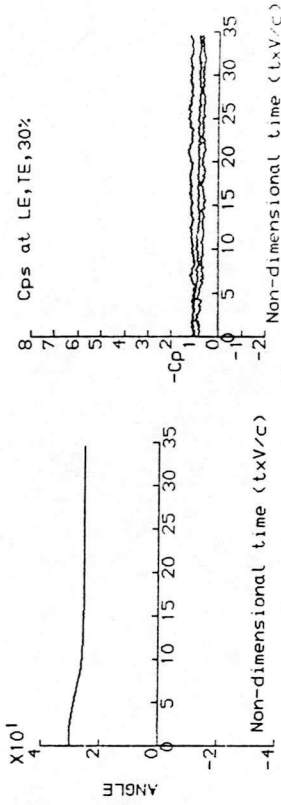
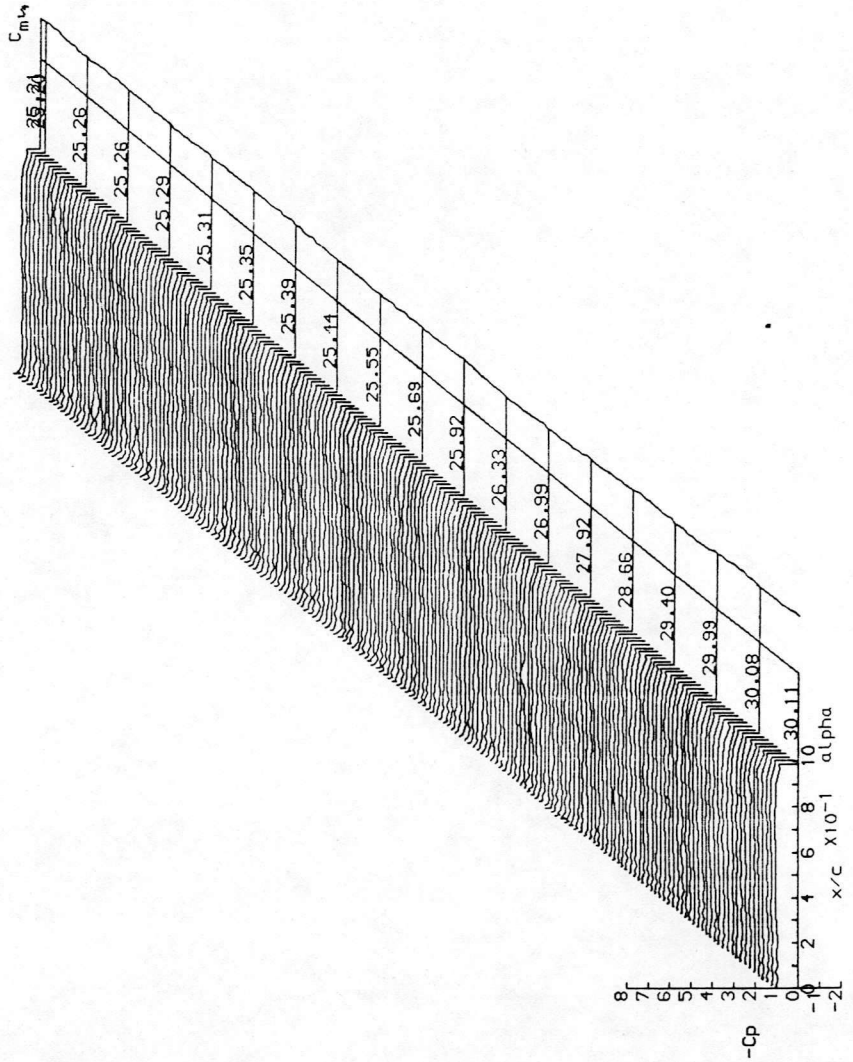
AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

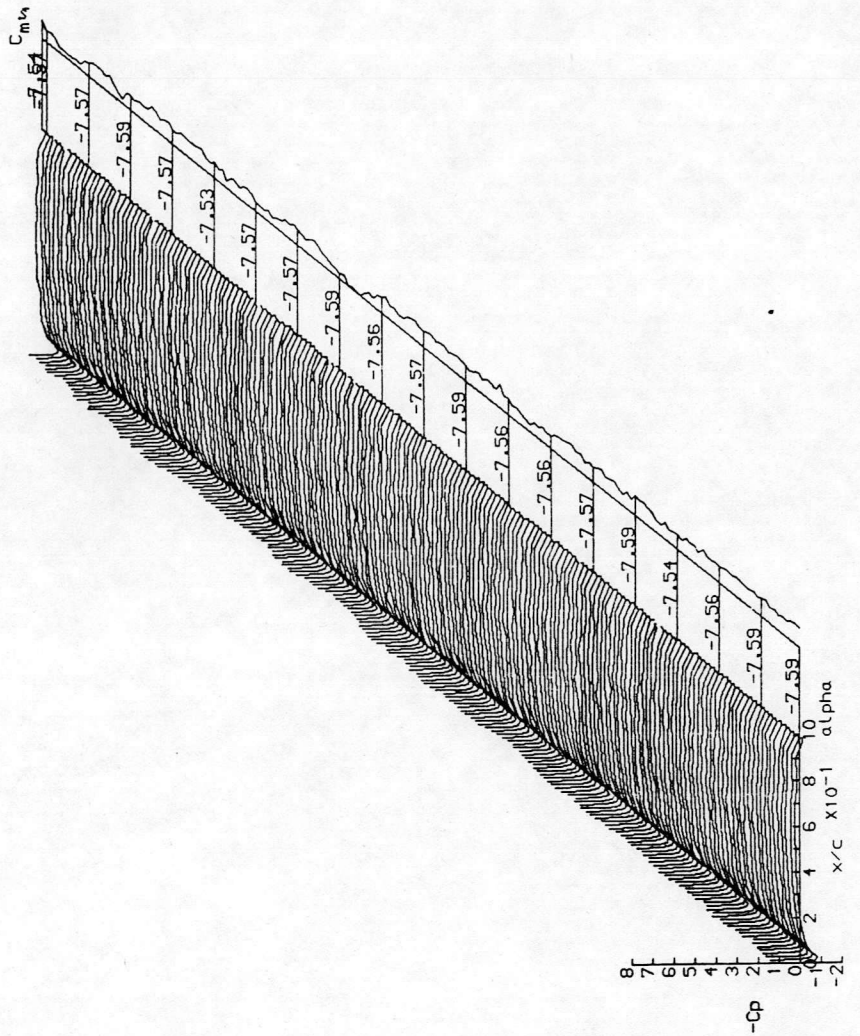
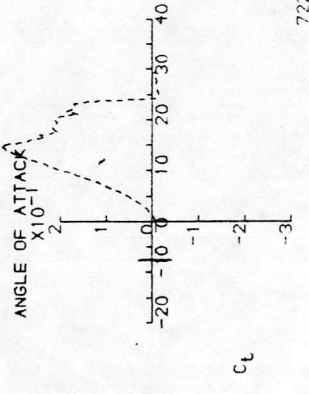
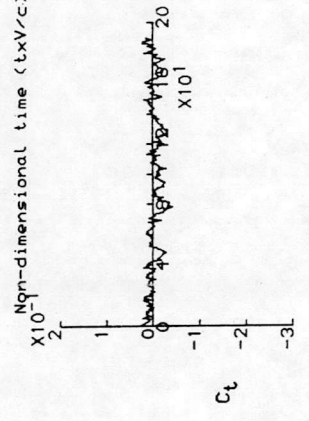
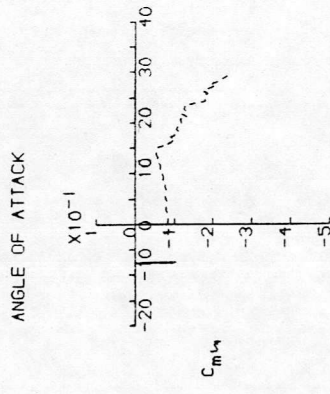
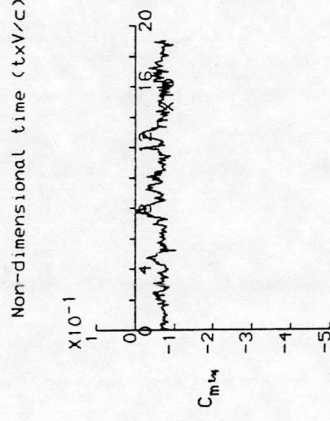
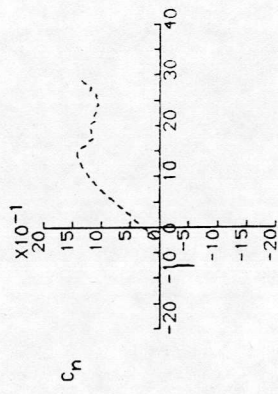
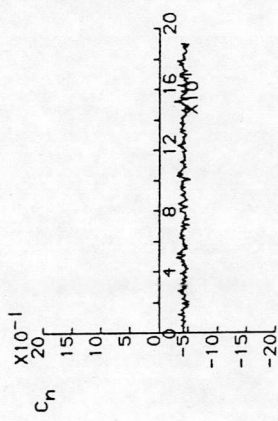
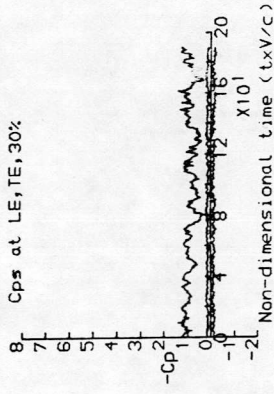
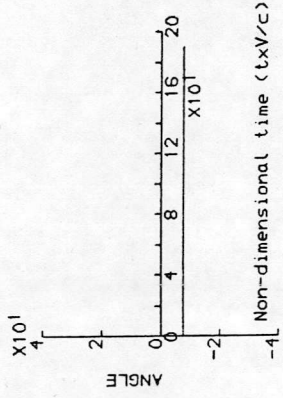
RUN REFERENCE NUMBER: 38551
 REYNOLDS NUMBER = 1463759.
 DYNAMIC PRESSURE = 998.92 Nm⁻²
 NUMBER OF CYCLES = 5
 MOTION TYPE: RAMP DOWN
 START ANGLE = 30.00°
 RAMP ARC = -5.000°
 DATE OF TEST: 14/12/88
 MACH NUMBER = 0.117
 AIR TEMPERATURE = 30.2°C
 SAMPLING FREQUENCY = 550.05 Hz.
 REDUCED PITCH RATE = -0.00502
 LINEAR PITCH RATE = -42.90°s⁻¹

AVERAGED DATA OF 5 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

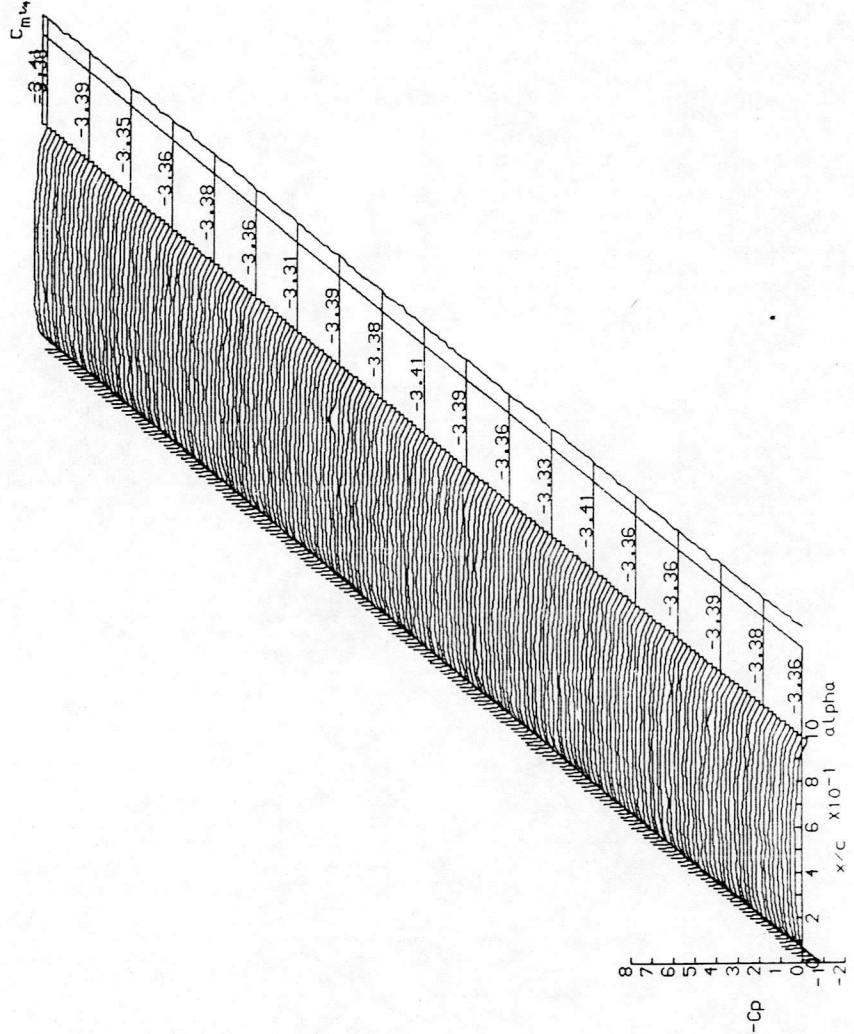
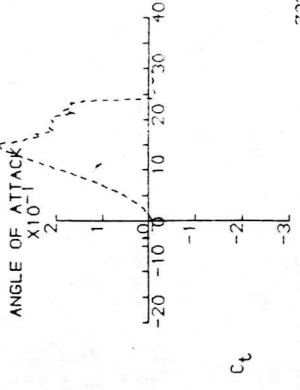
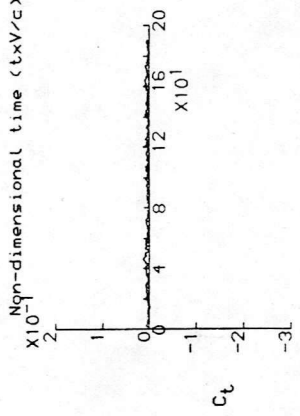
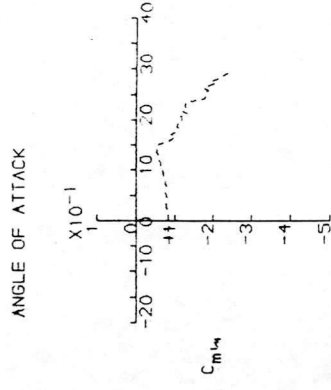
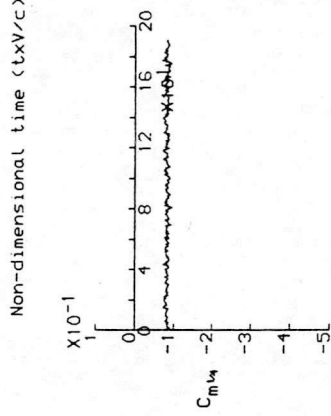
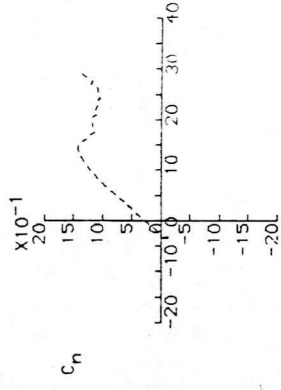
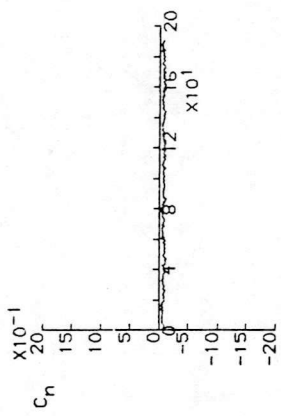
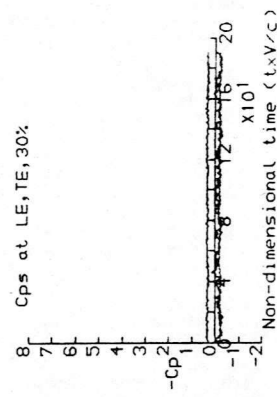
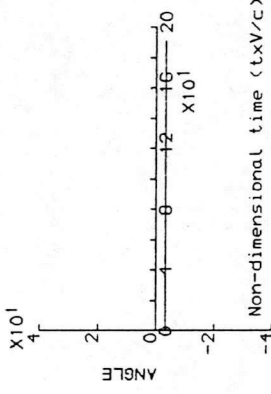
RUN REFERENCE NUMBER: 47221
 DATE OF TEST: 13/12/88
 REYNOLDS NUMBER = 1490149.
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 AIR TEMPERATURE = 26.6°C
 NUMBER OF CYCLES = 1
 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: UNSTEADY STATIC
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

