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COLLECTED DATA FOR TESTS ON AN AHAVAW AEROFOIL

VOLUME III : *Pressure data relevant to the study of large-scale vertical-axis wind-turbines.*

by

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Herein is presented the collected data for tests in which an AHAVAW aerofoil was subjected to a variety of oscillatory displacements in pitch about the quarter-chord location at low Reynolds numbers.

VOLUME III

PRESSURE DATA RELEVANT TO THE STUDY OF LARGE-SCALE VERTICAL-AXIS WIND-TURBINES.

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AHAVAW - VOLUME III

CONTENTS

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 ($\rho V^2/2$)
k	reduced frequency ($\omega c/2V$)
r	reduced pitch-rate $(c/2V)d\alpha/dt$
TSR	tip speed ratio
Re	Reynolds number
V	velocity
x/c	chordwise dimension
α	angle of attack
ω	rotational velocity

1 INTRODUCTION

At present, in the United Kingdom, United States of America and Canada, vertical-axis wind turbines (VAWTs) typically employ the NACA 0015 aerofoil for the turbine rotors. If thicker sections could be shown to be aerodynamically satisfactory, their use would lead to a simplification in the blade design and, hence, cost reductions. As a result, the University of Glasgow is currently researching the effect on aerodynamic characteristics of varying aerofoil thickness.

As part of this investigation, in the dynamic stall facility at the University of Glasgow[1,2,3], two-dimensional data has been acquired from experiments on a number of aerofoils under a variety of motion types. **Angell et al**[4] obtained relevant lift, thrust and pitching-moment data for five aerofoil sections (NACA 0015, NACA 0018, NACA 0021, NACA 0025 and NACA 0030). From analysis of data produced by experiments on these aerofoils, a second generation of aerofoil sections have been designed. This report, the third of three, presents the collected data from a series of oscillatory tests performed on a new aerofoil, designed by Vertical Axis Wind Turbines Limited, which is a member of the second group. The coordinates for this aerofoil section, named the AHAVAW, are listed in **Table 1**. The experiments are split between the three volumes as follows:

VOLUME I *Pressure data from ramp function tests.*

VOLUME II *Pressure data from oscillatory tests.*

VOLUME III *Pressure data relevant to the study of large-scale vertical-axis wind turbines.*

Each volume also includes the pressure data from tests in steady conditions and a brief description of the experimental apparatus and techniques.

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 **Figure 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. The hand-finished surface was very smooth, and the profile accurate to better than 0.1mm. The instrumented model was fitted vertically into the University of Glasgow's "Handley Page" wind tunnel.

The "Handley Page" low-speed wind tunnel is an atmospheric-pressure closed-return type with a 1.61x2.13 octagonal working section (**Figure 2**) in which a wind velocity of $61ms^{-1}$ can be attained. The model was pivoted about its quarter-chord axis on two tubular steel shafts connected to the main support via two self-aligning bearings. A single thrust bearing on the top support beam took all the weight. The dynamic and aerodynamic loadings from the aerofoil were reacted to the 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 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 acuator was a UNIDYNE 907/1 type with a normal dynamc thrust of 6.1KN operated from a supply pressure of $7.0MNm^{-2}$. 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 model's angle of attack was incremented by the actuator controller. The input signal during the static tests was provided under software control by the data acquisition unit's own digital-to-analogue converter. This was possible because, during the sampling, the angle of attack was fixed and sufficient time was available between sampling to set the model at the required angle of attack. The two activities were separate and were performed sequentially.

Such was not the case during the unsteady tests, however, where sampling and control of the model's motion were required simultaneously. Therefore, during these tests, the input signal was provided by a separate function generator, comprised of an AMSTRAD 1512 microcomputer equipped with an ANALOG DEVICES RTI815 multi-function input/output board. The required output function was digitised into equal time steps in 2's complement code and the frequency of the function was controlled using the internal interrupts of the AMSTRAD microcomputer. The code was written in TURBO PASCAL.

2.3 Instrumentation and Data Logging

2.3.1 Pressure Transducers

To provide the chordwise pressure distribution at mid-span, thirty KULITE XCS-093-5 PSI G ultra-miniature pressure transducers were installed just below the surface of the centre section of the model. The transducers were of vented gauge type with one side of the pressure sensitive diaphragm open to the ambient pressure outside the wind-tunnel (via tubes in the model). 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 illustrated in **Figure 3**.

The low voltage outputs from the thirty presure transducers were suitably amplified and conditioned by a bank of differential amplifiers. The conditioned signals were passed to a "sample and hold" unit[1,5] to overcome the time-skew problem arising from the sequential conversion of the anlogue 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. The pressure tappings were connected to a FURNESS FC012 micromanometer, which provided an analogue signal suitable for the data acquisition unit's analogue-to-digital converter. This dynamic pressure was recorded as the sample-and-hold unit was 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 into an amplifier/splitter to produce three signals for the following purposes:

i) connection of the multiplexer for recording the aerofoil's angle of attack;

ii) connection of the Schmitt trigger for initiation of data sampling when a preset incidence (voltage) was attained;

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:

i) an analogue-to-digital converter module, with a 16-channel multiplexer incorported. The converter was a 12-bit successive approximation type with a conversion time of of 30μs, 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 44μs;

ii) a multiplexer module, of 16 single-ended channels, which increased the number of channels that could be sampled to 32;

iii) a real-time clock module, with two Schmitt triggers. This was used as a time-base generator to accurately set the sampling frequency. The sampling frequency was determined at run time from the frequency of oscillation and the requirement that 128 sample sweeps should be obtained during each cycle. One of the Shmitt triggers was used to initiate data sampling, by setting its reference voltage to a value corresponding to the angular displacement transducer's output for the required mean angle of attack;

iv) 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 **Figure 4**. The main control programs for the tests were written in FORTRAN IV, as described by **Murray-Smith and Galbraith**[6]. The programs prompt the user for specific run information before calling a specialised subroutine 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 achieved under software control.

3 TEST SERIES AND PROCEDURE

3.1 Static Experiment

A number of experiments were performed under steady conditions. Once the wind velocity had reached the required value, the aerofoil was rotated about its quarter-chord axis until it was positioned at the incidence at which the first set of data were to be recorded. Usually, this was approximately -2°. The model's angle of attack was then increased in steps of approximately 0.5°. After each increment in incidence, the flow was allowed to stabilise for a few seconds before each transducer's output was sampled 100 times and the mean value for each was stored. After 64 sweeps of data had been recorded, the model was returned to its starting position. Data sampling was maintained at the same rate on the return arc in order to record any delay in the reattachment of flow.

3.2 Sinusoidal Experiment

For this experiment, the model was rotated about its quarter-chord axis so that its angle of attack varied sinusoidally with time. The amplitude and frequency were controlled by the AMSTRAD function generator. During each oscillatory cycle 128 data sweeps were recorded and logged, with data being sampled during ten cycles.

3.3 VAWT Experiment

The VAWT experiment was designed to emulate the incidence time histories encountered by the blade of a vertical-axis wind turbine. A computer algorithm, coded in FORTRAN 77, has been developed at the University of Reading to calculate the blade's angle of attack as a function of its azimuth position. The program can use both single and multiple streamtube models[7] based on SANDIA[8] data for the NACA series of aerofoil characteristics.

At low tip-speed ratios the time history for the single streamtube model is a skewed sine function, but this tends toward a true sine as the tip-speed ratio is increased. The upwind (positive) and downwind (negative) sections of each cycle attain identical peak values of incidence. Tip-speed ratio and amplitude are related as follows:

TSR	Amplitude
6.00	5.4°
4.00	9.9°
3.50	12.2°
3.25	13.8°
2.80	17.4°
2.33	22.6°
1.75	32.8°

The AMSTRAD function generator reproduced the angle of attack histories based upon the NACA 0015 aerofoil's characteristics. Data acquisition was performed in an identical manner to that for sinusoidal tests.

In addition, a number of non-standard VAWT experiments were performed. Each is described in **Table 5**.

3.4 Procedure

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 these values were recorded, the appropriate data acquisition routine was initiated whilst the tunnel was brought up to speed and thence data gathered as per the software prompts. The tunnel was then shut down, offsets logged again and further tests were performed in the manner described above.

3.5 Roughness Transition Strips

A number of the experiments were repeated with graded sand deposited at the aerofoil's leading edge. It was intended that this should trip the boundary layer in the leading-edge region. A direct comparison can be made between tests with and those without these roughness transition strips.

3.6 Data Presentation

All data collected by the data acquisition routines were stored in unformatted form on magnetic tape. A library of programs (coded in FORTRAN 77) is available for the reduction, presentation and analysis of the data on a DEC MICROVAX 3400. By applying offsets, gains and calibrations, the data reduction programs convert the cycles of raw data into averaged or unaveraged non-dimensional pressure coefficients. As described by **Leitch and Galbraith**[9], these data are stored on the University of Glasgow's aerofoil database. The airloads are determined by suitably integrating the pressure coefficient values.

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, it was not possible to hold the dynamic pressure in the working section constant whilst altering the blockage due to the pitching of the aerofoil. During the static tests (i.e. **k**=0.0 and **r**=0.0), this variation was as illustrated in **Figure 5**, where it can be seen that there was approximately a 30% reduction in dynamic pressure as the angle of attack was increased from 0° to 30°. As illustrated in **Figures 6** and **7**, this reduction in dynamic pressure decreased as reduced frequency increased.

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

4.2 Averaging of the Data

The main data in this report are the average of a number of cycles. Individual cycles are presented in **Figures 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. In addition, the sweep at which any event occurred did not vary. Therefore the given data may be considered as typical of aerofoil performance during any given individual cycle. This is particularly relevant when considering the detailed flow phenomena of separation and reattachment.

4.3 Test Data

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

ACKNOWLEDGEMENTS

The authors wish to acknowledge the encouragement and support of their colleagues both academic and technical.