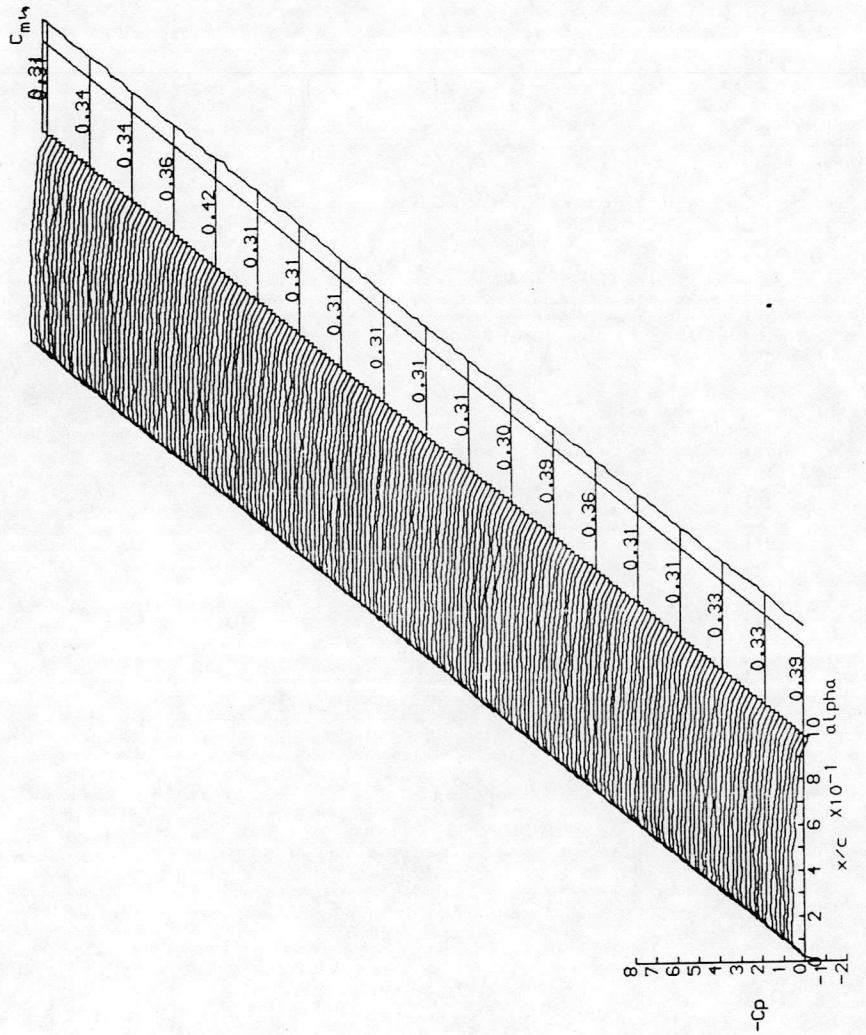
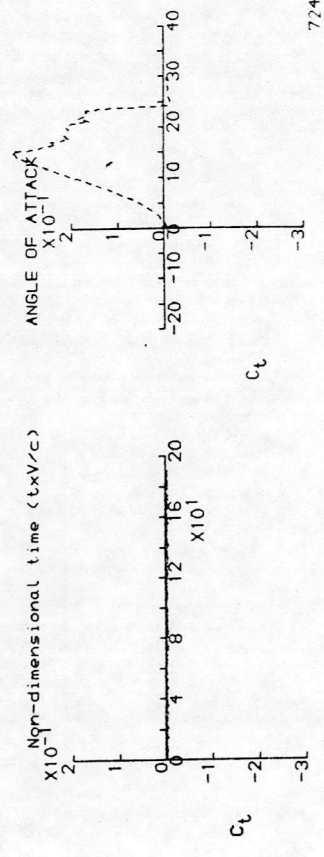
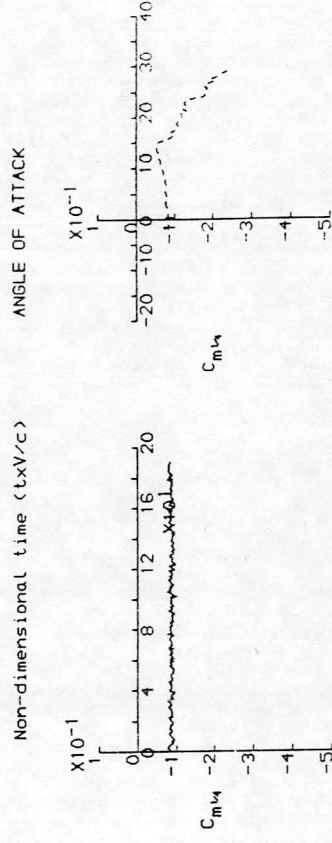
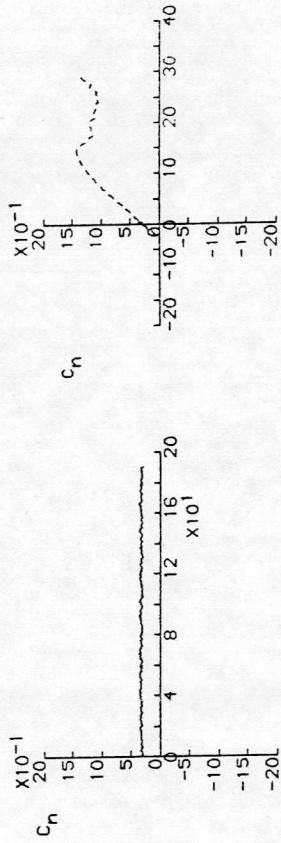
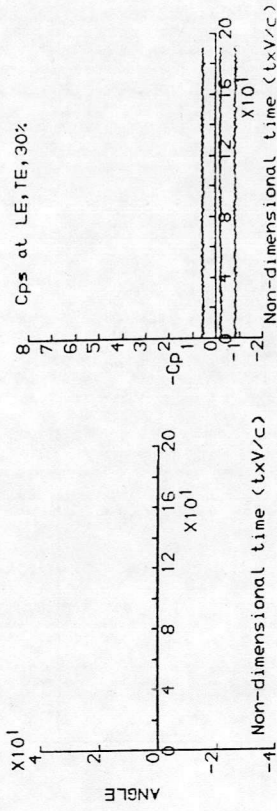
RUN REFERENCE NUMBER: 47231
 REYNOLDS NUMBER = 1485072.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.4°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



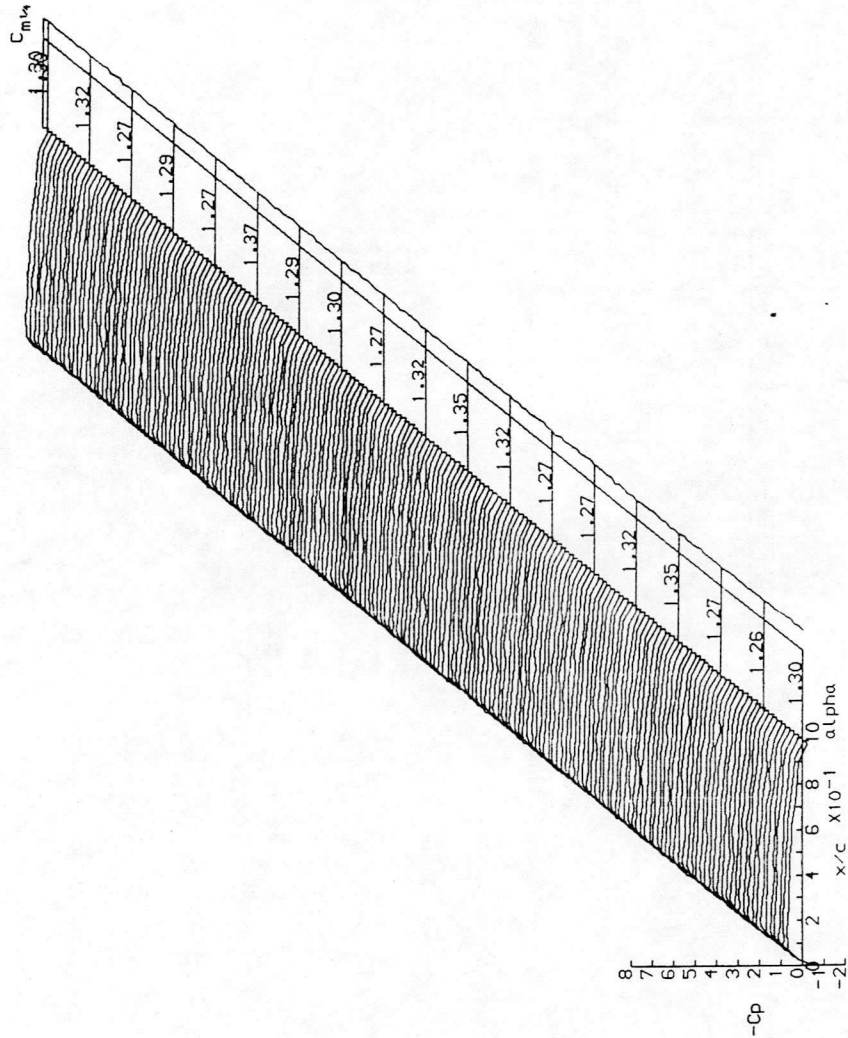
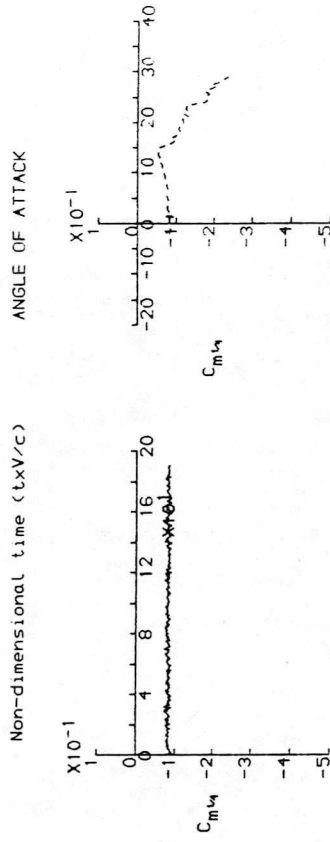
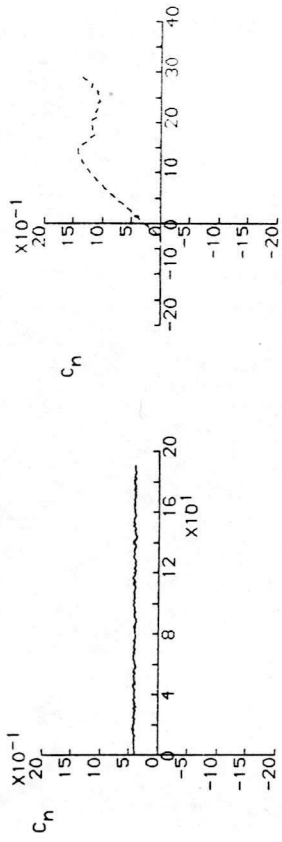
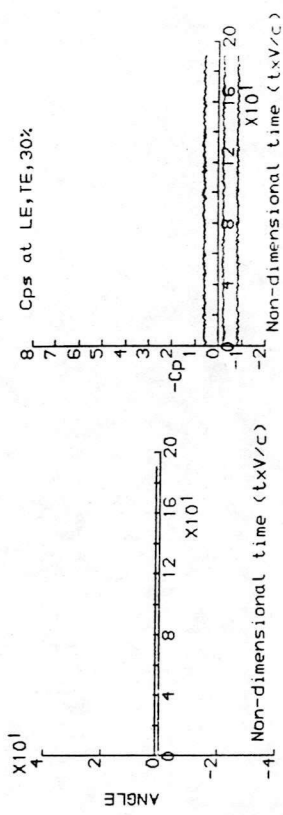
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47241
 DATE OF TEST: 13/12/88
 REYNOLDS NUMBER = 1483177
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 AIR TEMPERATURE = 27.7°C
 NUMBER OF CYCLES = 1
 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: UNSTEADY STATIC
 AVERAGED DATA OF 1 CYCLES



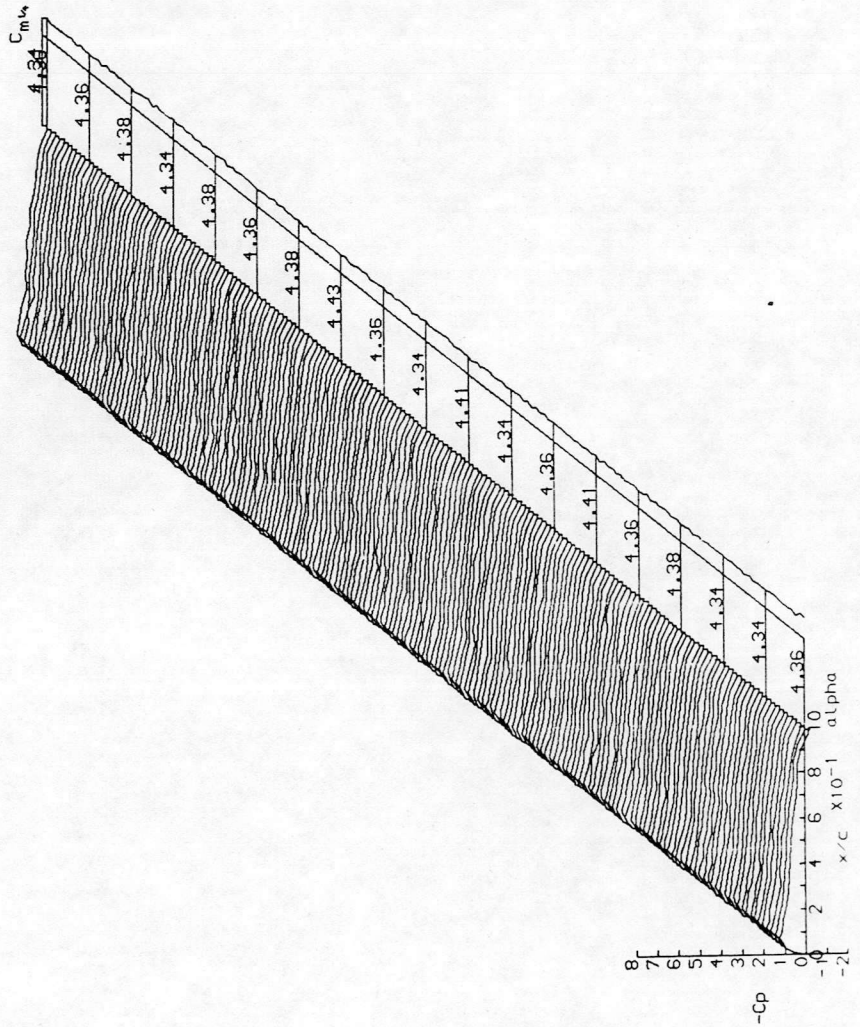
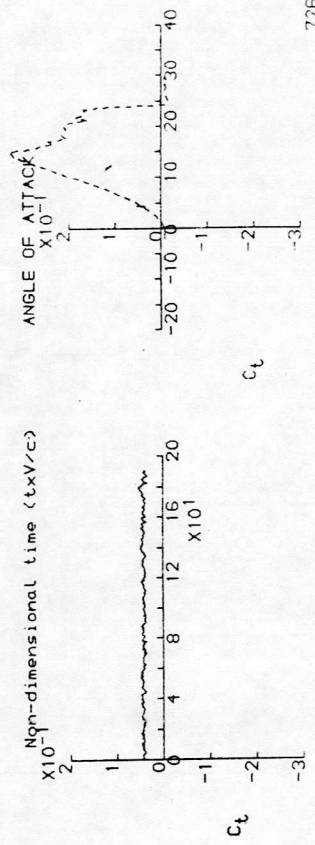
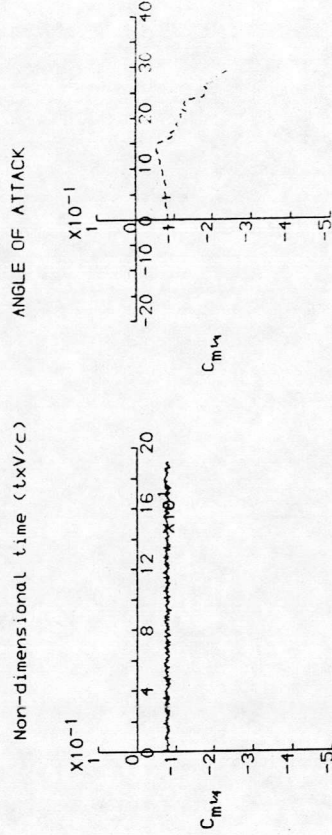
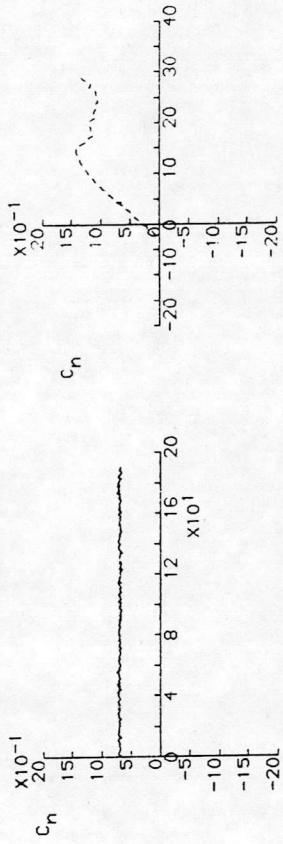
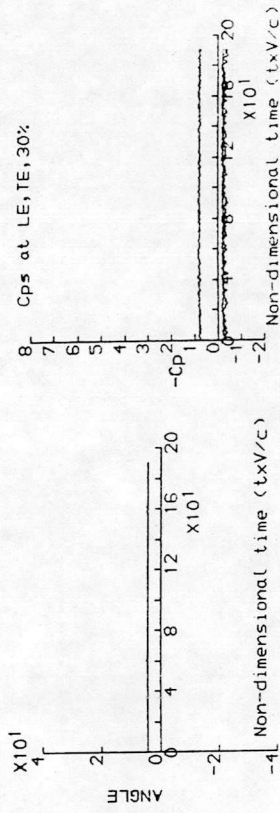
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47251
 REYNOLDS NUMBER = 1482546.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.8°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



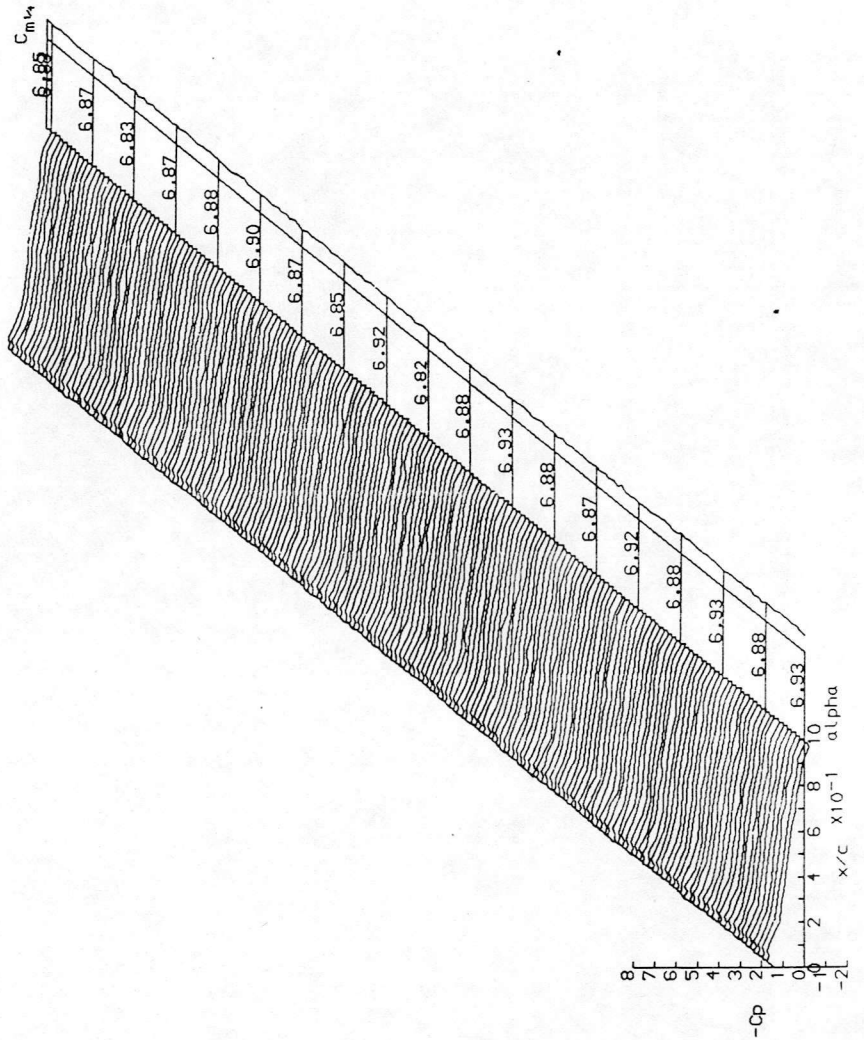
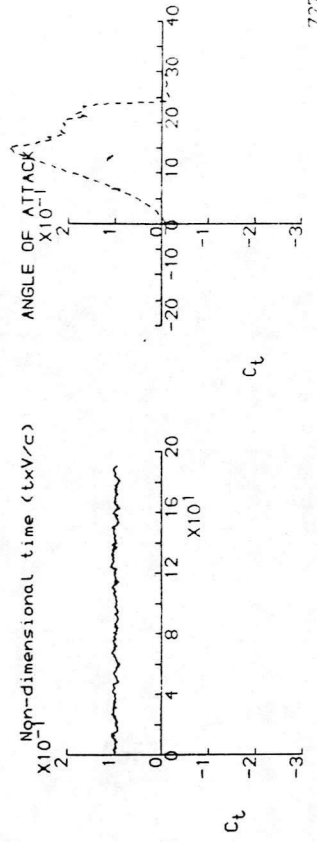
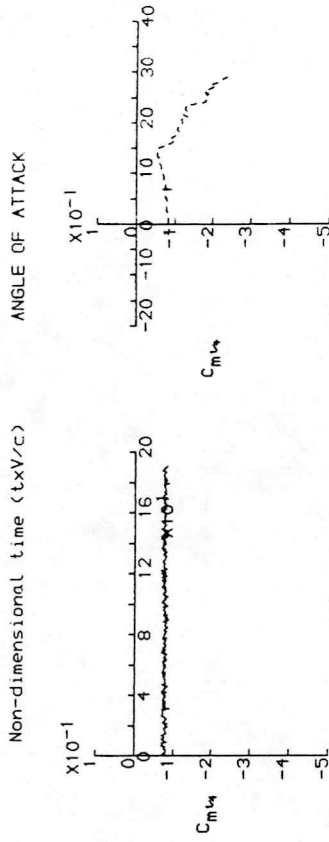
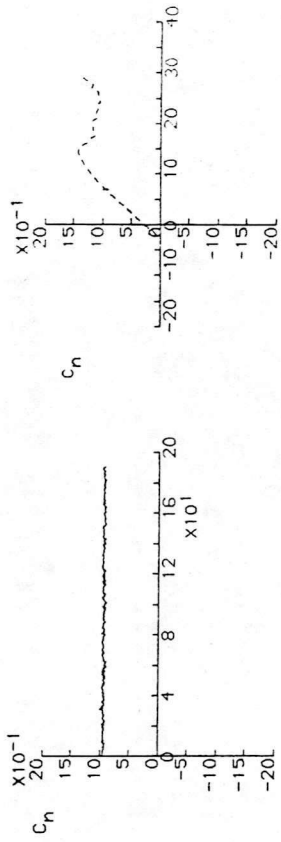
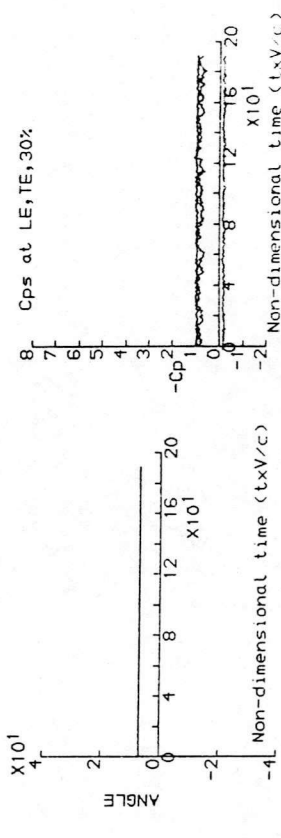
DYNAMIC CHARACTERISTICS FOR THE NACA23012C_MODEL04

RUN REFERENCE NUMBER: 47261
 REYNOLDS NUMBER = 1481916.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.9°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

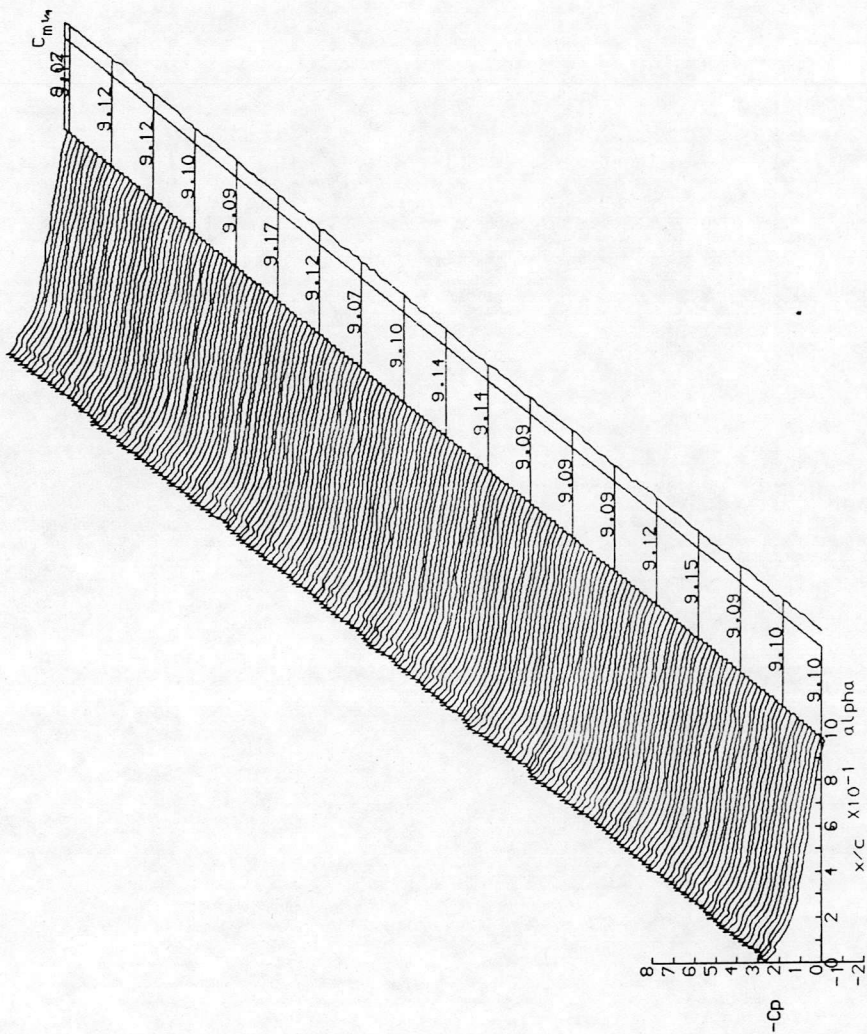
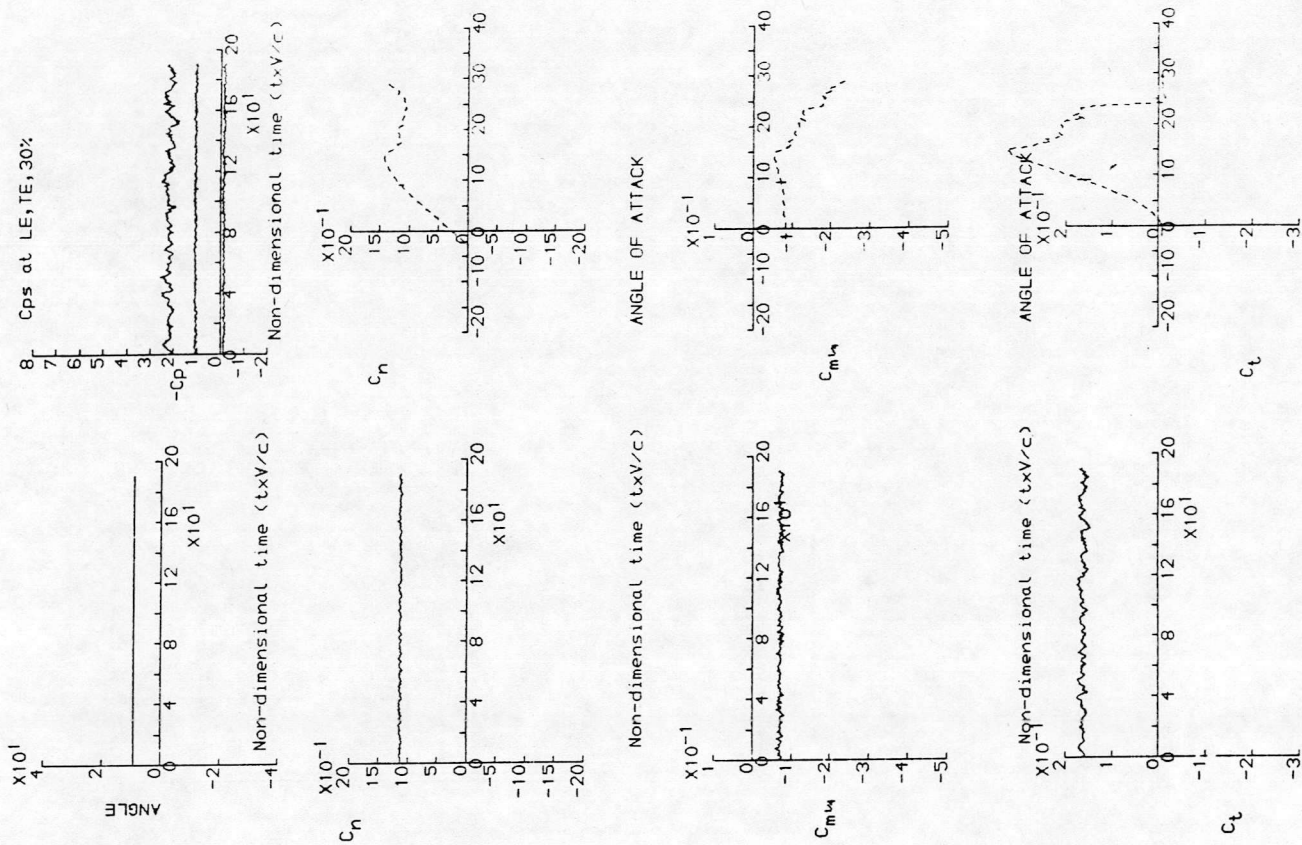
RUN REFERENCE NUMBER: 47271
 REYNOLDS NUMBER = 1481916.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 27.9°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

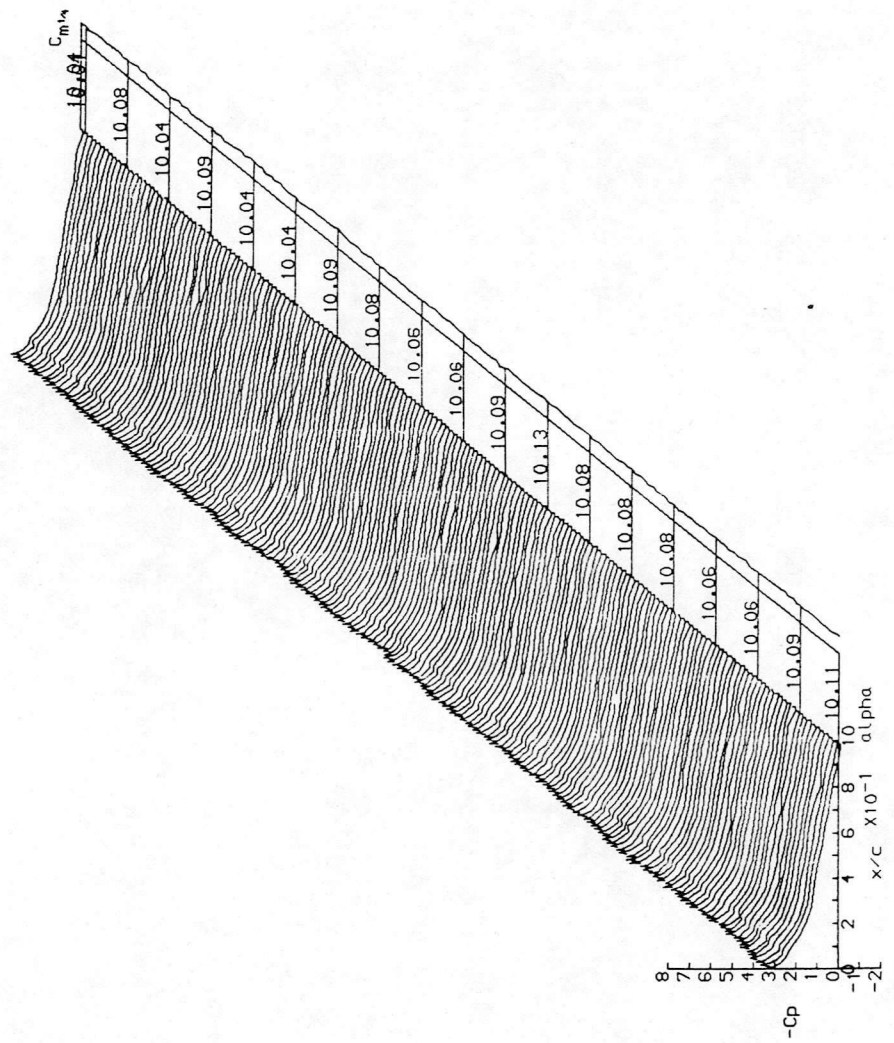
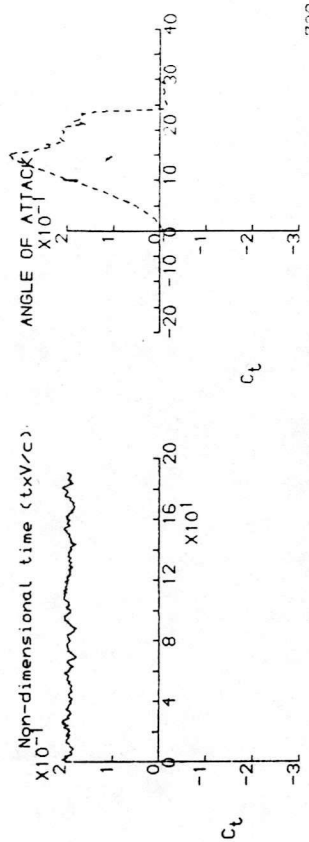
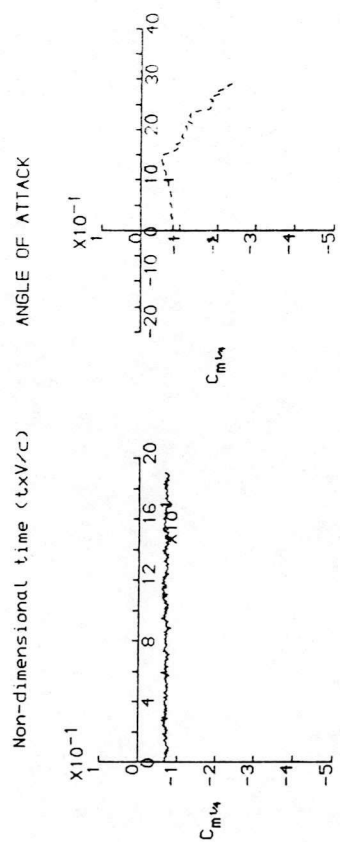
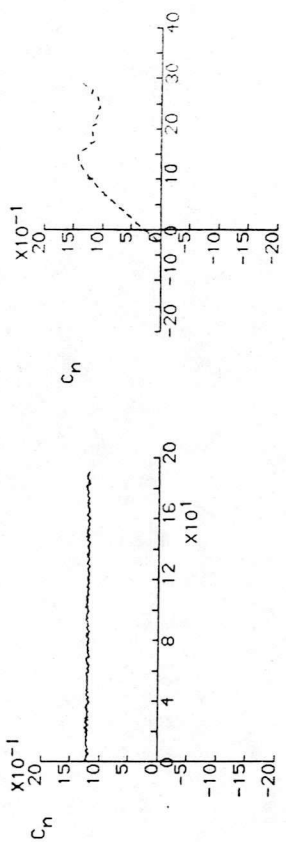
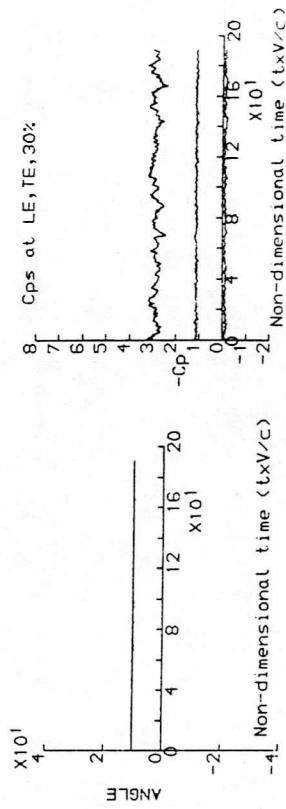
RUN REFERENCE NUMBER: 47281
 REYNOLDS NUMBER = 1481286.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.0°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