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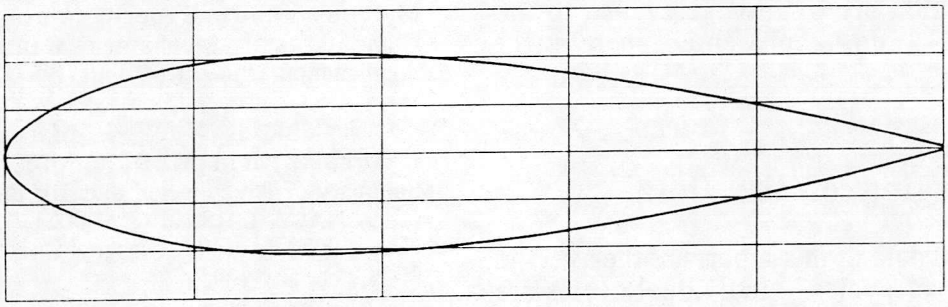
TABLE 1 : AHAVAW AEROFOIL PROFILE AND COORDINATES



Coordinates in %Chord

Upper Surface		Lower Surface	
Station	Ordinate	Station	Ordinate
0.000	0.000	0.000	0.000
0.081	0.643	0.081	-0.643
0.324	1.270	0.324	-1.270
0.729	1.868	0.729	-1.868
1.295	2.458	1.295	-2.458
2.021	3.074	2.021	-3.074
2.906	3.713	2.906	-3.713
3.948	4.366	3.948	-4.366
5.146	5.027	5.146	-5.027
6.498	5.685	6.498	-5.685
8.002	6.333	8.002	-6.333
9.655	6.962	9.655	-6.962
11.454	7.565	11.454	-7.565
13.398	8.132	13.398	-8.132
15.481	8.656	15.481	-8.656
17.702	9.128	17.702	-9.128
20.056	9.539	20.056	-9.539
22.539	9.882	22.539	-9.882
25.149	10.153	25.149	-10.153
27.880	10.348	27.880	-10.348
30.728	10.464	30.728	-10.464
33.688	10.500	33.688	-10.500
36.756	10.454	36.756	-10.454
39.926	10.330	39.926	-10.330
43.194	10.132	43.194	-10.132
46.553	9.863	46.553	-9.863
50.000	9.528	50.000	-9.528
53.528	9.129	53.528	-9.129
57.131	8.669	57.131	-8.669
60.803	8.150	60.803	-8.150
64.539	7.577	64.539	-7.577
68.333	6.952	68.333	-6.952
72.178	6.277	72.178	-6.277
76.068	5.554	76.068	-5.554
79.997	4.783	79.997	-4.783
83.959	3.967	83.959	-3.967
87.946	3.104	87.946	-3.104
91.953	2.193	91.953	-2.193
95.973	1.232	95.973	-1.232
100.000	0.220	100.000	-0.220

TABLE 2 : DETAILS OF STATIC TESTS

TABLE 2.1 : SUMMARY OF STATIC TESTS (nominal)

Reynolds Number	$0.8x10^6$	$1.1x10^6$	$1.5x10^6$	$2.0x10^6$
Angle of Attack	-2° to 30°			

(all permutations)

TABLE 2.2 : LIST OF STATIC TESTS (actual)

Run Number	Start (°)	Sweep (°)	Reynolds No. x 10^{-6}
00011	-2	32	1.60
00491	-2	32	1.54
00751	-2	32	1.04
00801	-2	32	2.06
01681	-2	32	1.53
03541	-2	32	1.10
03711	-2	32	1.59
03961	-2	32	2.02
04131	-2	32	0.87
04211	-2	32	1.21
04291	-2	32	1.63
04371	-2	32	2.08
04801	-2	32	0.86
04881	-2	32	1.20
05031	-2	32	2.09
05181	-2	32	1.66
*805541	-2	32	1.57
*805741	-2	32	1.53

(*experiments with roughness transition strips)

TABLE 3 : DETAILS OF SINUSOIDAL EXPERIMENTS

TABLE 3.1 : SUMMARY OF SINUSOIDAL EXPERIMENTS AT FIXED REDUCED FREQUENCY (nominal)

Mean Angle	0^o						
Amplitude	5.4^o	10.0^o	12.2^o	13.8^o	17.4^o	22.6^o	32.8^o
Reduced Frequency	0.05						
Reynolds Number	$0.8x10^6$	$1.1x10^6$	$1.5x10^6$	$2.0x10^6$			

(all permutations)

TABLE 3.2 : SUMMARY OF SINUSOIDAL EXPERIMENTS AT FIXED REYNOLDS NUMBER (nominal)

Mean Angle	0^o						
Amplitude	5.4^o	10.0^o	12.2^o	13.8^o	17.4^o	22.6^o	32.8^o
Reduced Frequency	0.02	0.04	0.05	0.06	0.075		
Reynolds Number	$1.5x10^6$						

(all permutations; tests at reduced frequency of 0.075 were repeated with roughness transition strips)

TABLE 3.3 : LIST OF SINUSOIDAL EXPERIMENTS (actual)

Run Number	Mean (°)	Amp'ude (°)	Reduced Frequency	Reynolds No. x 10^{-6}
14141	0	5.4	0.047	0.87
14151	0	10.0	0.047	0.87
14161	0	12.2	0.047	0.87
14171	0	13.8	0.047	0.87
14181	0	17.4	0.047	0.87
14191	0	22.6	0.047	0.87
14201	0	32.8	0.047	0.87
14221	0	5.4	0.047	1.20
14231	0	10.0	0.047	1.20
14241	0	12.2	0.047	1.20
14251	0	13.8	0.047	1.20
14261	0	17.4	0.047	1.20
14271	0	22.6	0.047	1.20
14281	0	32.8	0.047	1.20
14301	0	5.4	0.047	1.60
14311	0	10.0	0.047	1.60
14321	0	12.2	0.047	1.60

TABLE 3.3 : LIST OF SINUSOIDAL EXPERIMENTS (concluded)

Run Number	Mean (°)	Amp'ude (°)	Reduced Frequency	Reynolds No. x 10^{-6}
14331	0	13.8	0.047	1.60
14341	0	17.4	0.047	1.59
14351	0	22.6	0.047	1.59
14361	0	32.8	0.047	1.59
14381	0	5.4	0.049	2.07
14391	0	10.0	0.049	2.06
14401	0	12.2	0.049	2.05
14411	0	13.8	0.049	2.05
14421	0	17.4	0.049	2.04
14431	0	22.6	0.049	2.04
14442	0	32.8	0.049	1.98
14451	0	5.4	0.019	1.58
14461	0	10.0	0.019	1.58
14471	0	12.2	0.019	1.57
14481	0	13.8	0.019	1.57
14491	0	17.4	0.019	1.57
14501	0	22.6	0.019	1.57
14511	0	32.8	0.019	1.56
14521	0	5.4	0.038	1.56
14531	0	10.0	0.038	1.56
14541	0	12.2	0.038	1.56
14551	0	13.8	0.038	1.56
14561	0	17.4	0.038	1.56
14571	0	22.6	0.038	1.55
14581	0	32.8	0.038	1.55
14591	0	5.4	0.047	1.56
14601	0	10.0	0.047	1.56
14611	0	12.2	0.047	1.55
14621	0	13.8	0.047	1.55
14631	0	17.4	0.047	1.55
14641	0	22.6	0.047	1.55
14651	0	32.8	0.047	1.55
14661	0	5.4	0.057	1.55
14671	0	10.0	0.057	1.55
14681	0	12.2	0.057	1.55
14691	0	13.8	0.057	1.55
14701	0	17.4	0.057	1.55
14711	0	22.6	0.057	1.55
14721	0	32.8	0.057	1.55
14731	0	5.4	0.071	1.55
14741	0	10.0	0.071	1.55
14751	0	12.2	0.071	1.54
14761	0	13.8	0.071	1.54
14771	0	17.4	0.071	1.54
14781	0	22.6	0.071	1.54
14791	0	32.8	0.071	1.54
*815671	0	5.4	0.078	1.49
*815681	0	10.0	0.078	1.48
*815691	0	12.2	0.078	1.48
*815701	0	13.8	0.078	1.48
*815711	0	17.4	0.078	1.48
*815721	0	22.6	0.078	1.48
*815731	0	32.8	0.078	1.48

*experiments with roughness transition strips

TABLE 4 : DETAILS OF SINGLE STREAMTUBE VAWT EXPERIMENTS

TABLE 4.1 : SUMMARY OF VAWT EXPERIMENTS AT FIXED REDUCED FREQUENCY (nominal)

<table>
<tr><td>Mean Angle</td><td colspan="7">0°</td></tr>
<tr><td>Tip Speed Ratio</td><td>1.75</td><td>2.33</td><td>2.80</td><td>3.25</td><td>3.50</td><td>4.00</td><td>6.00</td></tr>
<tr><td>Reduced Frequency</td><td colspan="7">0.05</td></tr>
<tr><td>Reynolds Number</td><td>$0.8x10^6$</td><td colspan="2">$1.1x10^6$</td><td colspan="2">$1.5x10^6$</td><td colspan="2">$2.0x10^6$</td></tr>
</table>

(all permutations)

TABLE 4.2 : SUMMARY OF VAWT EXPERIMENTS AT FIXED REYNOLDS NUMBER (nominal)

<table>
<tr><td>Mean Angle</td><td colspan="7">0°</td></tr>
<tr><td>Tip Speed Ratio</td><td>1.75</td><td>2.33</td><td>2.80</td><td>3.25</td><td>3.50</td><td>4.00</td><td>6.00</td></tr>
<tr><td>Reduced Frequency</td><td>0.02</td><td>0.04</td><td>0.05</td><td>0.06</td><td colspan="3">0.075</td></tr>
<tr><td>Reynolds Number</td><td colspan="7">$1.5x10^6$</td></tr>
</table>

(all permutations)

TABLE 4.3 : LIST OF VAWT EXPERIMENTS (actual)

Run Number	Mean (°)	TSR	Reduced Frequency	Reynolds No. x 10^{-6}
54811	0	6.00	0.047	0.86
54821	0	4.00	0.047	0.86
54831	0	3.50	0.047	0.86
54841	0	3.25	0.047	0.86
54851	0	2.85	0.047	0.86
54861	0	2.33	0.047	0.86
54871	0	1.75	0.047	0.86
54891	0	6.00	0.046	1.20
54901	0	4.00	0.046	1.20
54911	0	3.50	0.046	1.19
54921	0	3.25	0.046	1.19
54931	0	2.85	0.046	1.19
54941	0	2.33	0.046	1.19
54951	0	1.75	0.046	1.19

TABLE 4.3 : LIST OF VAWT EXPERIMENTS (concluded)

Run Number	Mean (°)	TSR	Reduced Frequency	Reynolds No. x 10^{-6}
54961	0	6.00	0.046	1.60
54971	0	4.00	0.046	1.60
54981	0	3.50	0.046	1.60
54991	0	3.25	0.046	1.59
55001	0	2.85	0.046	1.59
55011	0	2.33	0.046	1.59
55021	0	1.75	0.046	1.58
55041	0	6.00	0.046	2.07
55051	0	4.00	0.046	2.07
55061	0	3.50	0.046	2.06
55071	0	3.25	0.045	2.05
55081	0	2.85	0.045	2.05
55091	0	2.33	0.045	2.04
55102	0	1.75	0.049	1.97
55111	0	6.00	0.018	1.57
55121	0	4.00	0.018	1.57
55131	0	3.50	0.018	1.56
55141	0	3.25	0.018	1.56
55151	0	2.85	0.018	1.56
55161	0	2.33	0.018	1.56
55171	0	1.75	0.018	1.56
55191	0	6.00	0.037	1.64
55201	0	4.00	0.037	1.64
55211	0	3.50	0.037	1.64
55221	0	3.25	0.037	1.64
55231	0	2.85	0.037	1.64
55241	0	2.33	0.037	1.63
55251	0	1.75	0.037	1.63
55261	0	6.00	0.046	1.64
55271	0	4.00	0.046	1.64
55281	0	3.50	0.046	1.63
55291	0	3.25	0.046	1.63
55301	0	2.85	0.046	1.63
55311	0	2.33	0.046	1.62
55321	0	1.75	0.046	1.62
55331	0	6.00	0.055	1.61
55341	0	4.00	0.055	1.61
55351	0	3.50	0.055	1.61
55361	0	3.25	0.055	1.60
55371	0	2.85	0.055	1.60
55381	0	2.33	0.055	1.60
55391	0	1.75	0.055	1.60
55401	0	6.00	0.069	1.61
55411	0	4.00	0.069	1.61
55421	0	3.50	0.069	1.60
55431	0	3.25	0.069	1.60
55441	0	2.85	0.069	1.60
55451	0	2.33	0.069	1.60
55461	0	1.75	0.069	1.60