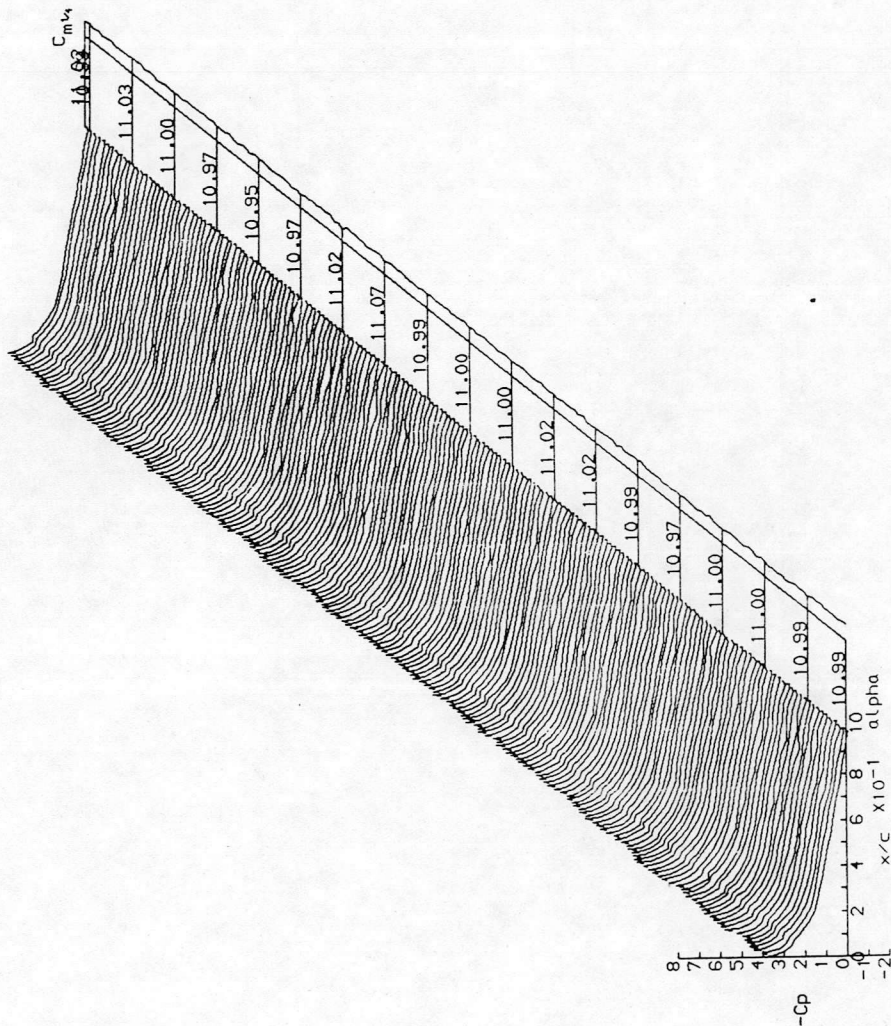
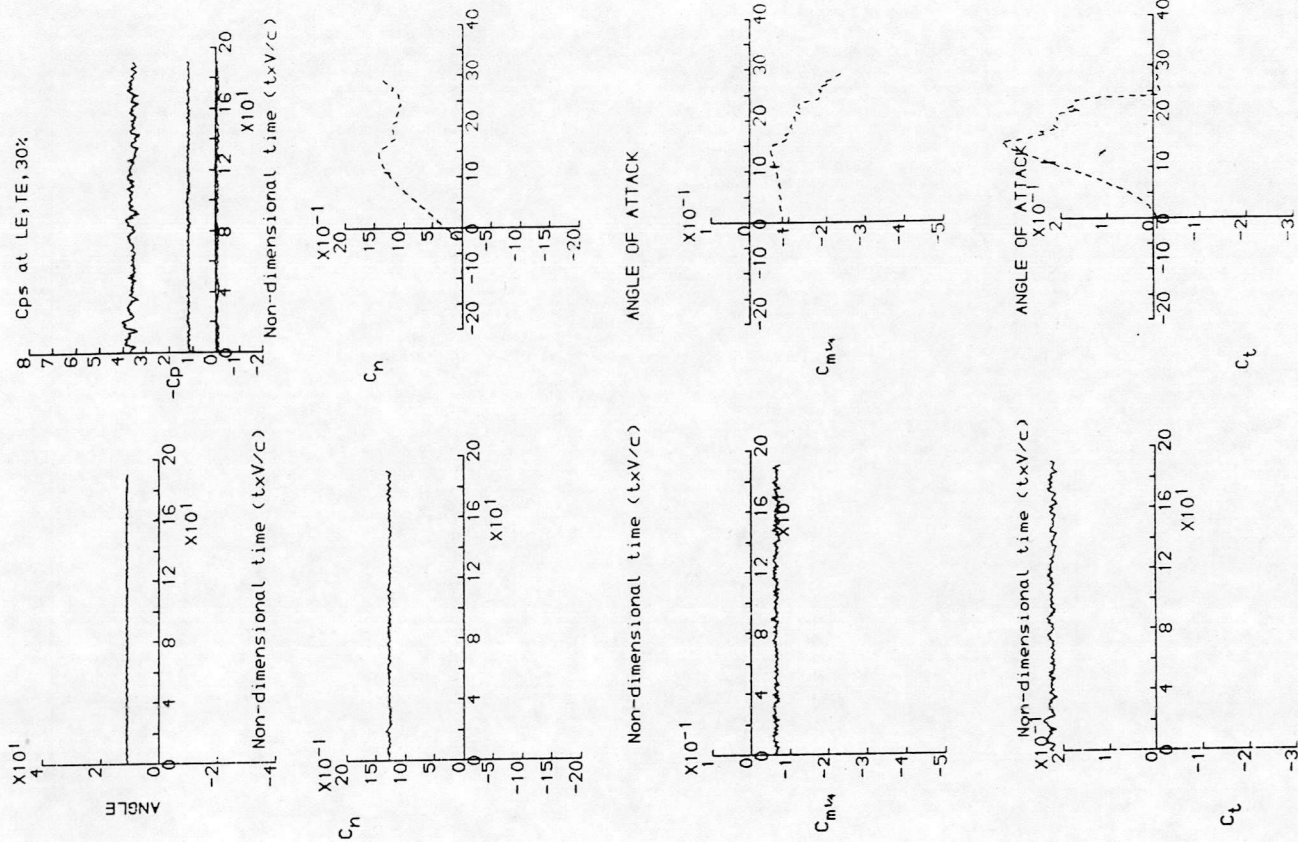
RUN REFERENCE NUMBER: 47291
 REYNOLDS NUMBER = 1480657.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.1°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

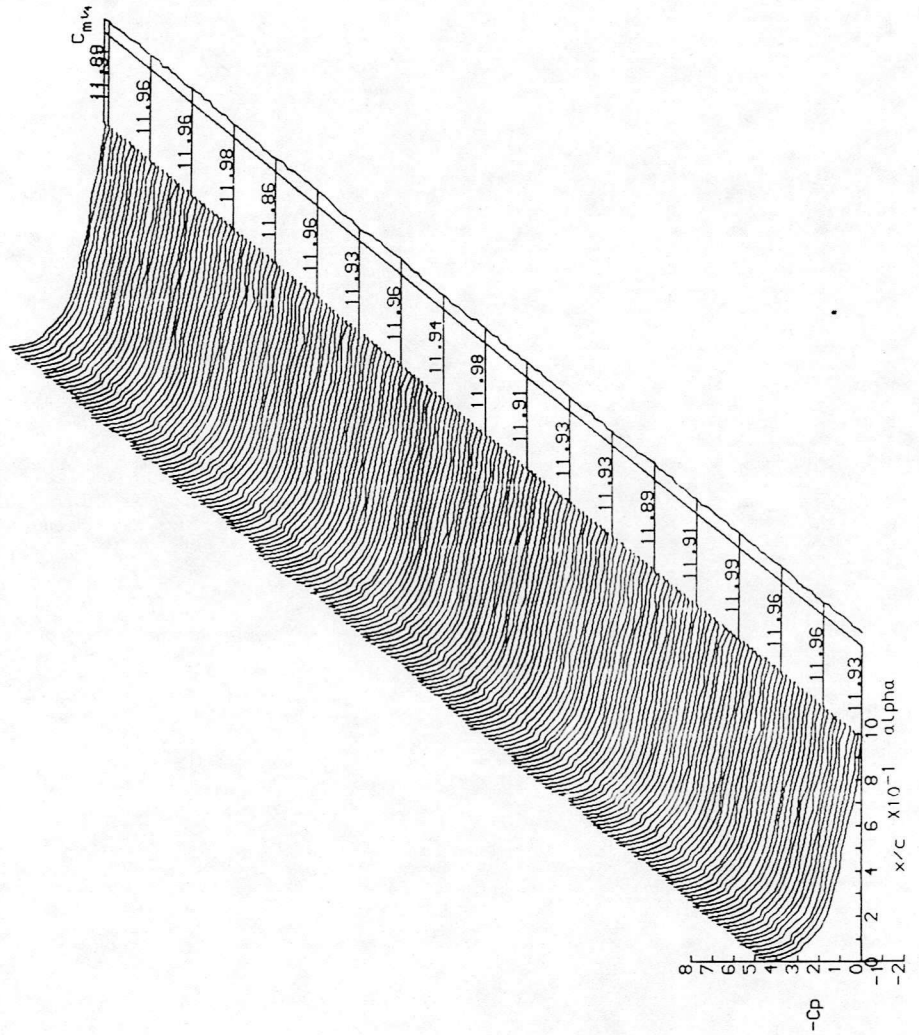
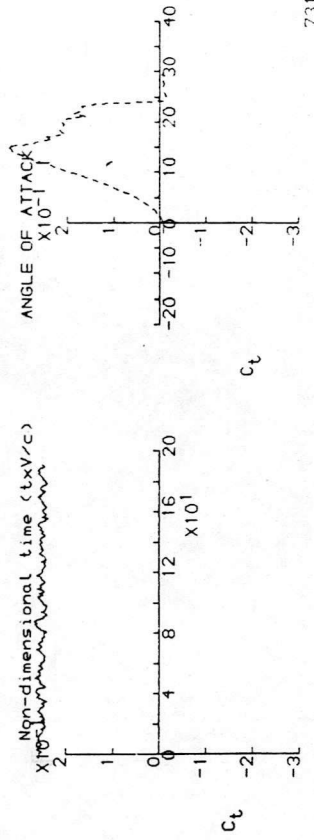
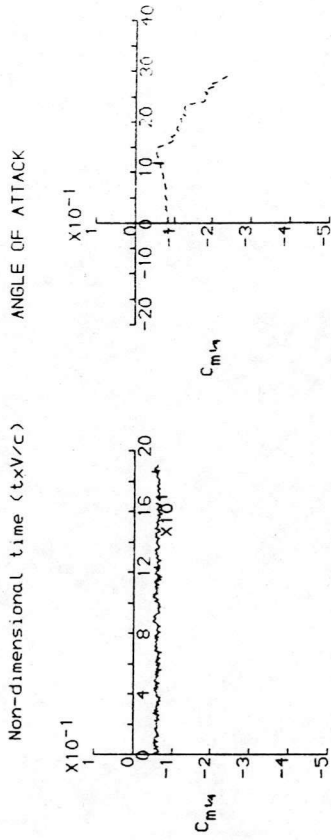
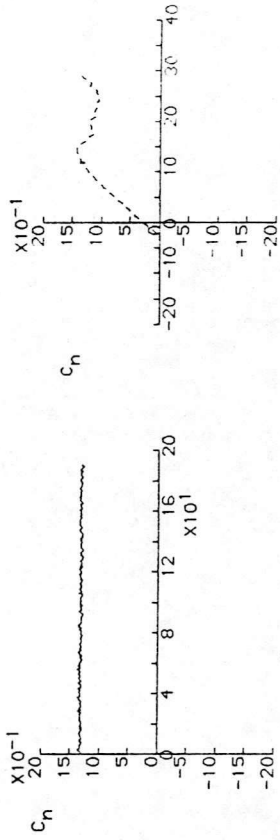
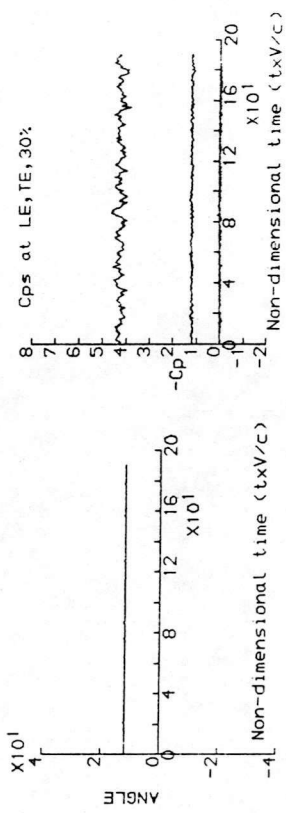
RUN REFERENCE NUMBER: 47301
 REYNOLDS NUMBER = 1480657.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.1°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



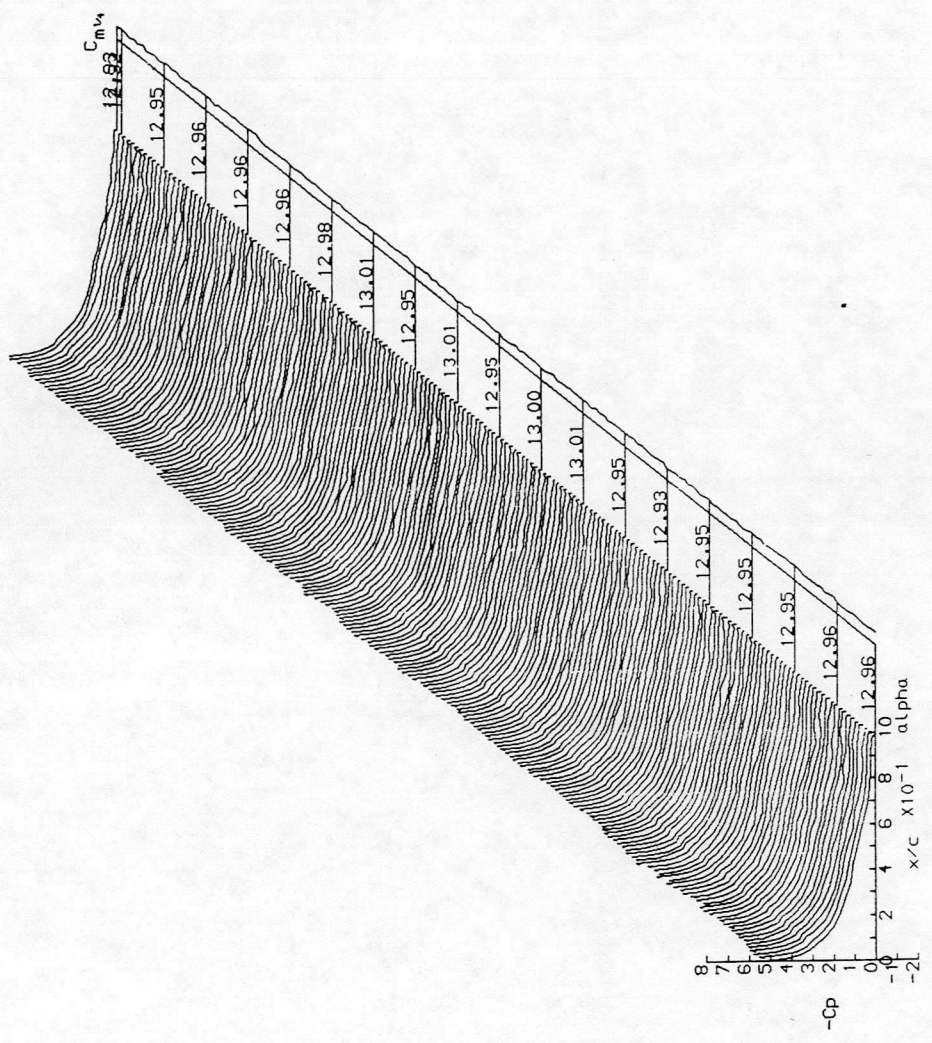
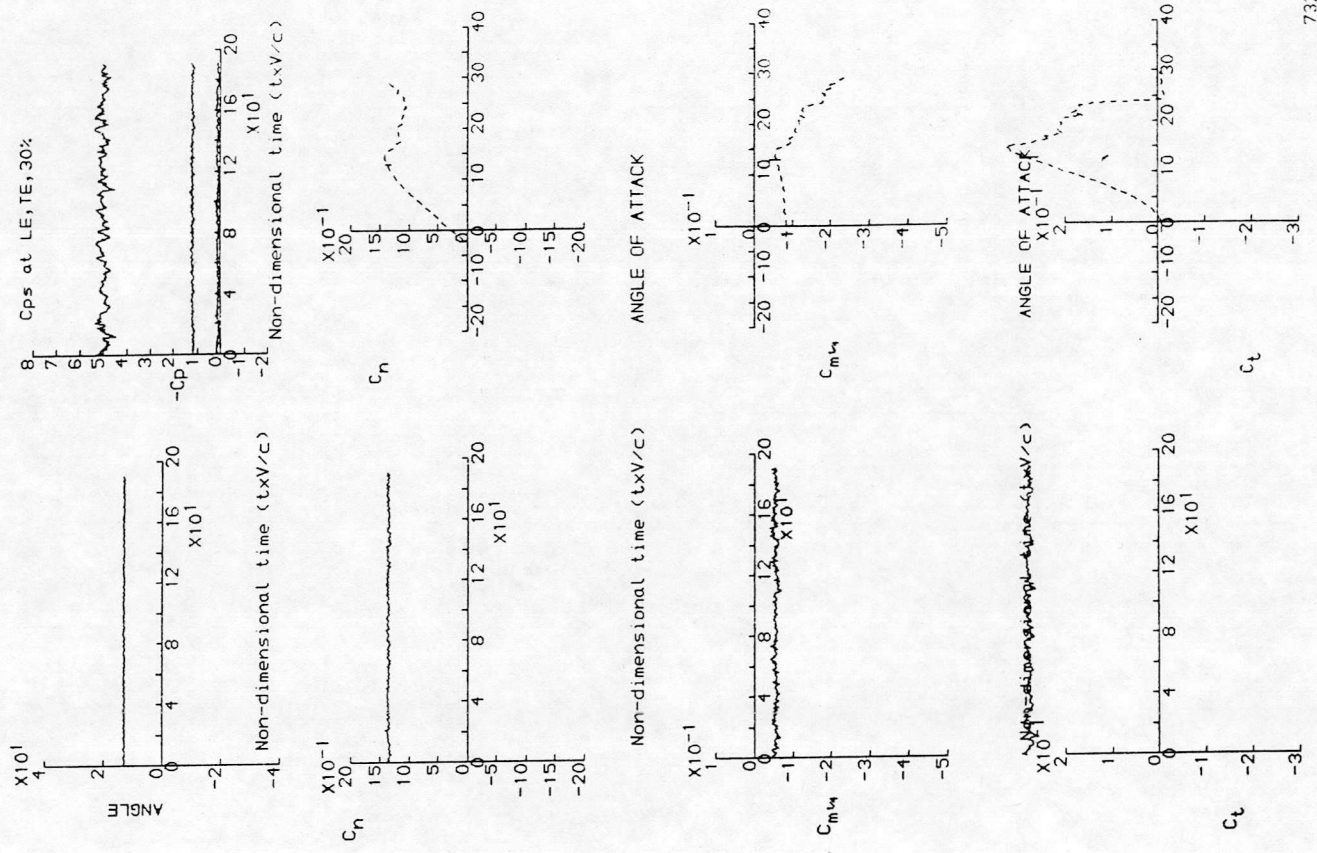
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47311
 RETNOLDS NUMBER = 1480028.
 DYNAMIC PRESSURE = 1007.36 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.2°C
 SAMPLING FREQUENCY = 100.00 HZ.
 AVERAGED DATA OF 1 CYCLES