TABLE 5 : LIST OF NON-STANDARD VAWT EXPERIMENTS

Run Number	Mean (°)	Amp'ude (°)	Reduced Frequency	Reynolds No. x 10^{-6}
[a]55482	0	12	0.045	2.00
[b]55492	0	12	0.045	1.99
[c]55502	0	20	0.045	1.98
[d]55512	0	20	0.045	1.97
[e]55521	0	30	0.046	1.96
[f]55531	0	30	0.046	1.94

[a]angle of attack trace from simulation of the VAWT 260 at a wind speed of 7.89 ms^{-1}
(structural dynamic effects not included)

[b]angle of attack trace from simulation of the VAWT 260 at a wind speed of 7.89 ms^{-1}
(structural dynamic effects included)

[c]angle of attack trace from simulation of the VAWT 260 at a wind speed of 10.57 ms^{-1}
(structural dynamic effects not included)

[d]angle of attack trace from simulation of the VAWT 260 at a wind speed of 10.57 ms^{-1}
(structural dynamic effects included)

[e]angle of attack trace from VAWT 260

[f]equivalent angle of attack trace for wind tunnel to reproduce airloads from VAWT 260

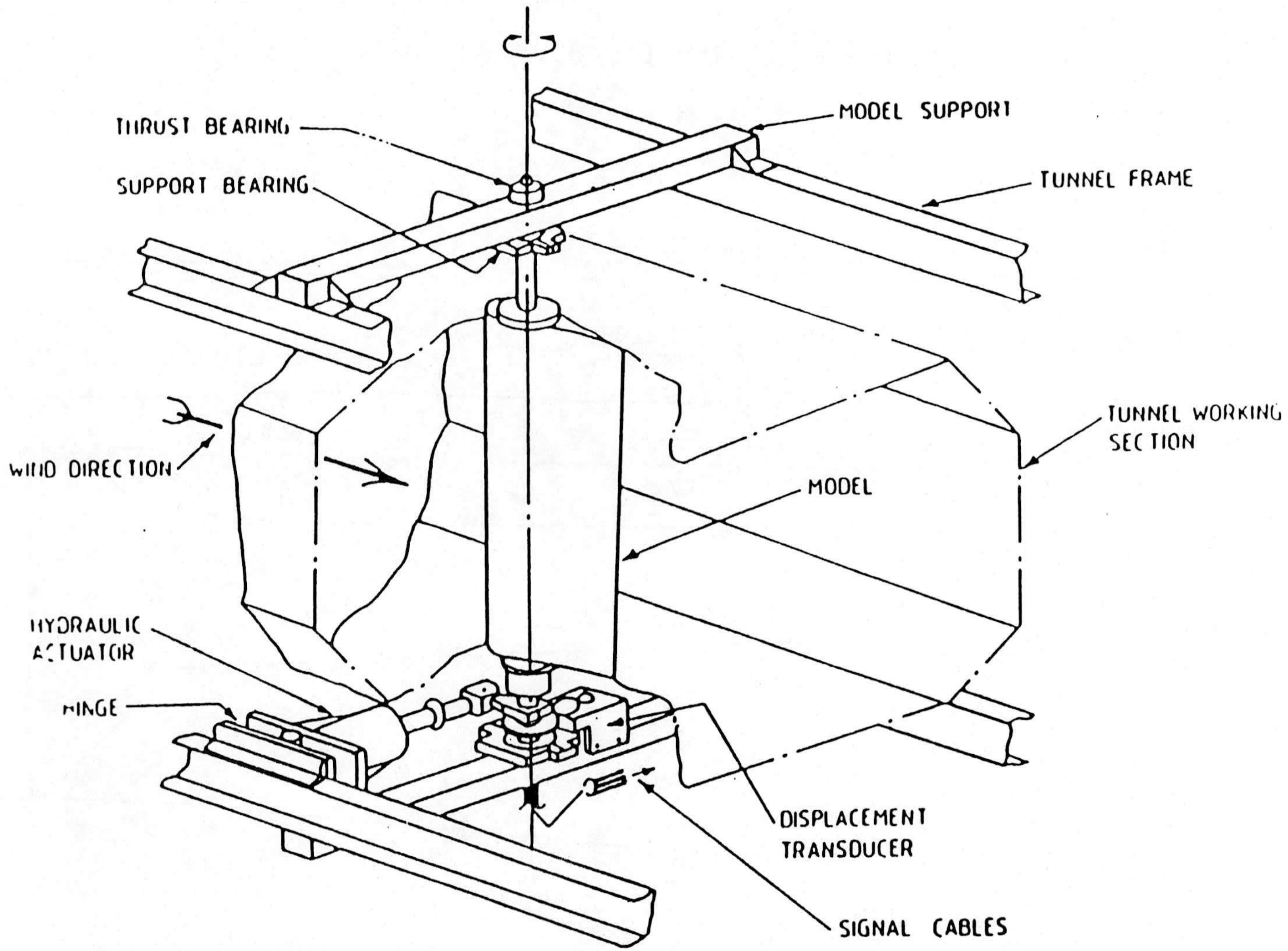


FIGURE 1 : GLASGOW UNIVERSITY'S DYNAMIC STALL RIG

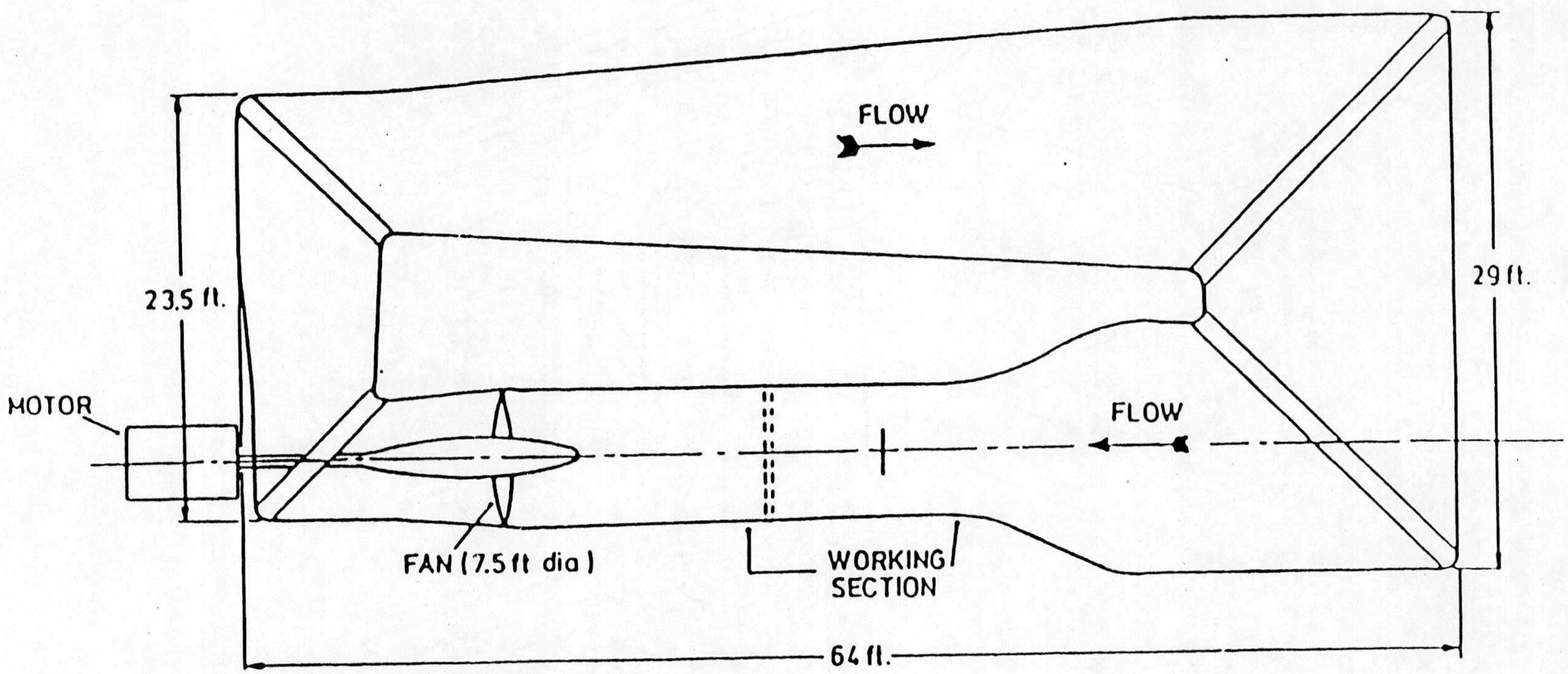
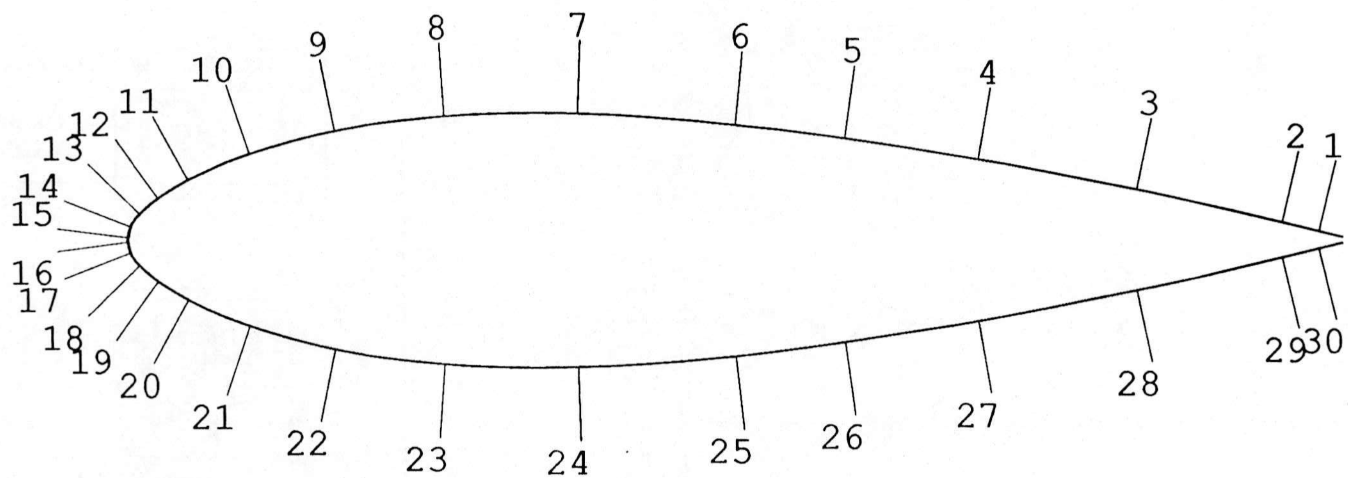


FIGURE 2 : PLAN VIEW OF THE GLASGOW UNIVERSITY "HANDLEY PAGE"
7ft X 5ft 3in WIND TUNNEL



X(1)/C = 0.98000	X(11)/C = 0.05000	X(21)/C = 0.10000
X(2)/C = 0.95000	X(12)/C = 0.02500	X(22)/C = 0.17000
X(3)/C = 0.83000	X(13)/C = 0.01000	X(23)/C = 0.26000
X(4)/C = 0.70000	X(14)/C = 0.00250	X(24)/C = 0.37000
X(5)/C = 0.59000	X(15)/C = 0.00025	X(25)/C = 0.50000
X(6)/C = 0.50000	X(16)/C = 0.00025	X(26)/C = 0.59000
X(7)/C = 0.37000	X(17)/C = 0.00250	X(27)/C = 0.70000
X(8)/C = 0.26000	X(18)/C = 0.01000	X(28)/C = 0.83000
X(9)/C = 0.17000	X(19)/C = 0.02500	X(29)/C = 0.95000
X(10)/C = 0.10000	X(20)/C = 0.05000	X(30)/C = 0.98000

FIGURE 3 : PRESSURE TRASDUCER LOCATIONS FOR THE AHAVAW.

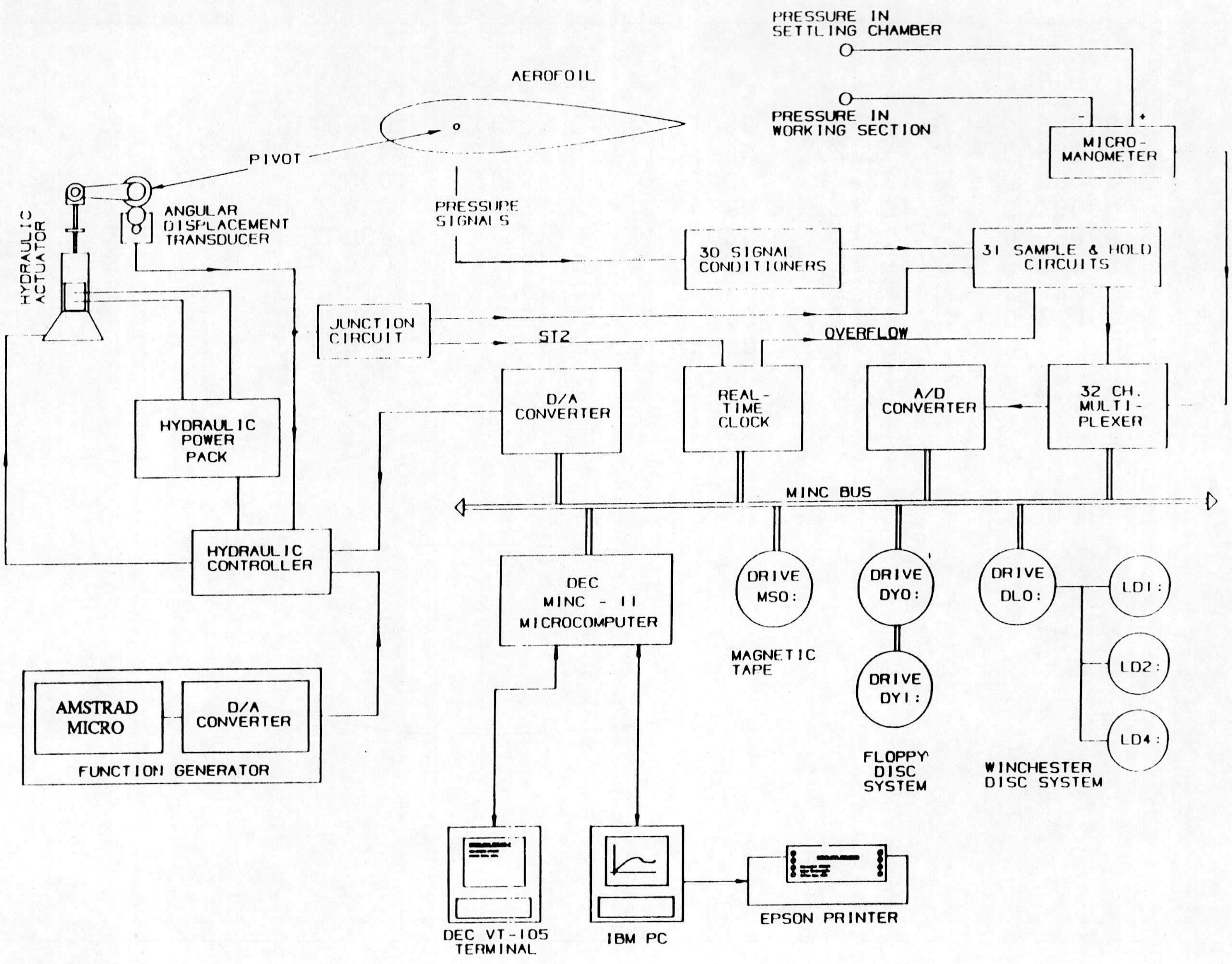


FIGURE 4: SYSTEMATIC ARRANGEMENT OF DATA ACQUSITION AND CONTROL SYSTEM

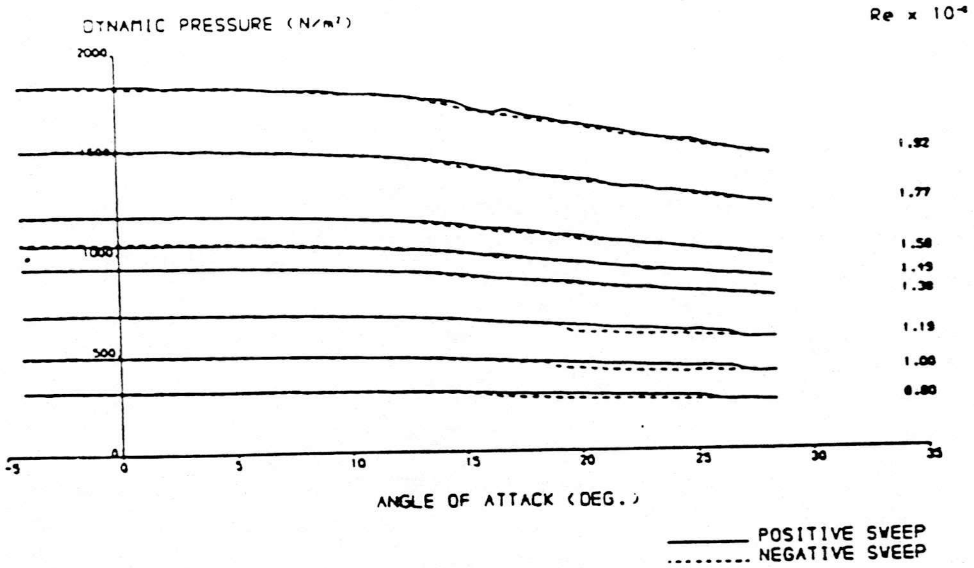


FIGURE 5 : REDUCTION OF DYNAMIC PRESSURE WITH INCREASING ANGLE OF ATTACK.

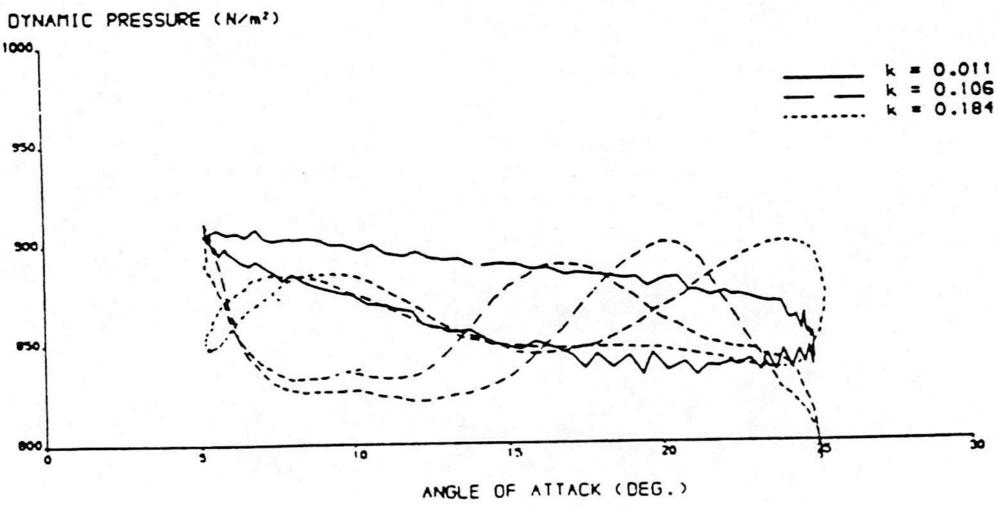


FIGURE 6 : VARIATION OF DYNAMIC PRESSURE DURING OSCILLATORY TESTS.

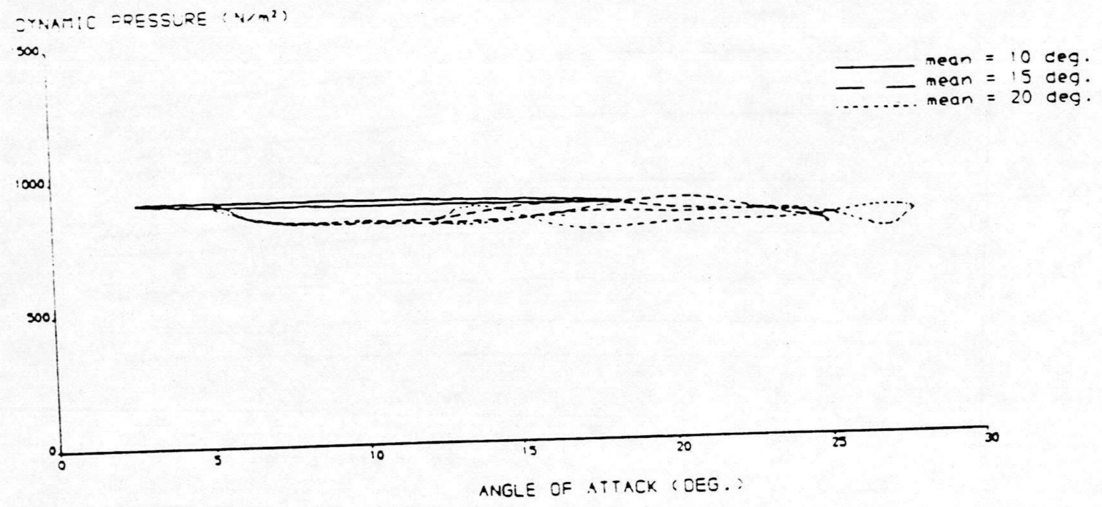


FIGURE 7 : VARIATION OF DYNAMIC PRESSURE FOR VARIOUS MEAN ANGLES OF ATTACK AT A REDUCED FREQUENCY OF 0.10.