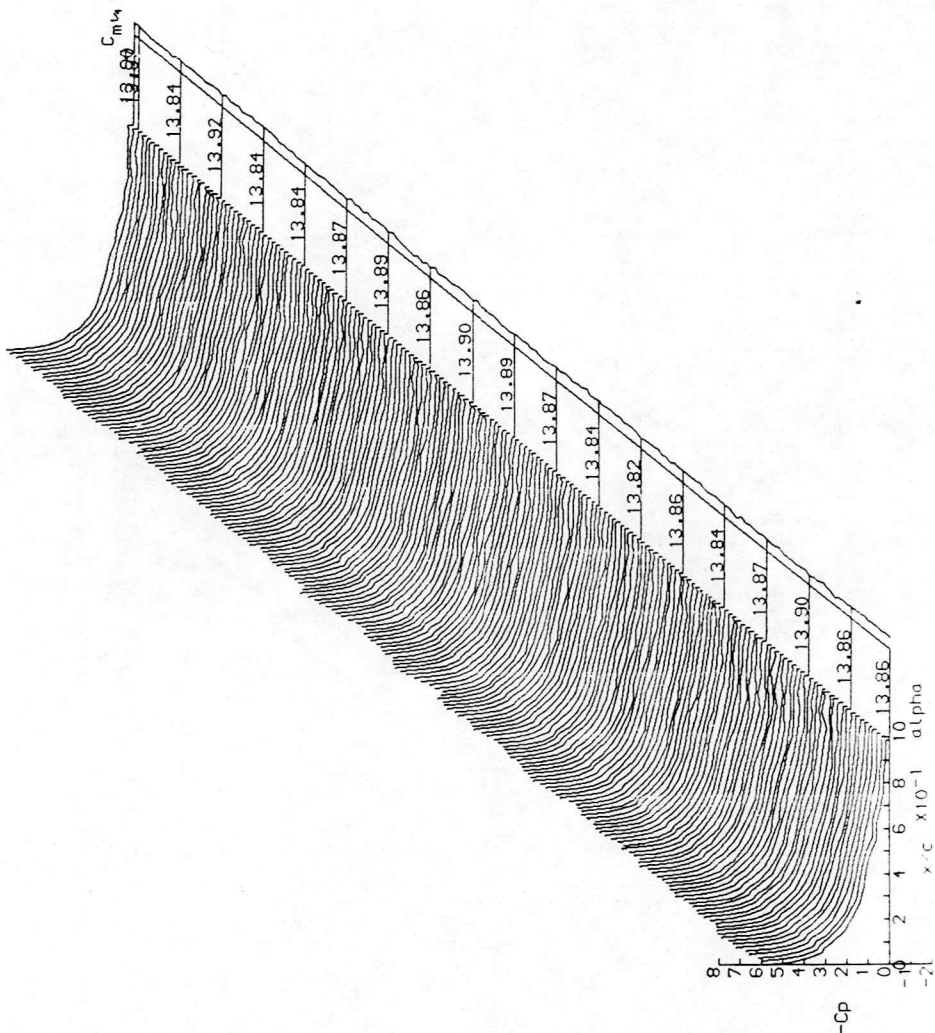
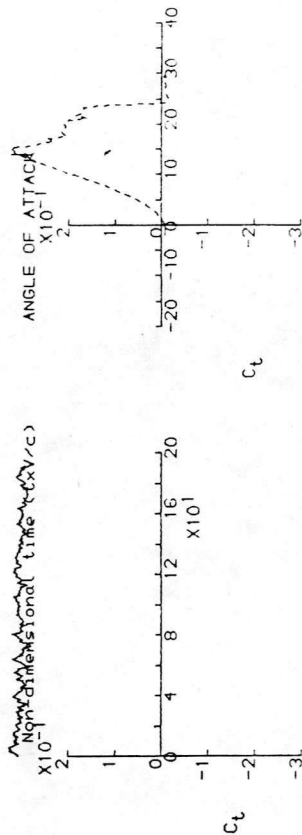
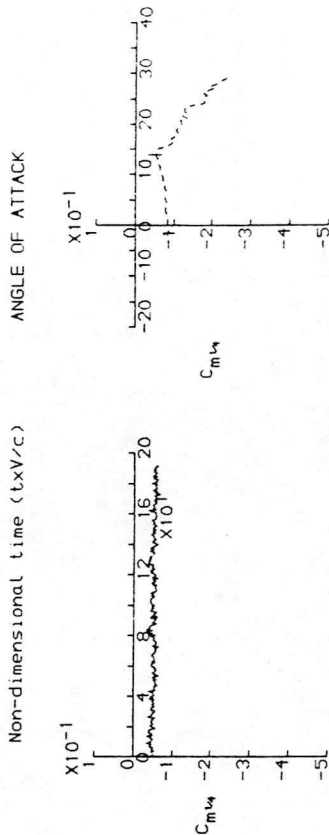
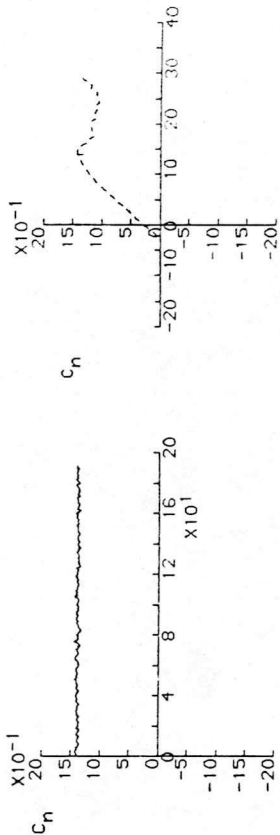
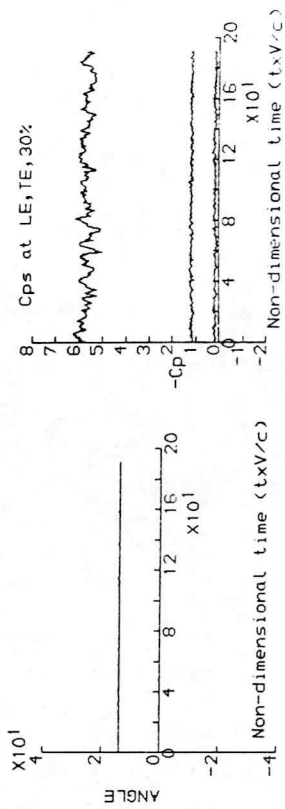
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47321 DATE OF TEST: 13/12/88
 REYNOLDS NUMBER = 1488079 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1012.30 Nm⁻² AIR TEMPERATURE = 27.5°C
 NUMBER OF CYCLES = 1 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: UNSTEADY STATIC AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

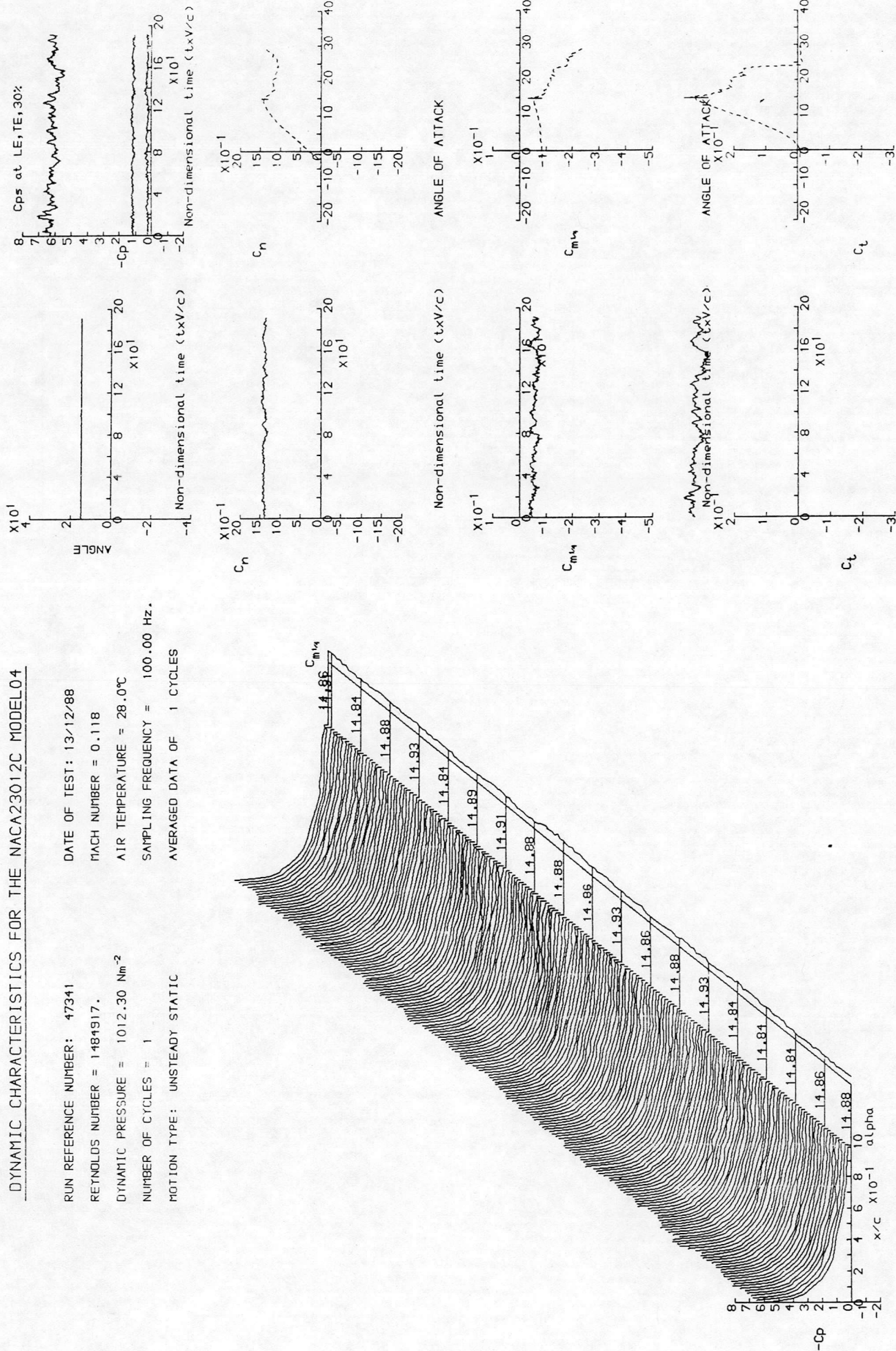
RUN REFERENCE NUMBER: 47331
 REYNOLDS NUMBER = 1485548.
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 AIR TEMPERATURE = 27.9°C
 NUMBER OF CYCLES = 1
 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: UNSTEADY STATIC
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47341
 REYNOLDS NUMBER = 1484917.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

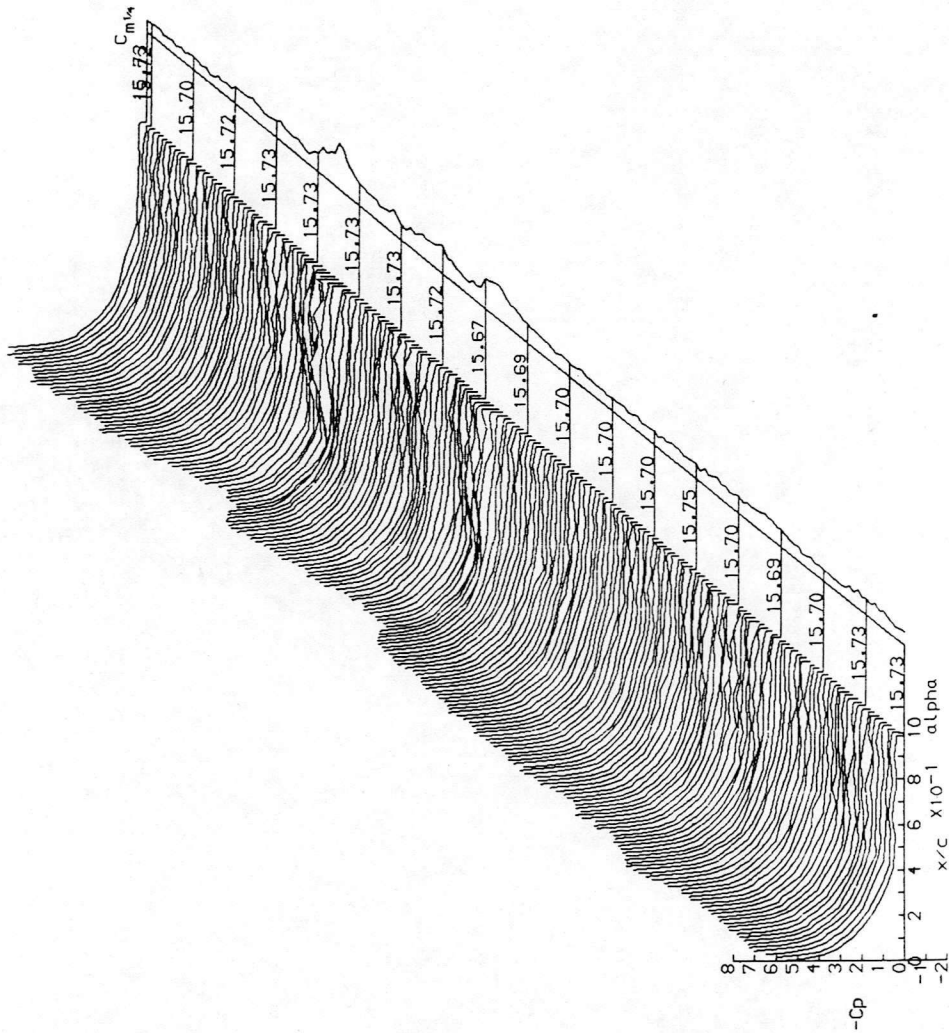
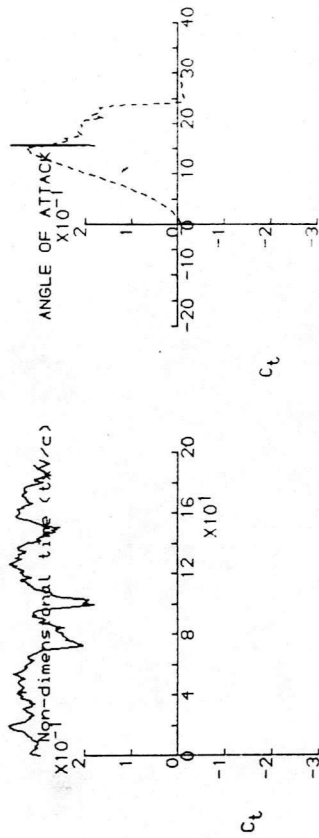
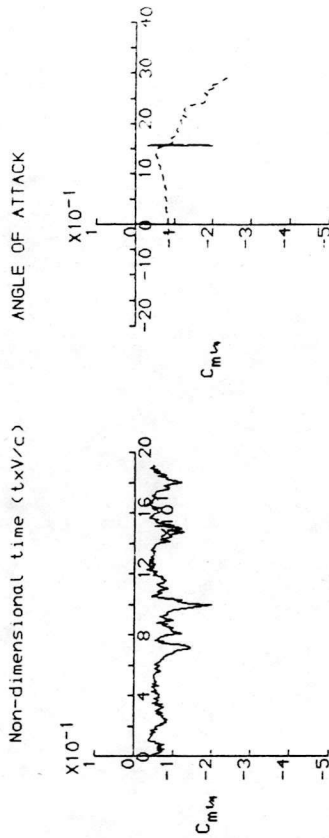
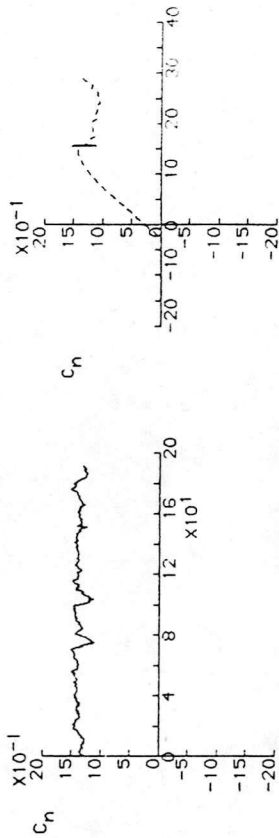
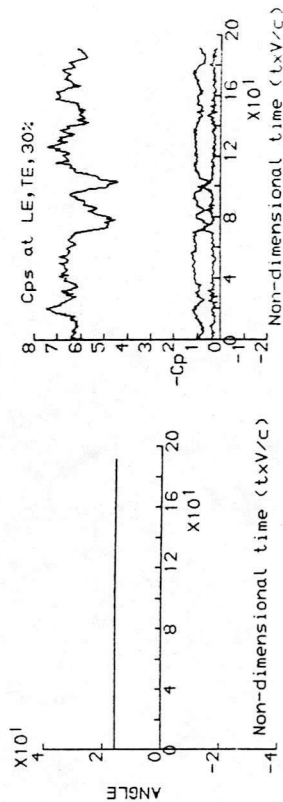
DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.0°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47351
 REYNOLDS NUMBER = 1481286.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

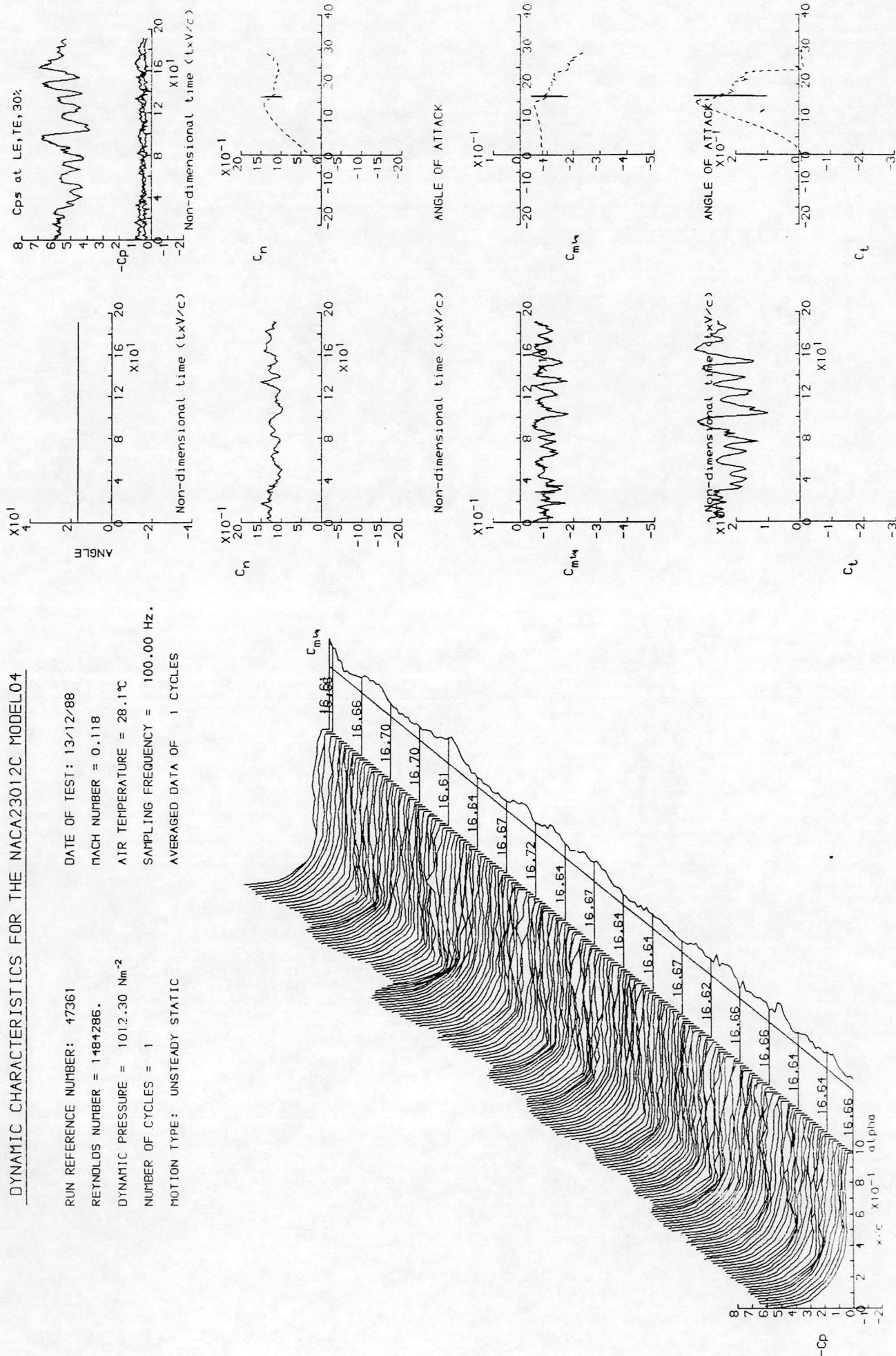
DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.1°C
 SAMPLING FREQUENCY = 100.00 HZ.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47361
 REYNOLDS NUMBER = 1484286.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