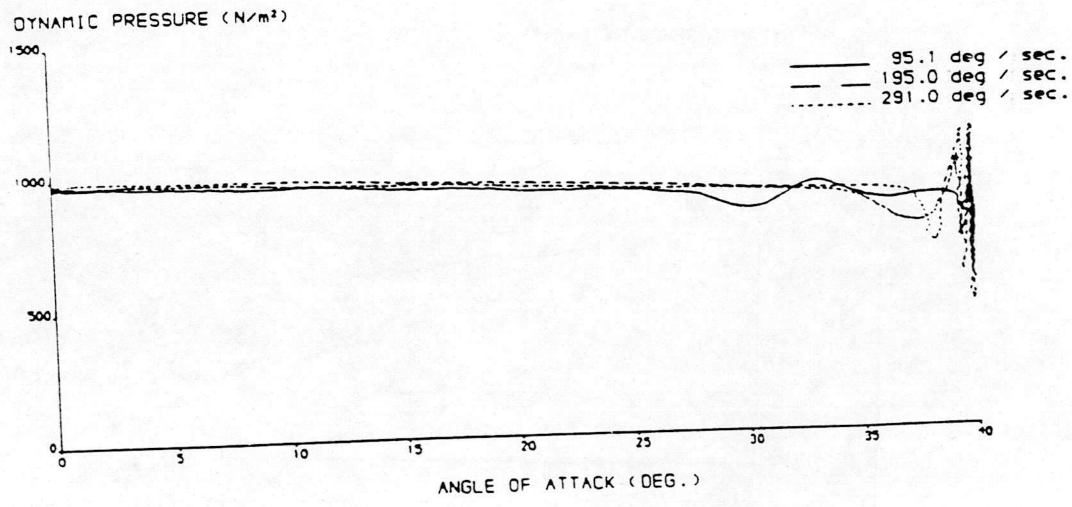


FIGURE 8 : VARIATION OF DYNAMIC PRESSURE FOR VARIOUS PITCH RATES DURING RAMP TESTS.

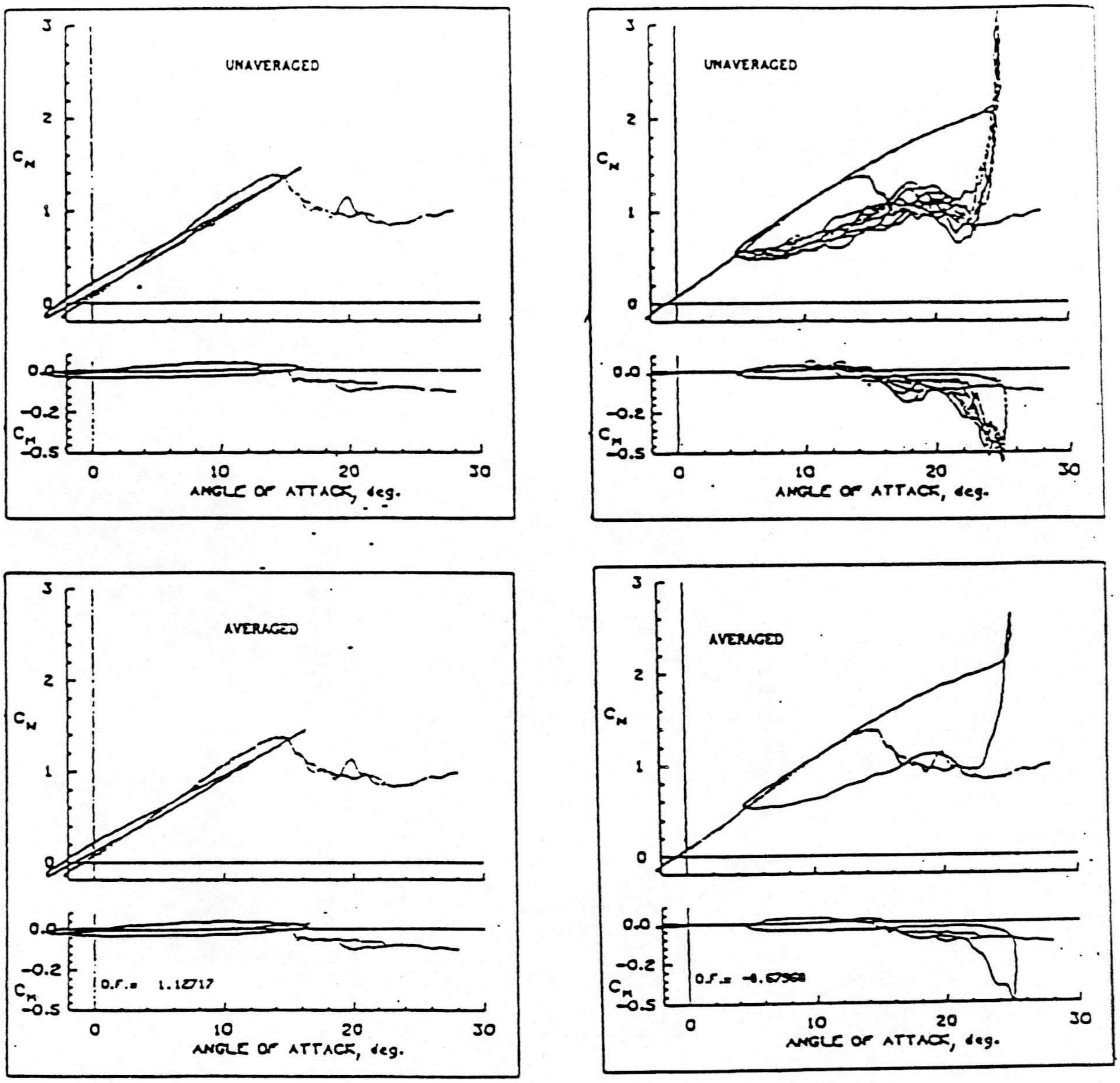


FIGURE 9: EFFECT OF AVERAGING ON THE NORMAL FORCE AND PITCHING MOMENT FOR OSCILLATORY TESTS.

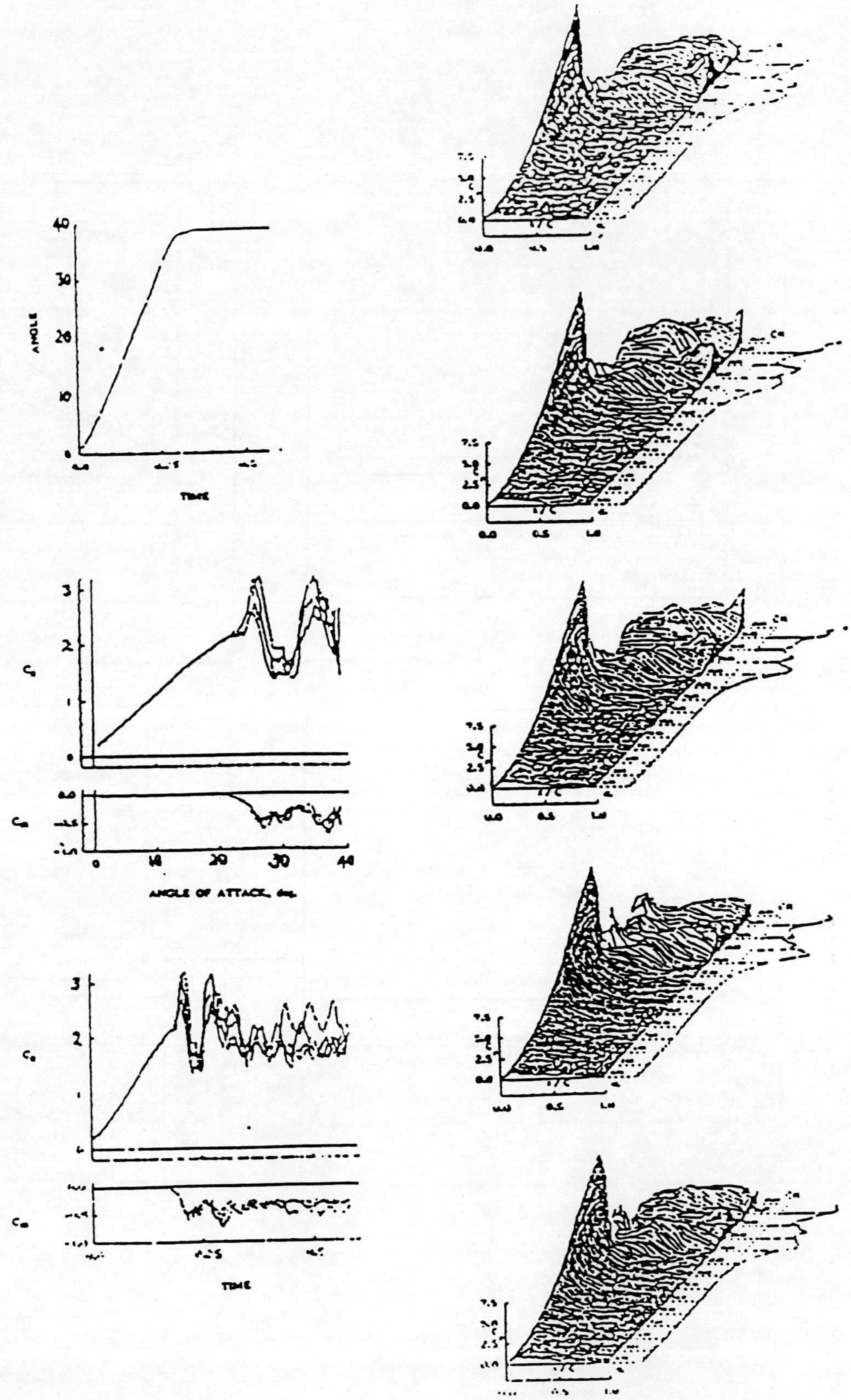


FIGURE 10: TYPICAL UNAVERAGED DATA FOR RAMP TESTS.

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UNIVERSITY OF GLASGOW

DEPARTMENT OF AEROSPACE ENGINEERING

PRESSURE DATA FROM

STATIC EXPERIMENTS

DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 11

REYNOLDS NUMBER = 1599672.

DYNAMIC PRESSURE = 1121.96 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

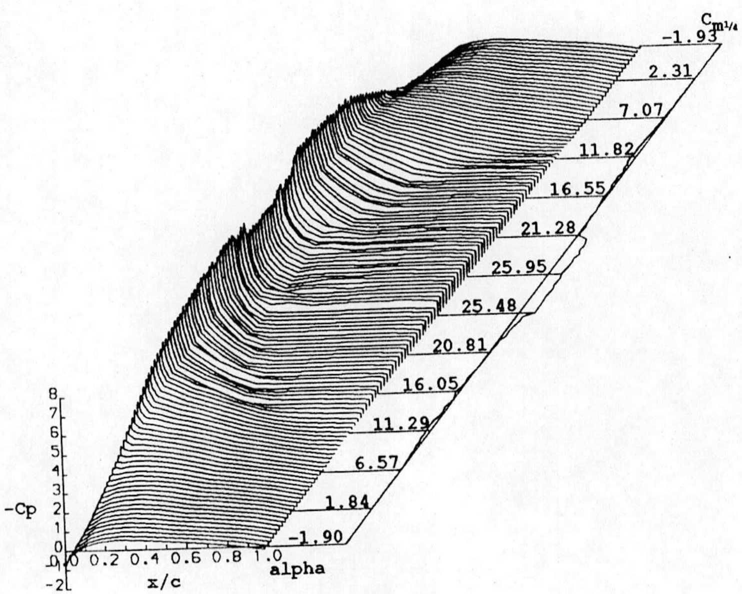
DATE OF TEST: 4/11/91

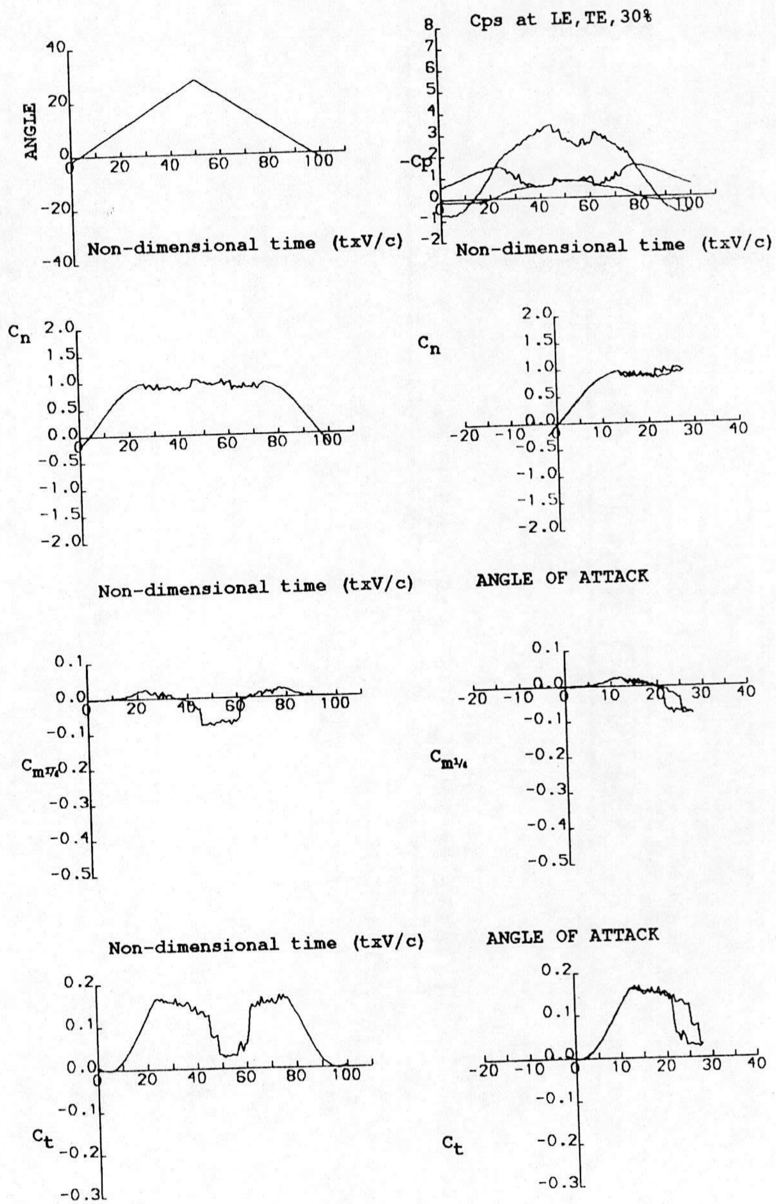
MACH NUMBER = 0.127

AIR TEMPERATURE = 18.5°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 491

REYNOLDS NUMBER = 1535418.

DYNAMIC PRESSURE = 1029.75 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

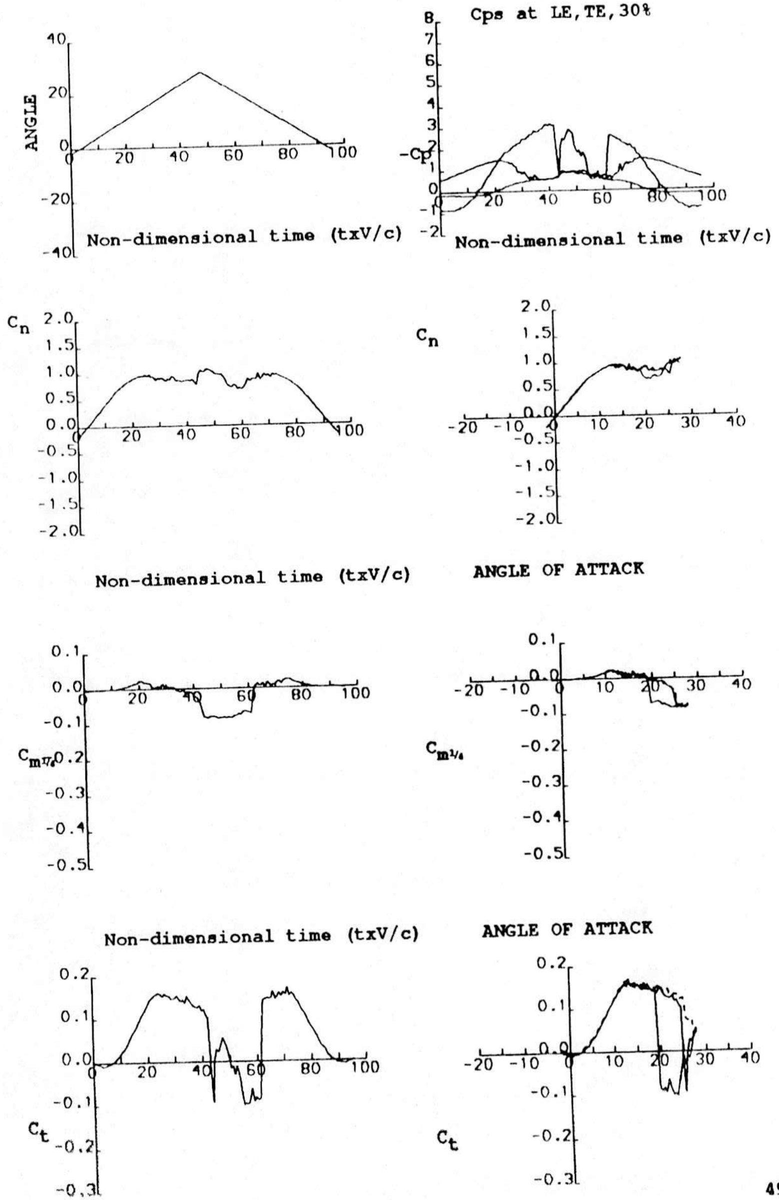
DATE OF TEST: 5/11/91

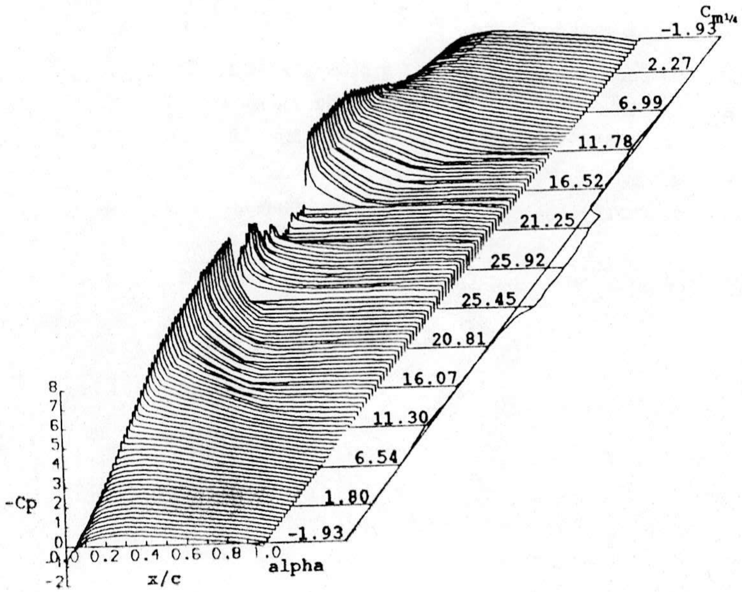
MACH NUMBER = 0.121

AIR TEMPERATURE = 20.0°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 751

REYNOLDS NUMBER = 1040063.