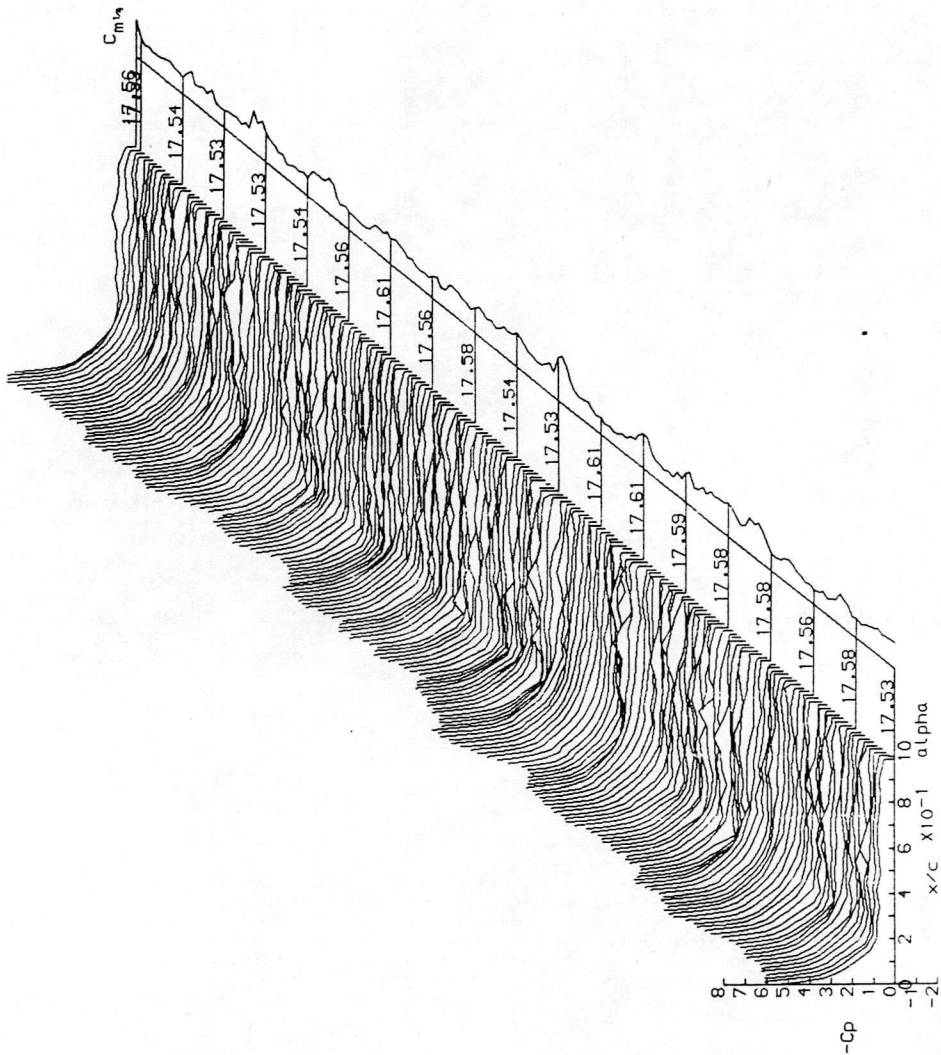
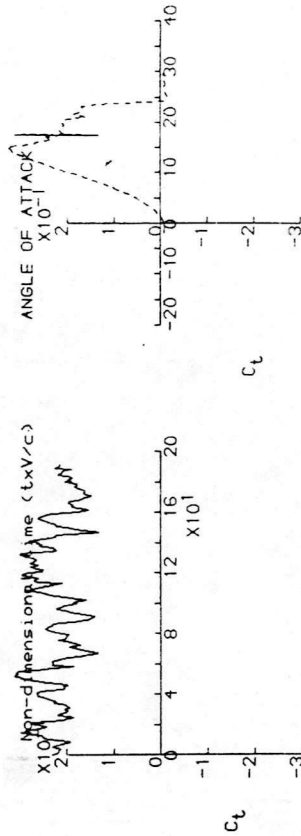
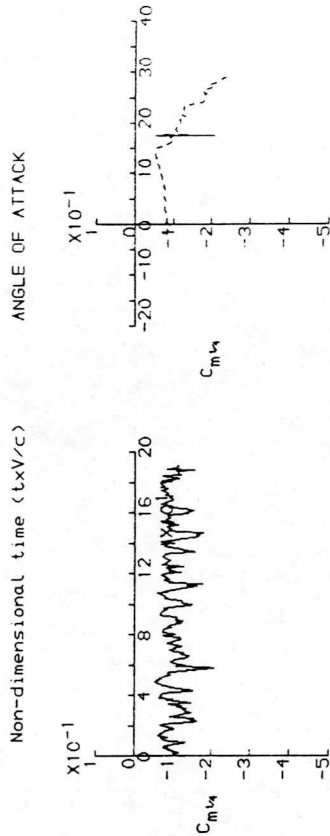
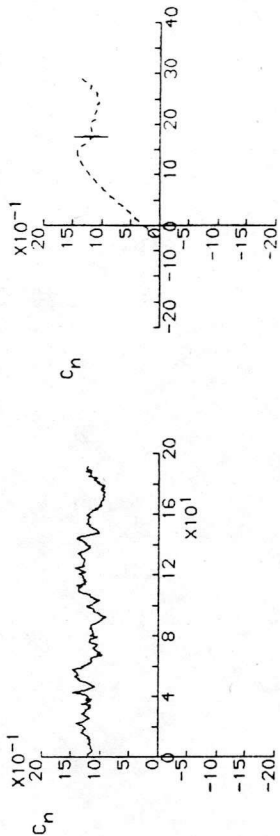
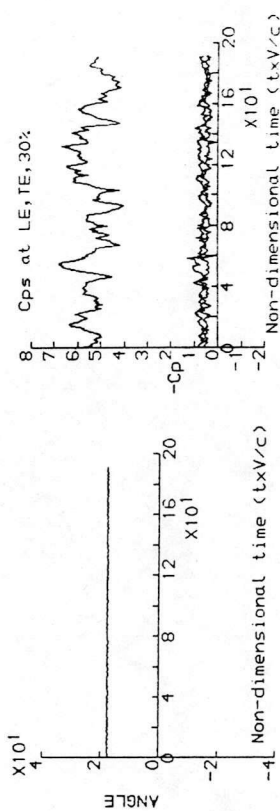
DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.1°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

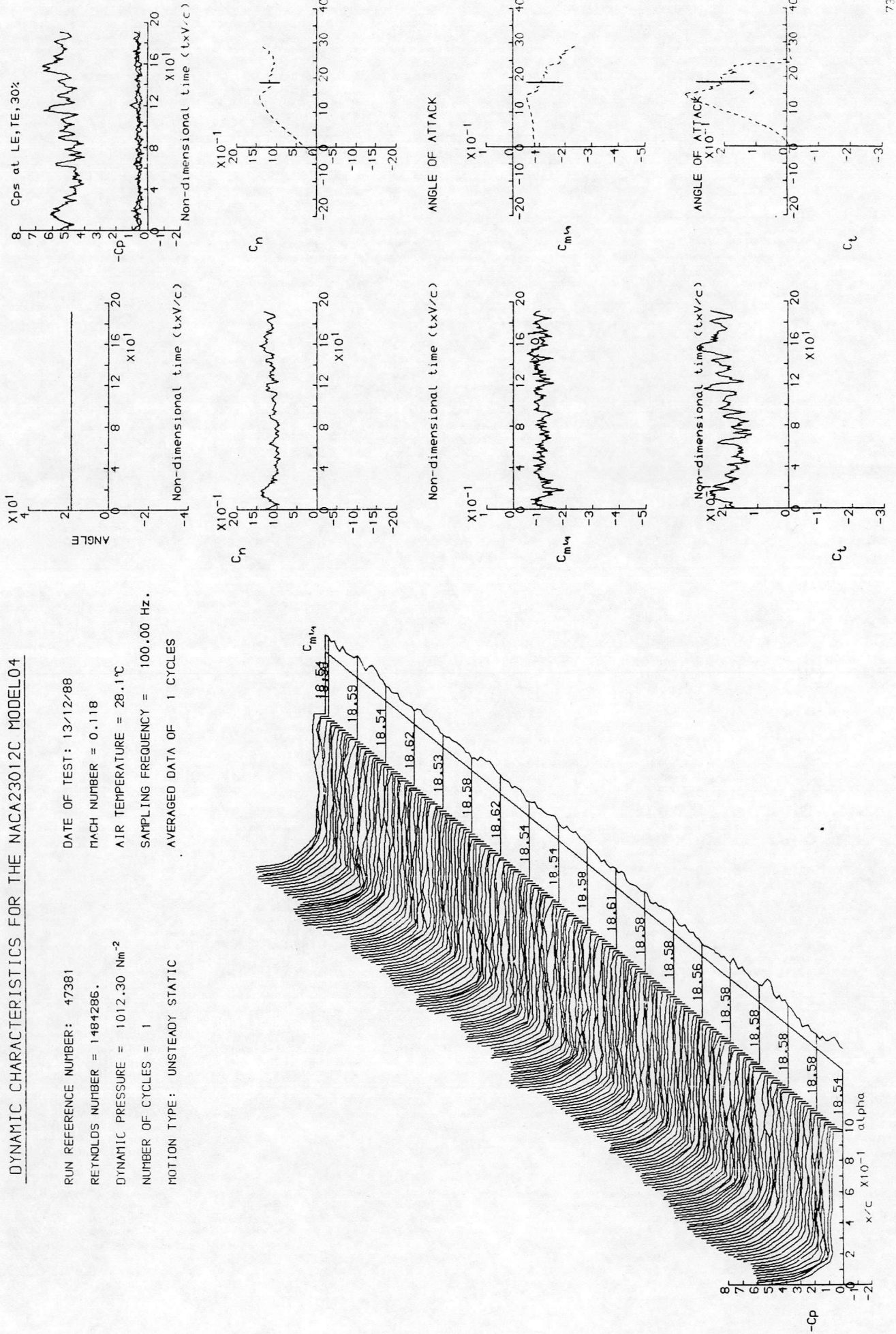
RUN REFERENCE NUMBER: 47371
 RETNOLDS NUMBER = 1484917.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.0°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



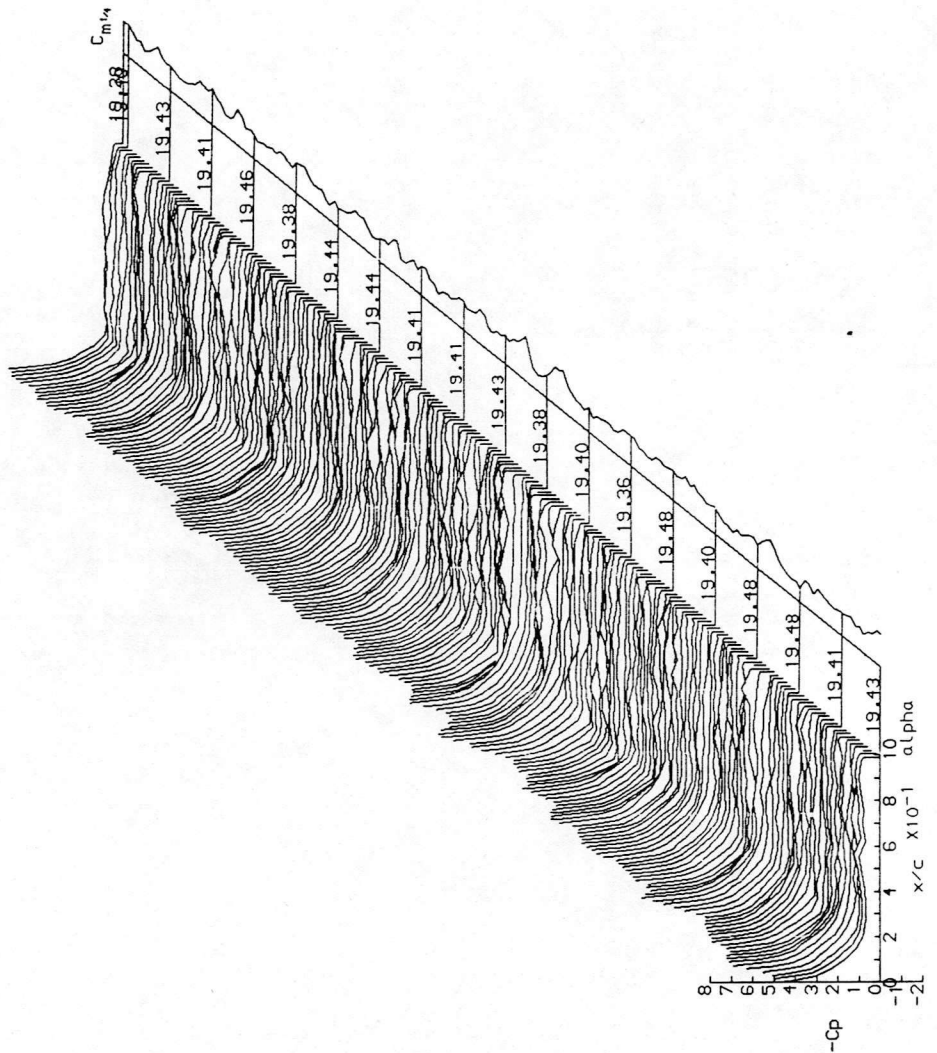
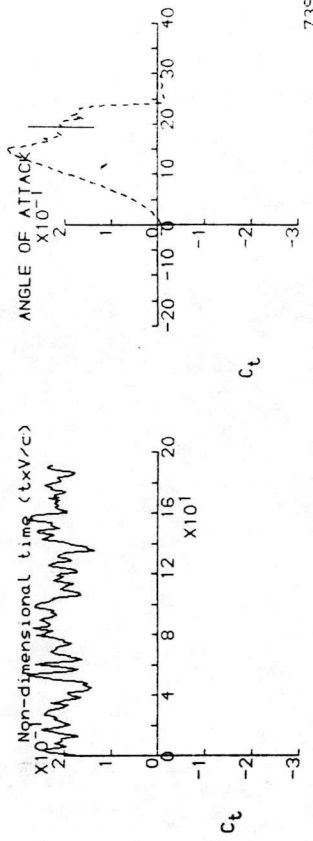
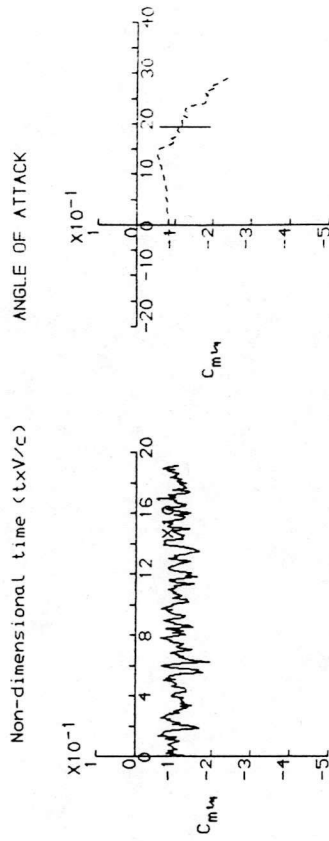
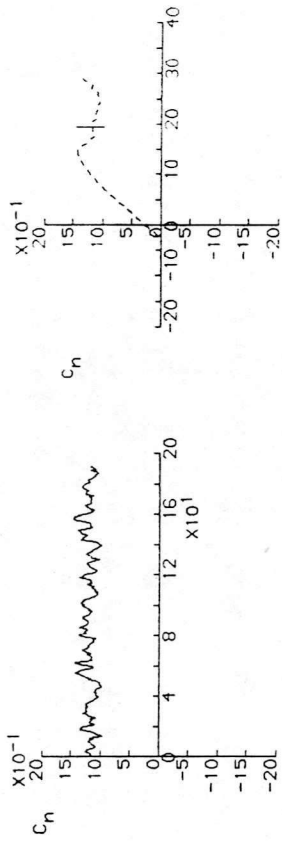
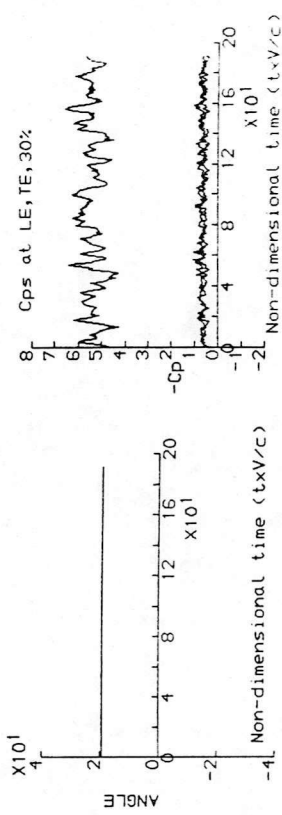
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47381
 REYNOLDS NUMBER = 1484286.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.1°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

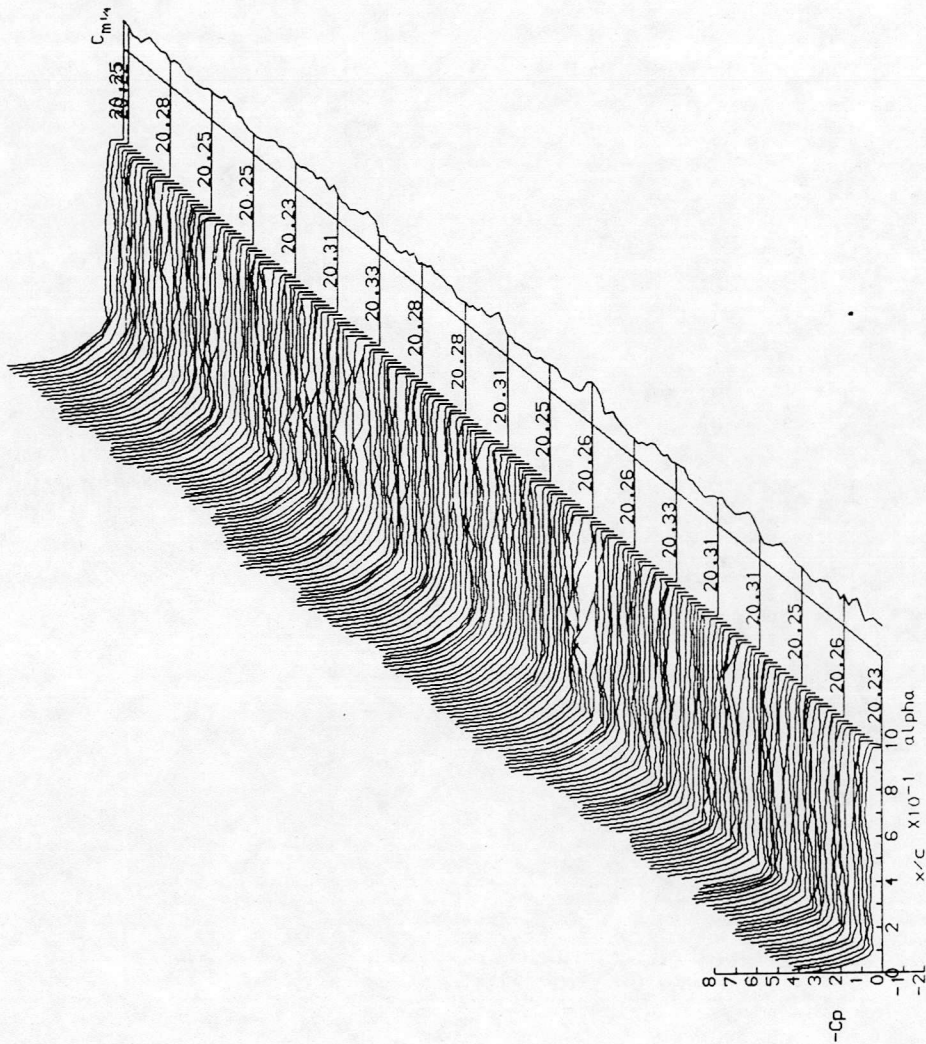
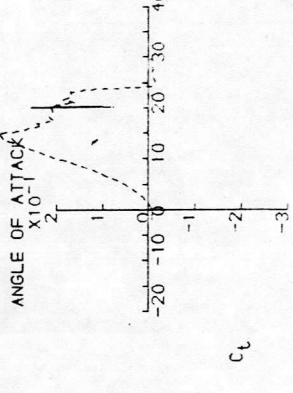
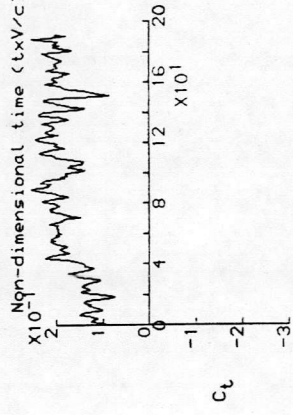
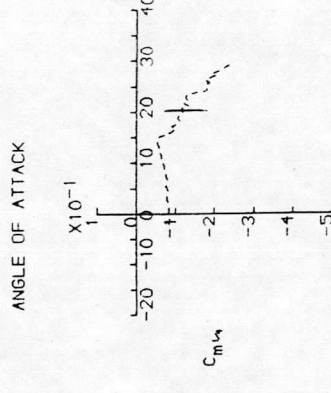
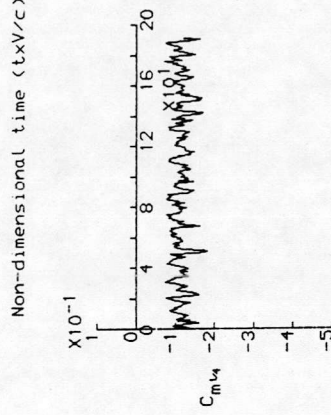
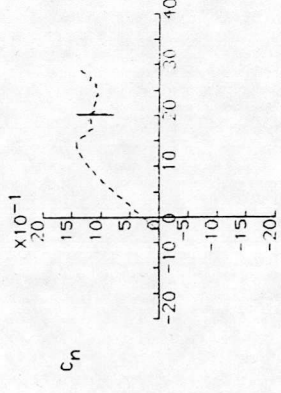
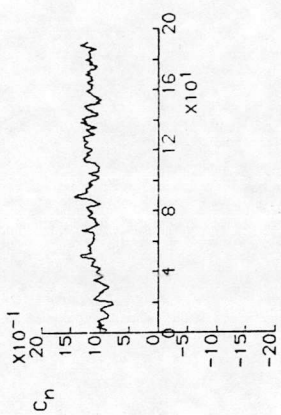
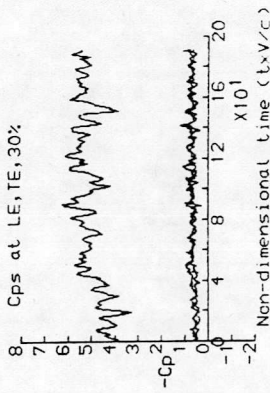
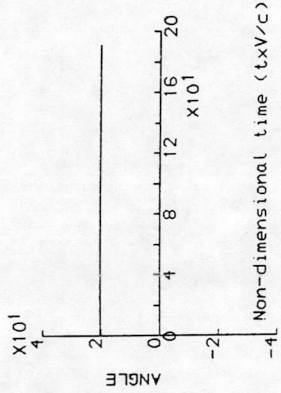
RUN REFERENCE NUMBER: 47391
 REYNOLDS NUMBER = 1484286.
 MACH NUMBER = 0.118
 DATE OF TEST: 13/12/88
 AIR TEMPERATURE = 28.1°C
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 SAMPLING FREQUENCY = 100.00 Hz.
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

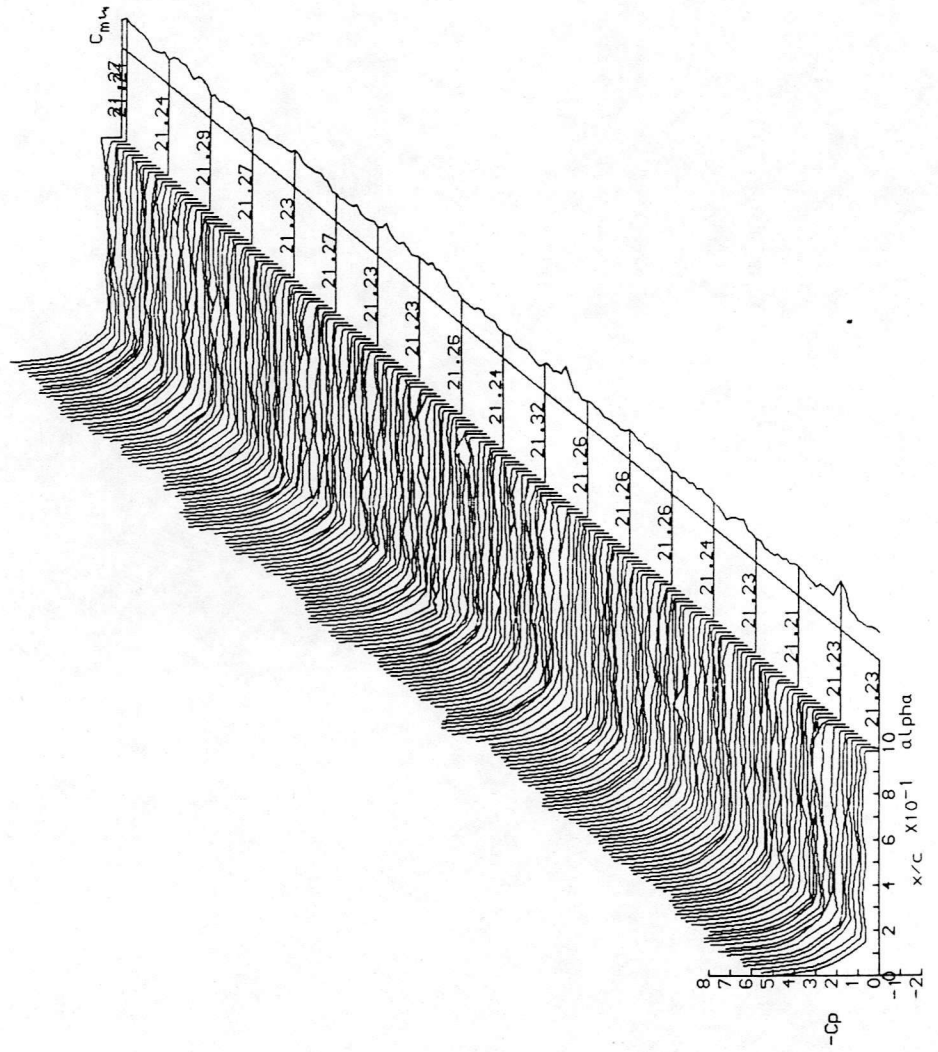
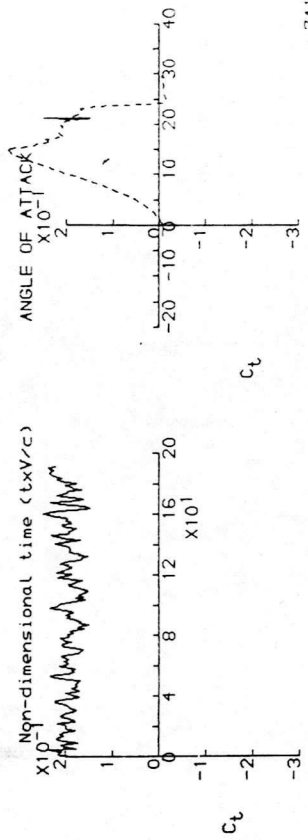
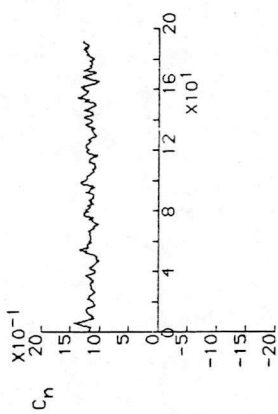
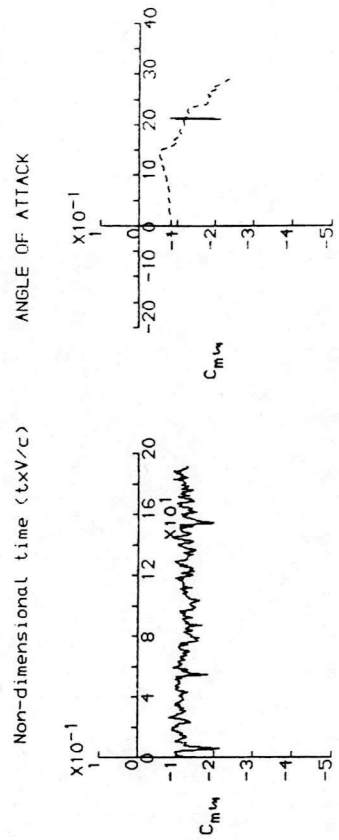
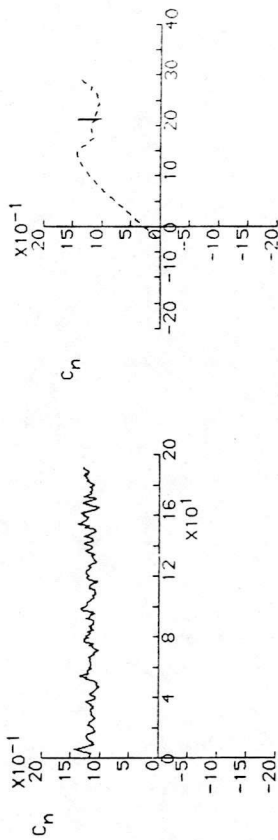
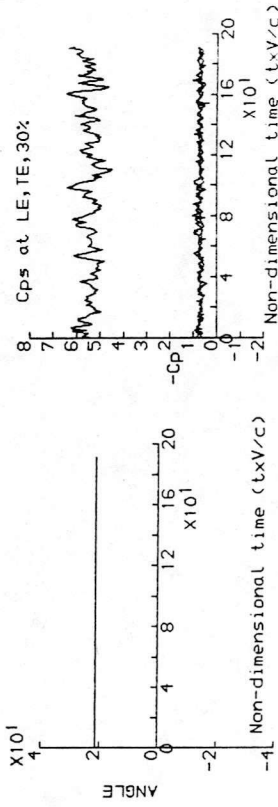
RUN REFERENCE NUMBER: 47401
 REYNOLDS NUMBER = 1483656.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.2°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



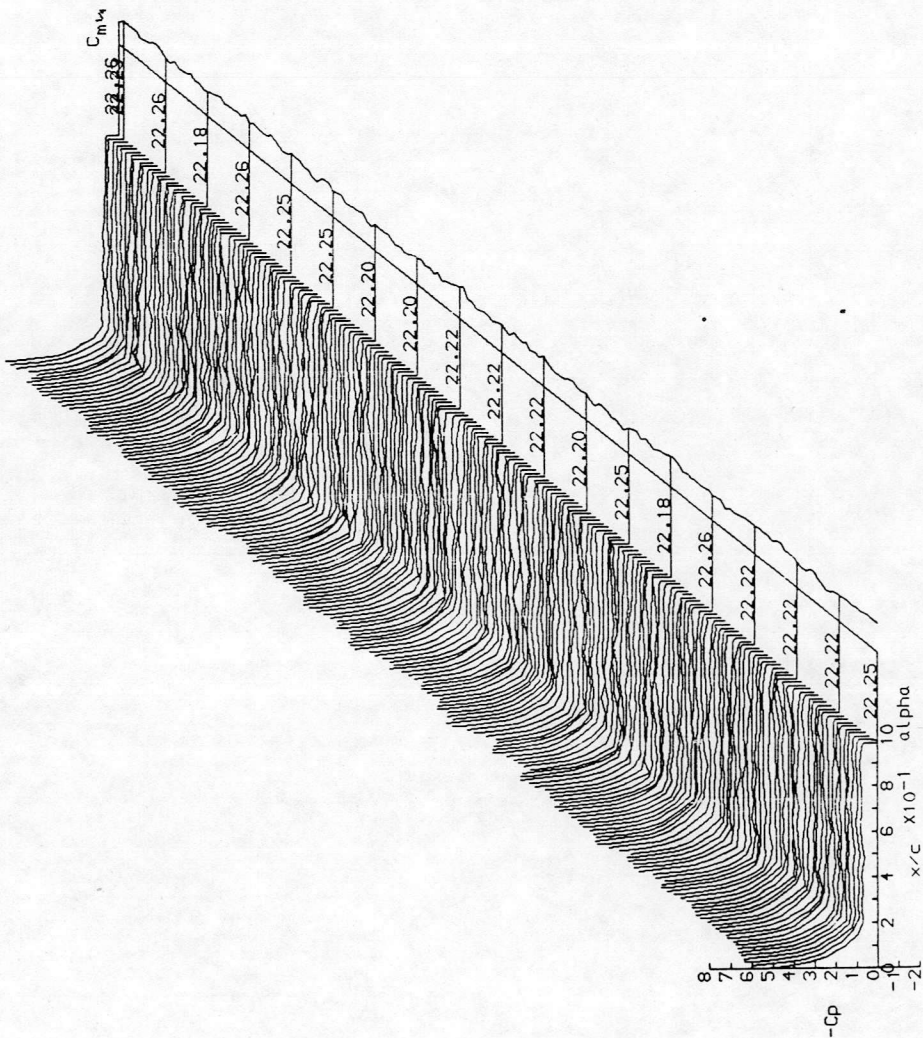
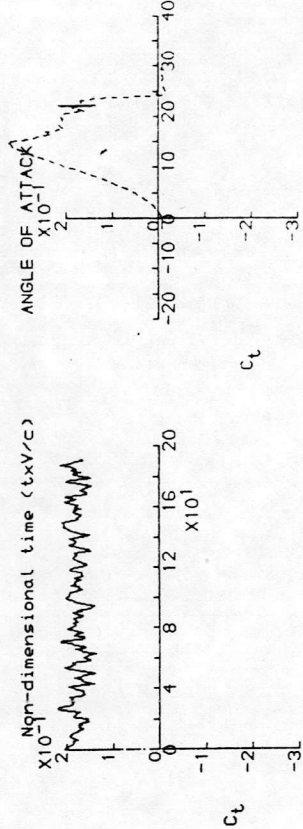
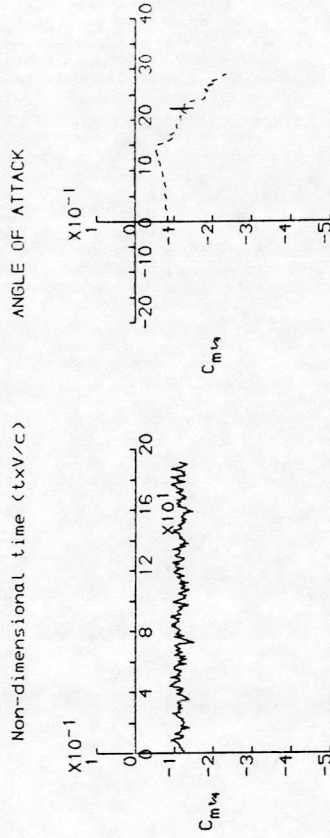
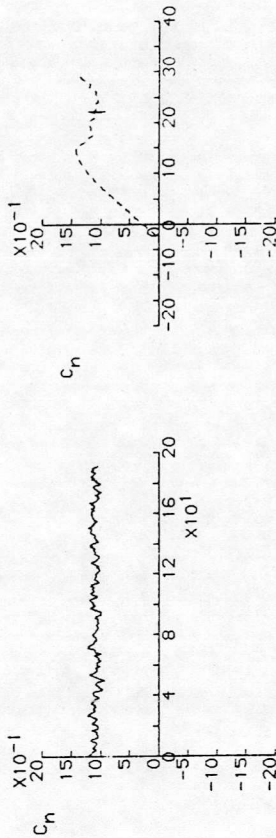
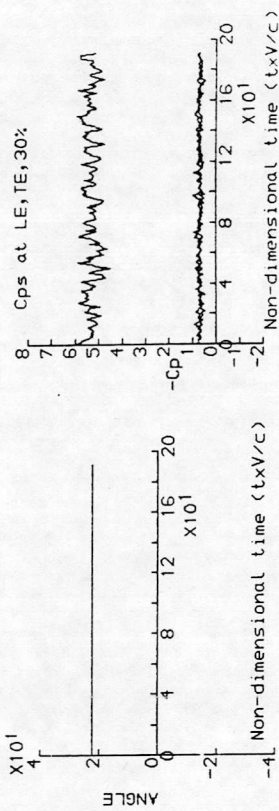
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47411
 REYNOLDS NUMBER = 1483656.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.2°C
 SAMPLING FREQUENCY = 100.00 HZ.
 AVERAGED DATA OF 1 CYCLES