DYNAMIC PRESSURE = 449.33 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

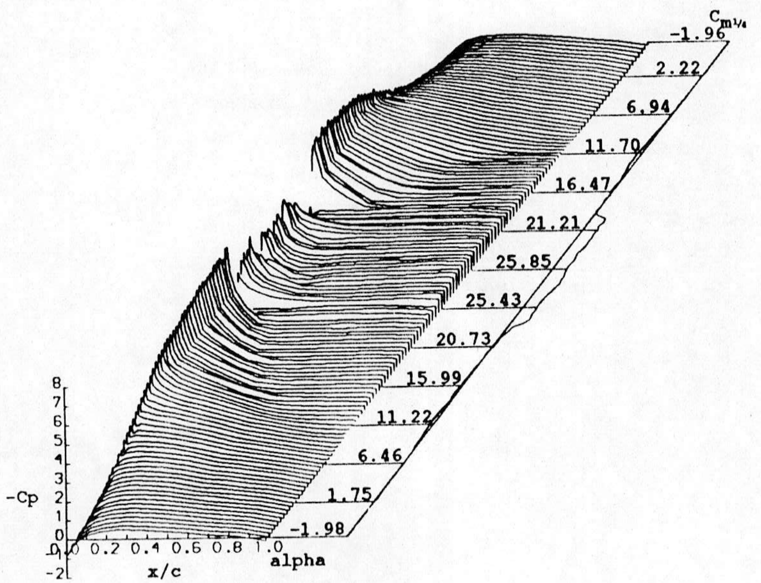
DATE OF TEST: 6/11/91

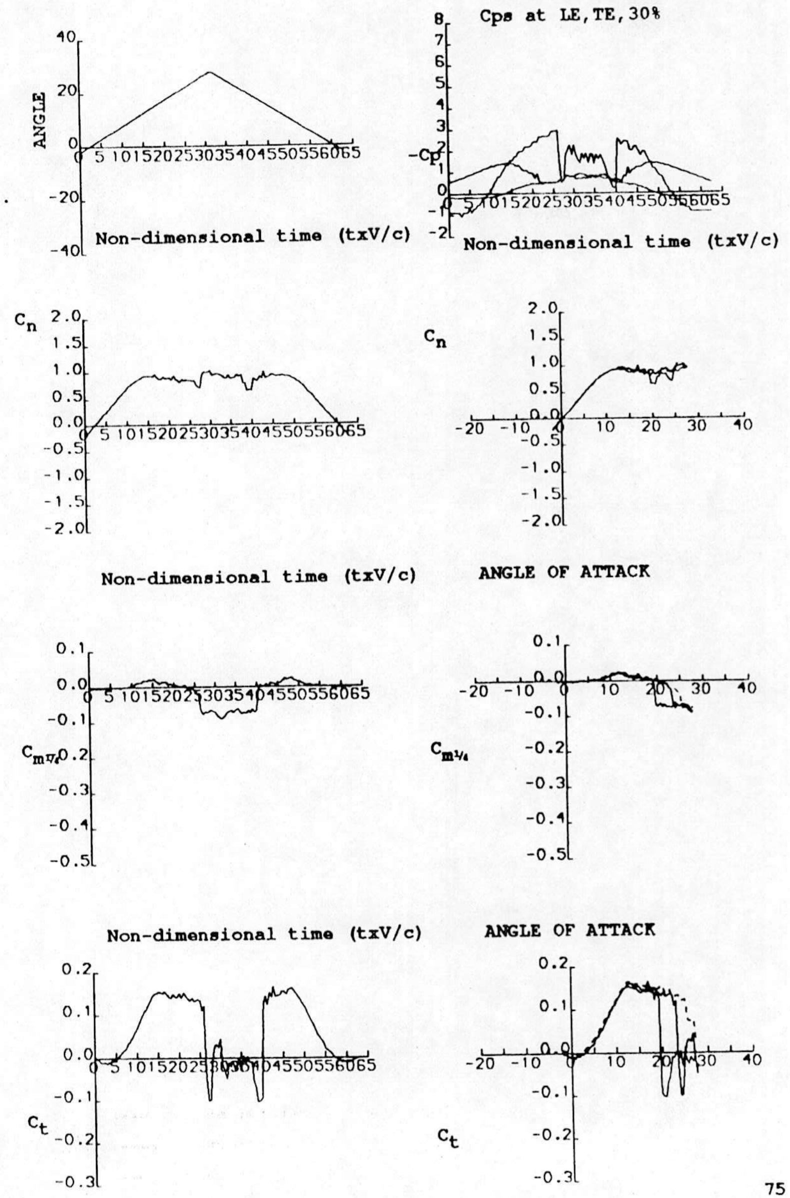
MACH NUMBER = 0.080

AIR TEMPERATURE = 14.0°C

SAMPLING FREQUENCY = 100.00 Hz.

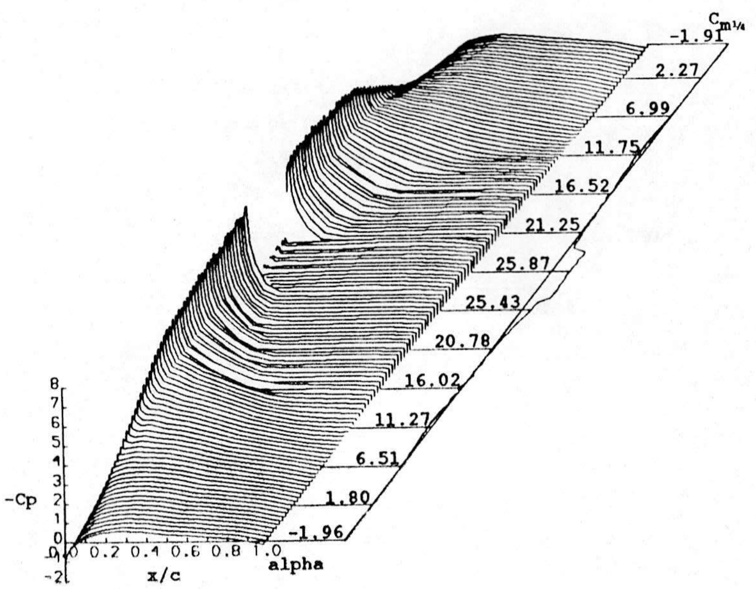
AVERAGED DATA OF 1 CYCLES

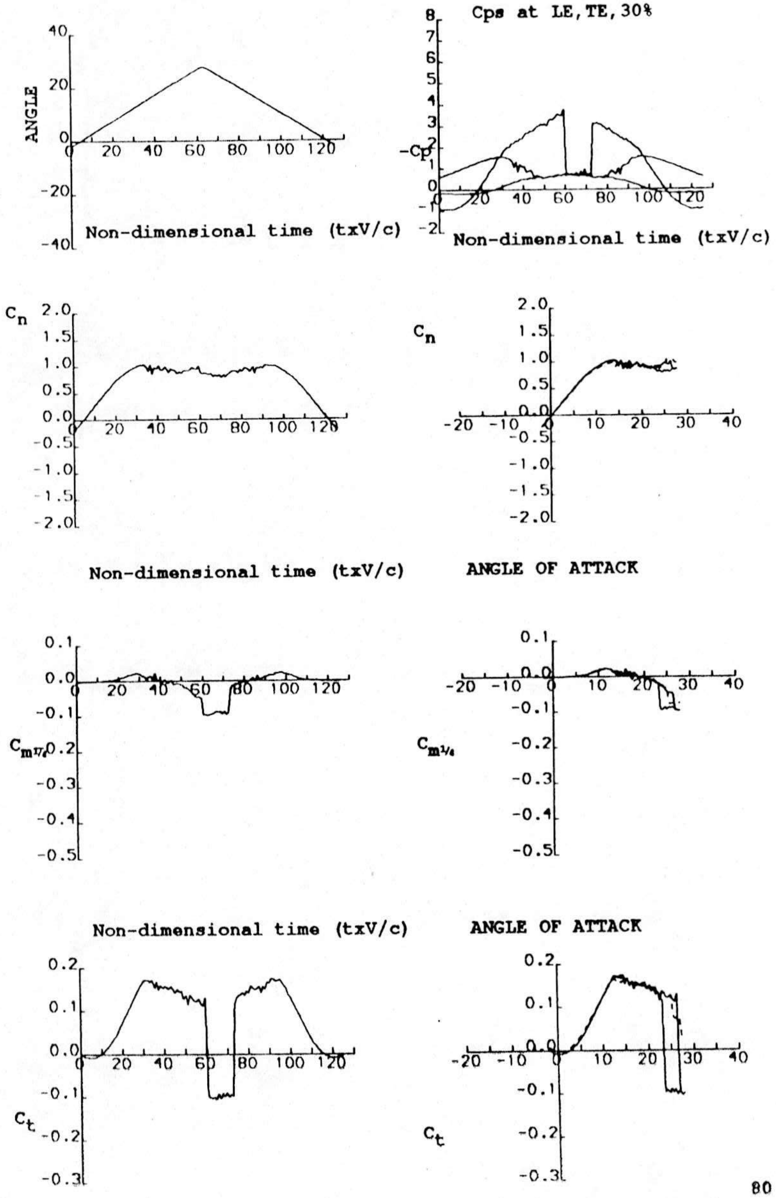




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 801	DATE OF TEST: 6/11/91
REYNOLDS NUMBER = 2057753.	MACH NUMBER = 0.160
DYNAMIC PRESSURE = 1801.81 Nm^{-2}	AIR TEMPERATURE = 16.7°C
NUMBER OF CYCLES = 1	SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC	AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 1681

REYNOLDS NUMBER = 1527842.

DYNAMIC PRESSURE = 1024.52 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

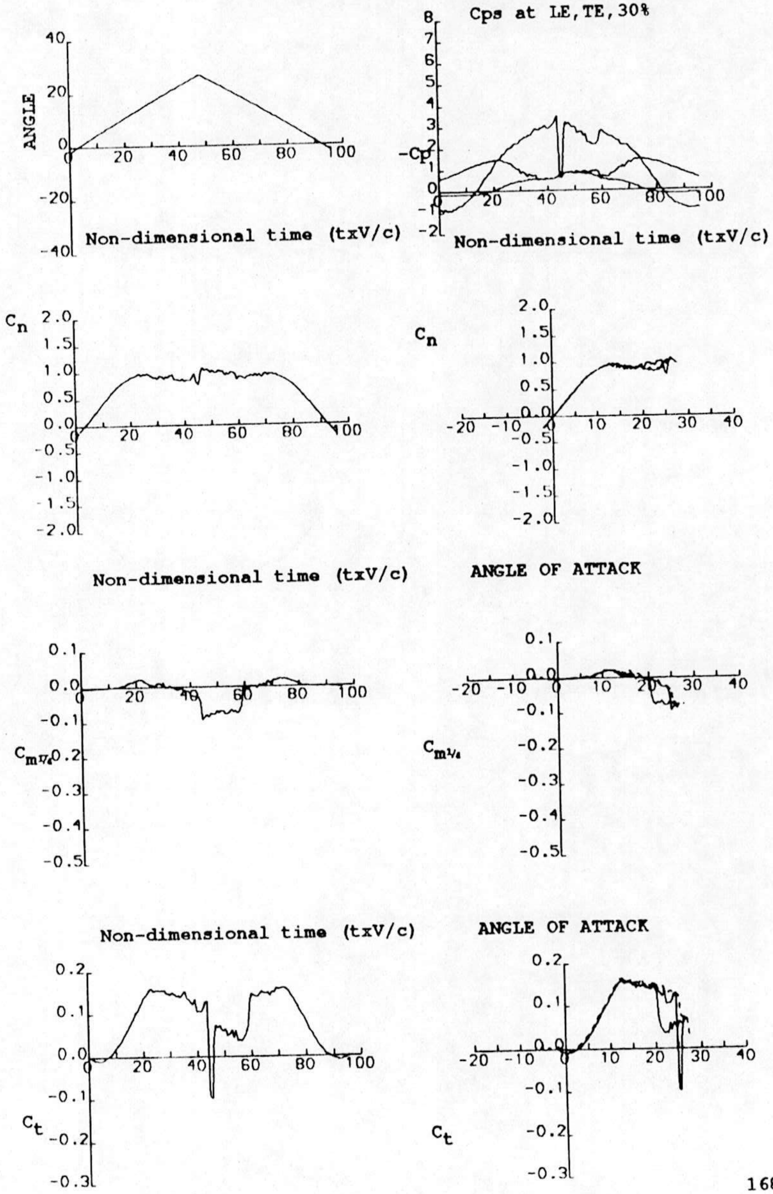
DATE OF TEST: 7/11/91

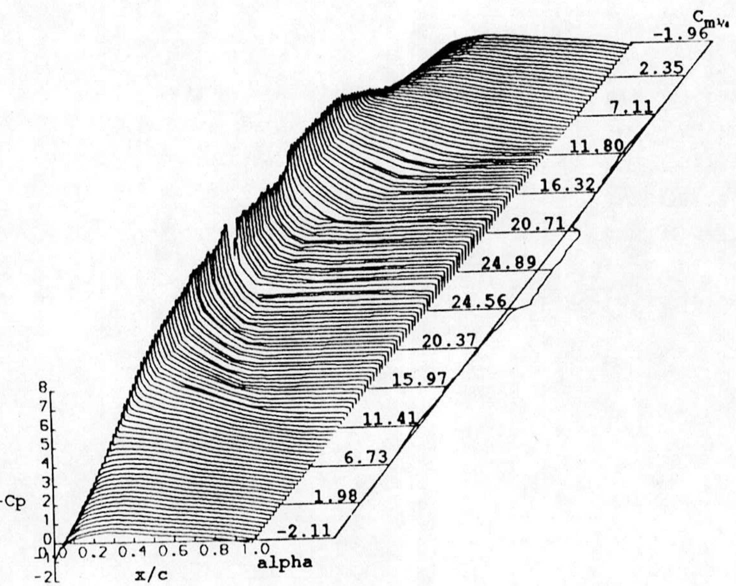
MACH NUMBER = 0.121

AIR TEMPERATURE = 19.3°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 3541

REYN LDS NUMBER = 1100086.