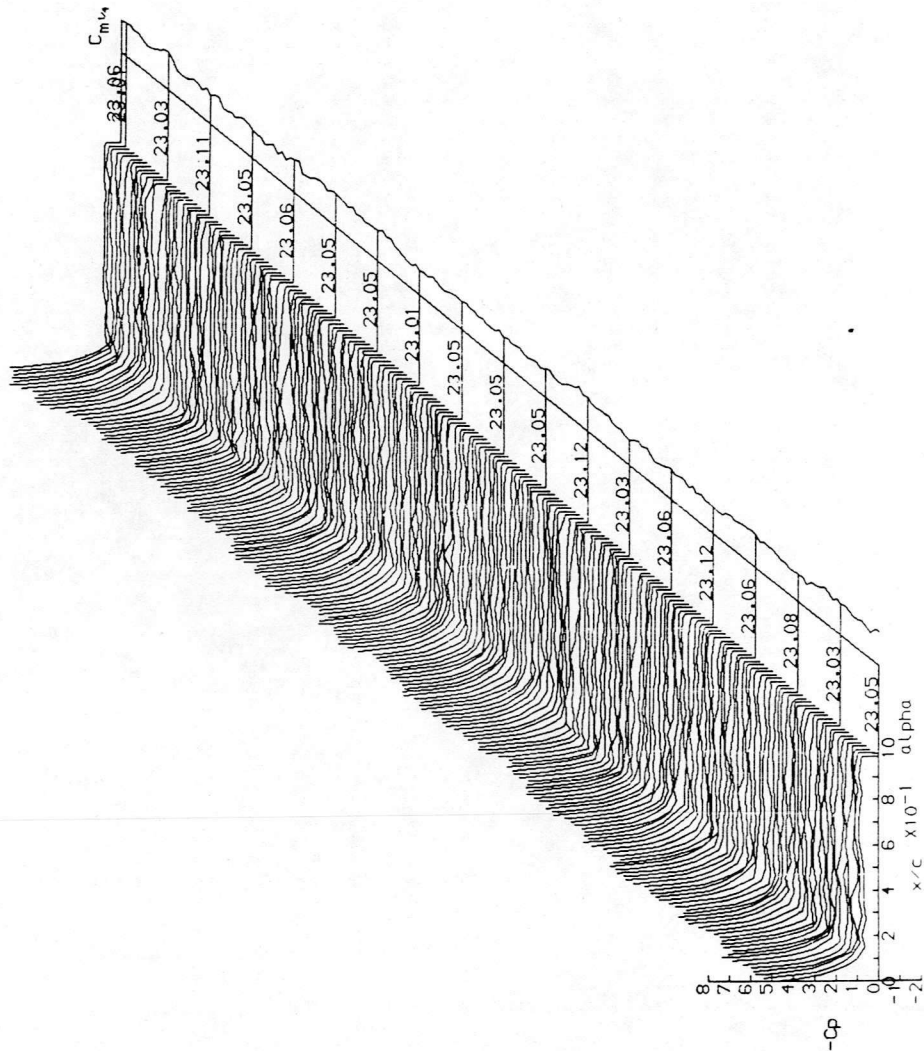
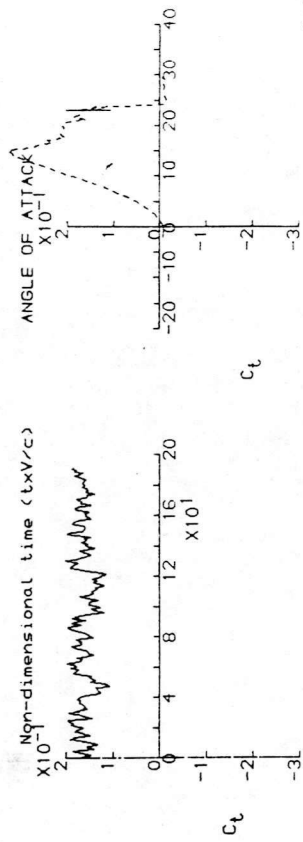
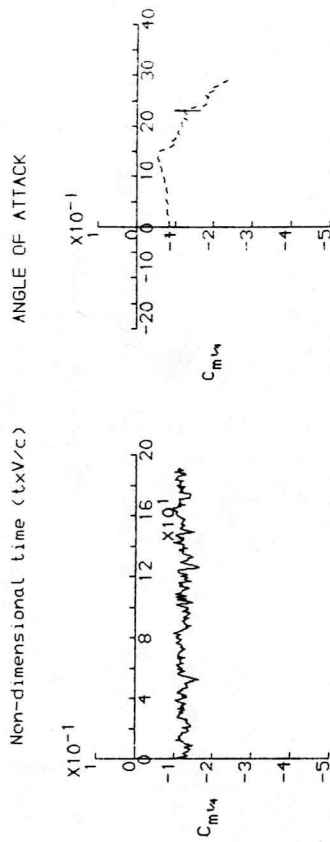
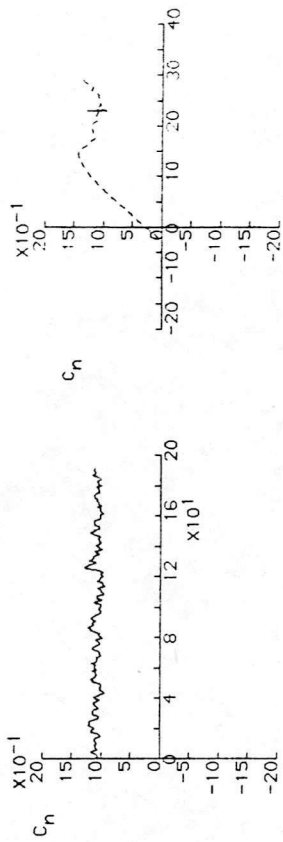
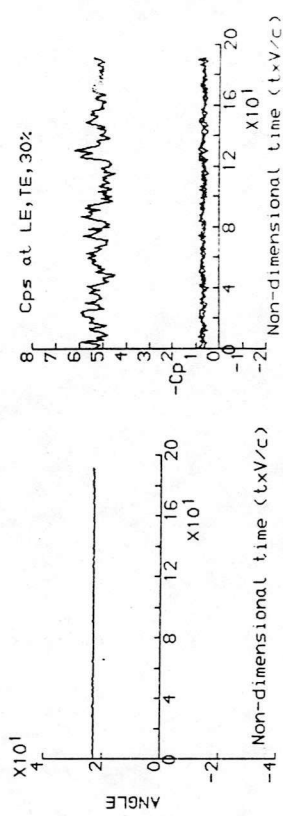
DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47421
 DATE OF TEST: 13/12/88
 REYNOLDS NUMBER = 1483026
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 AIR TEMPERATURE = 28.3°C
 NUMBER OF CYCLES = 1
 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: UNSTEADY STATIC
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

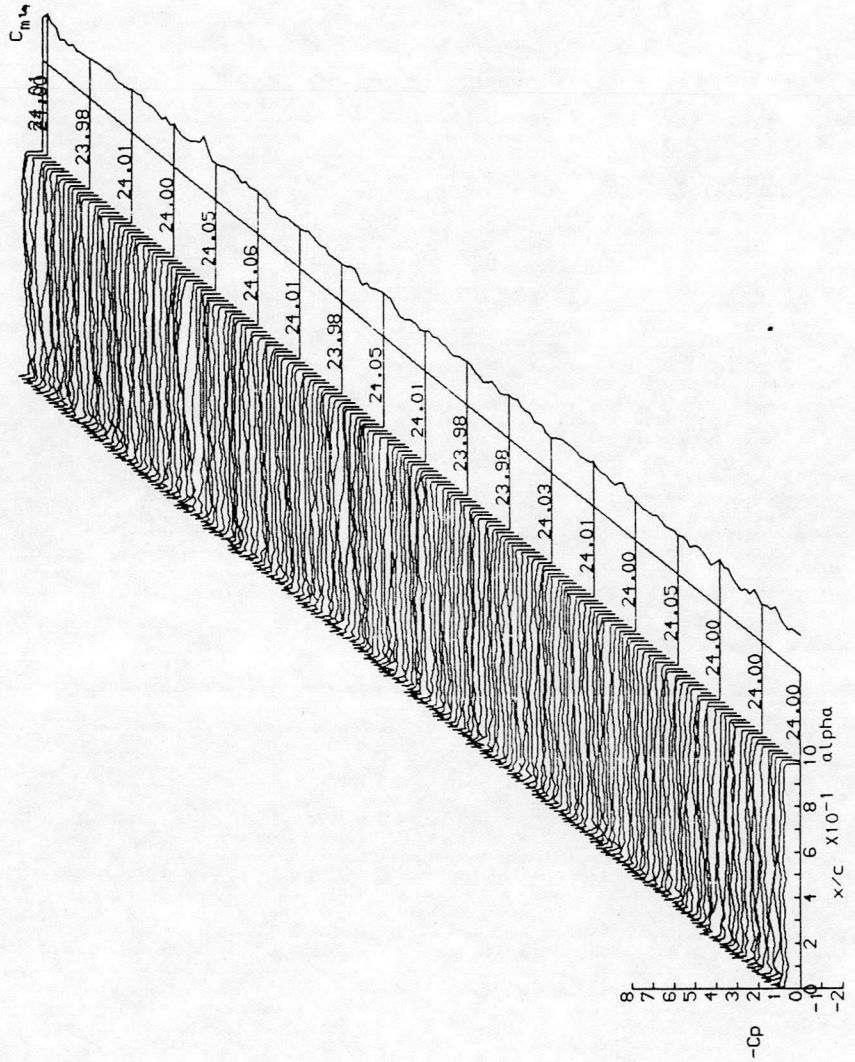
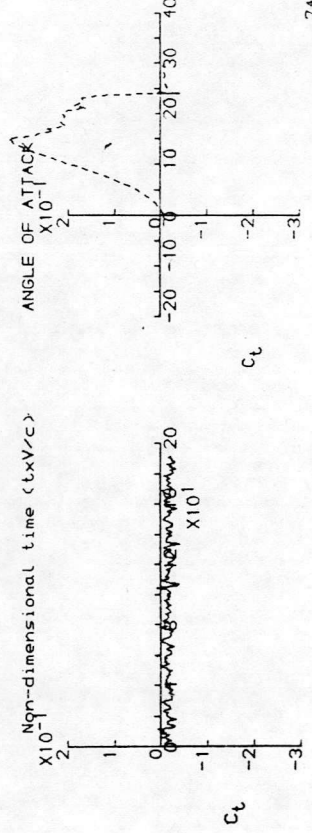
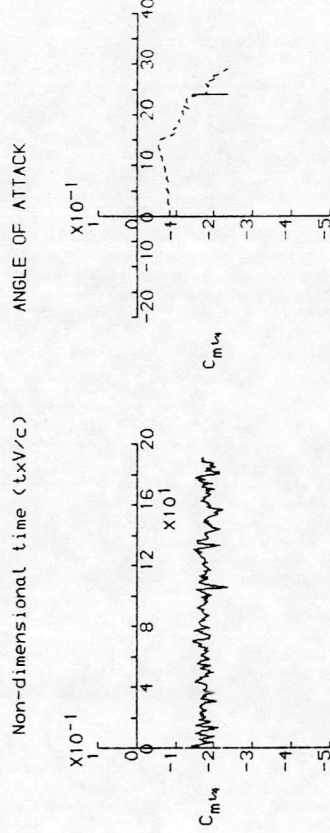
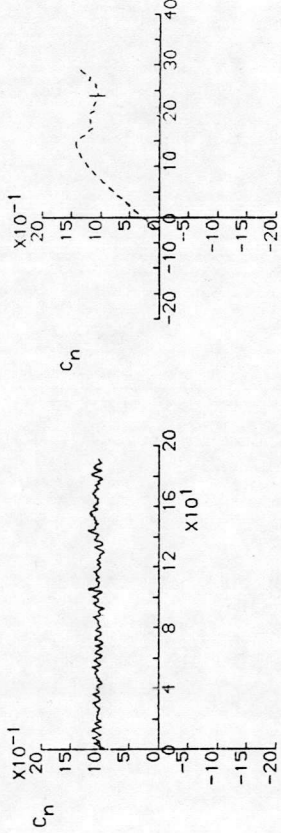
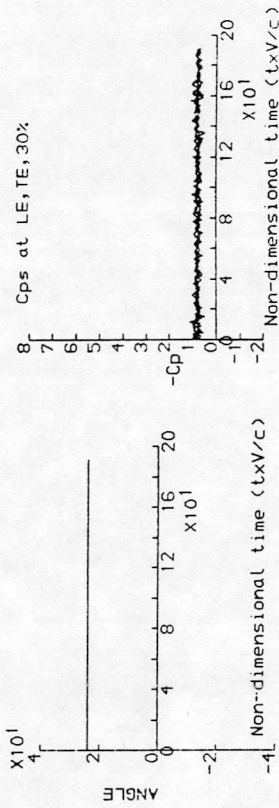
RUN REFERENCE NUMBER: 47431
 RETNOLDS NUMBER = 1482397.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC
 DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.4°C
 SAMPLING FREQUENCY = 100.00 HZ.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

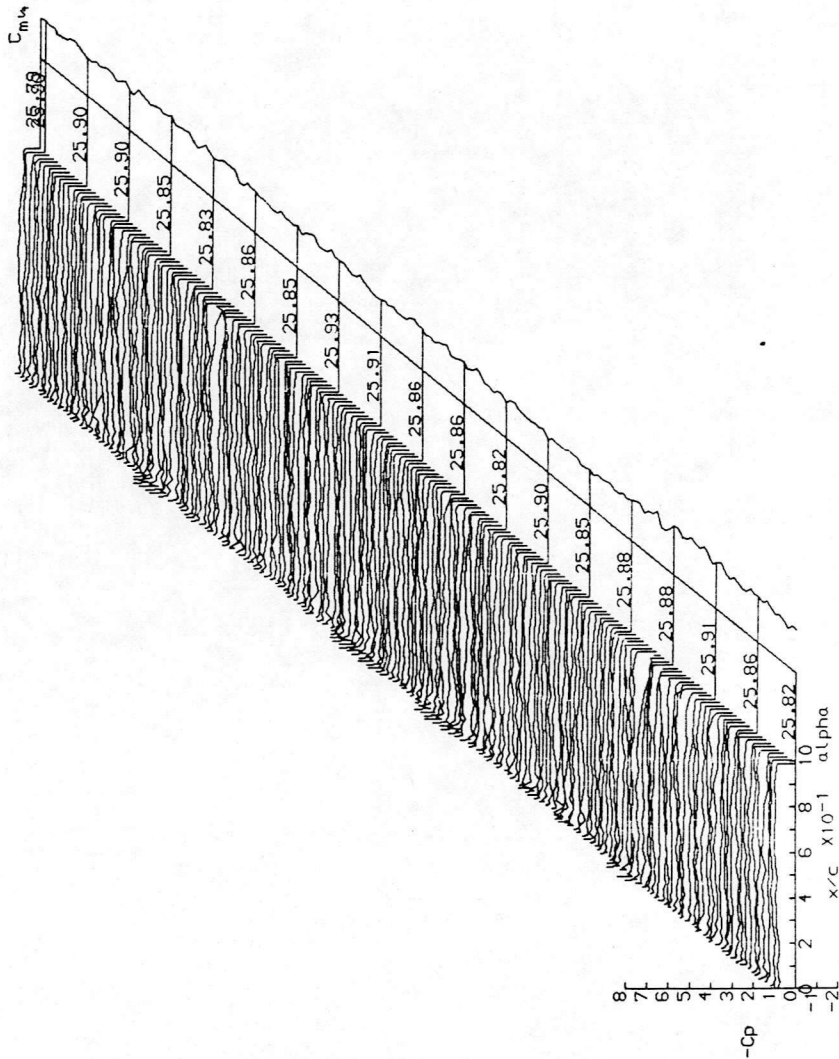
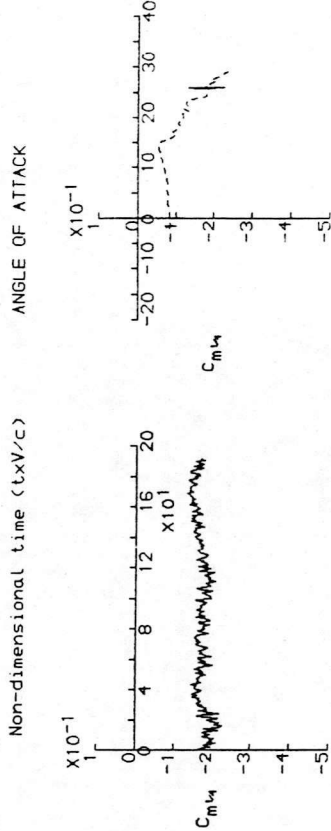
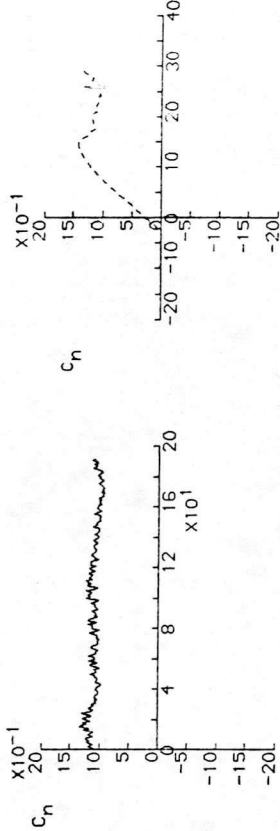
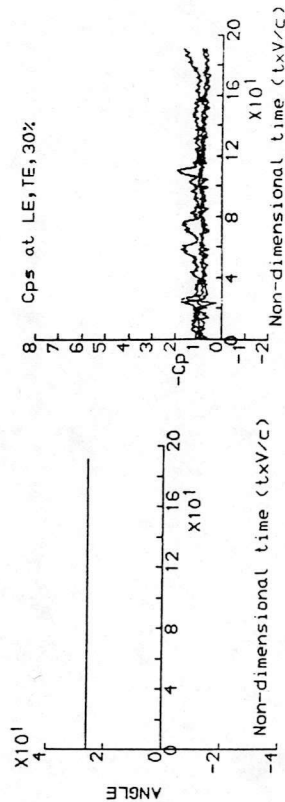
RUN REFERENCE NUMBER: 47441
 REYNOLDS NUMBER = 1482397.
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 NUMBER OF CYCLES = 1
 MOTION TYPE: UNSTEADY STATIC

DATE OF TEST: 13/12/88
 MACH NUMBER = 0.118
 AIR TEMPERATURE = 28.4°C
 SAMPLING FREQUENCY = 100.00 Hz.
 AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C_MODEL04

RUN REFERENCE NUMBER: 47451 DATE OF TEST: 13/12/88
 REYNOLDS NUMBER = 1481140. MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1012.30 Nm⁻² AIR TEMPERATURE = 28.6°C
 NUMBER OF CYCLES = 1 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: UNSTEADY STATIC AVERAGED DATA OF 1 CYCLES



DYNAMIC CHARACTERISTICS FOR THE NACA23012C MODEL04

RUN REFERENCE NUMBER: 47461
 DATE OF TEST: 13/12/88
 REYNOLDS NUMBER = 1481140
 MACH NUMBER = 0.118
 DYNAMIC PRESSURE = 1012.30 Nm⁻²
 AIR TEMPERATURE = 28.6°C
 NUMBER OF CYCLES = 1
 SAMPLING FREQUENCY = 100.00 Hz.
 MOTION TYPE: UNSTEADY STATIC
 AVERAGED DATA OF 1 CYCLES