DYNAMIC PRESSURE = 489.62 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

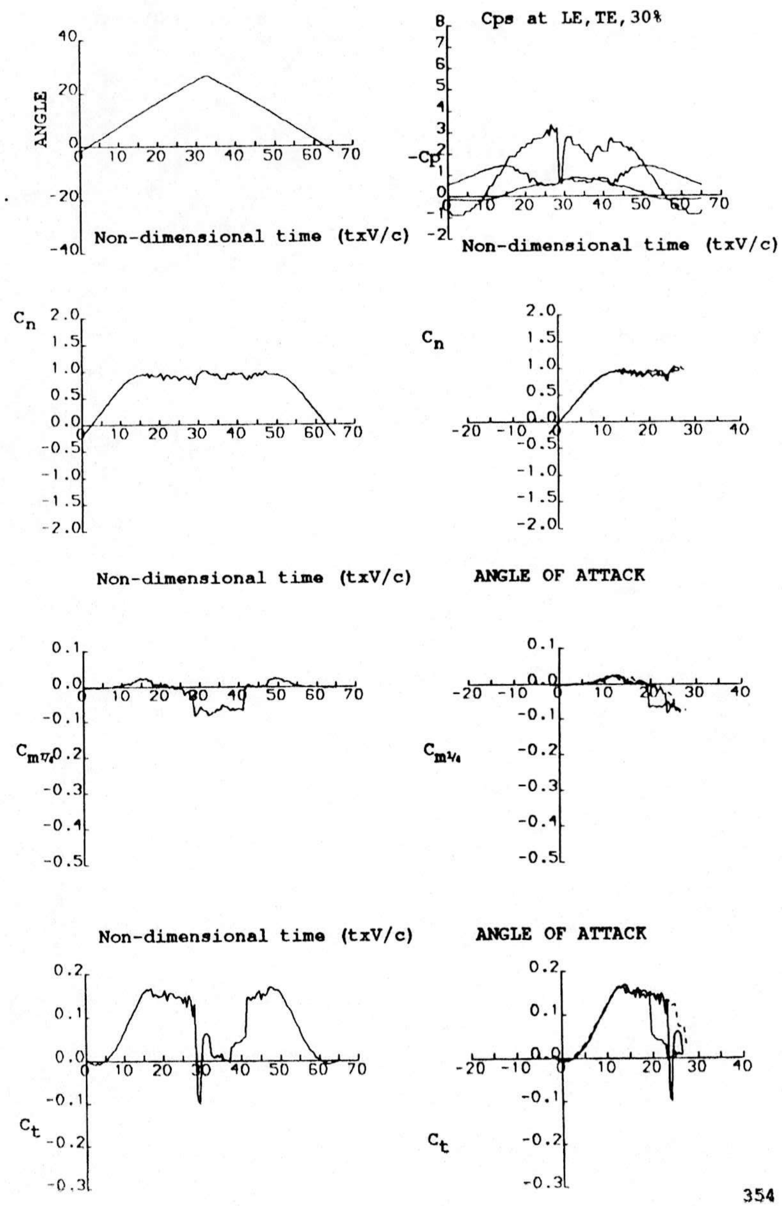
DATE OF TEST: 10/11/91

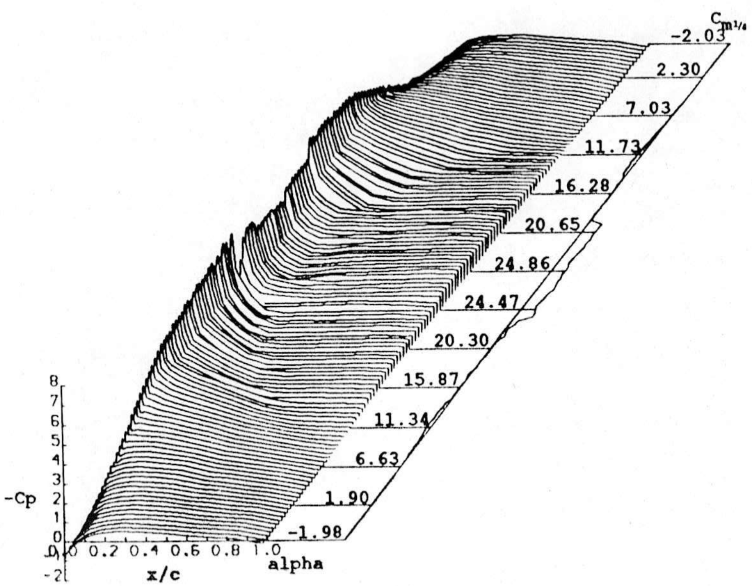
MACH NUMBER = 0.084

AIR TEMPERATURE = 10.5°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 3711

REYNOLDS NUMBER = 1588319.

DYNAMIC PRESSURE = 1040.48 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

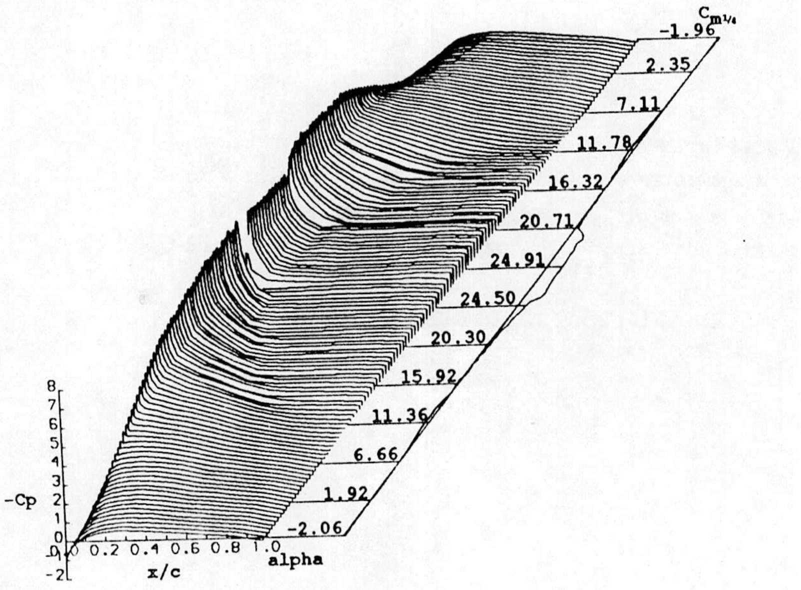
DATE OF TEST: 10/11/91

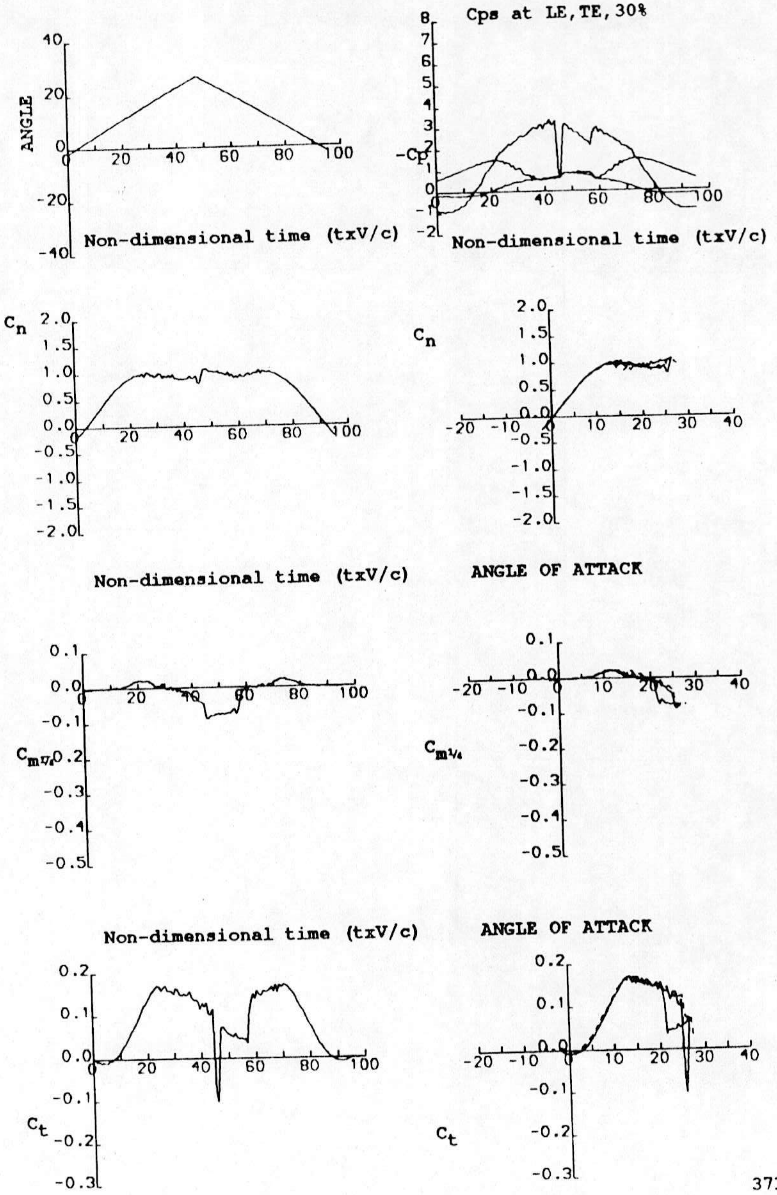
MACH NUMBER = 0.122

AIR TEMPERATURE = 12.4°C

SAMPLING FREQUENCY = 100.00 Hz.

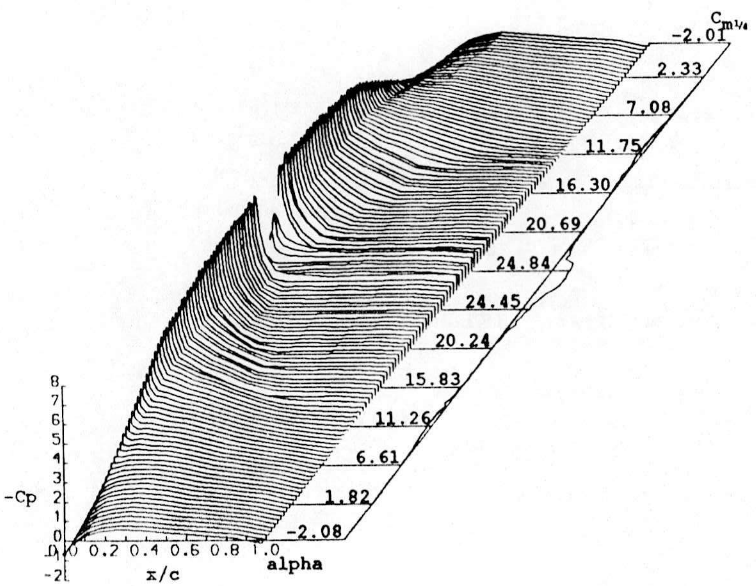
AVERAGED DATA OF 1 CYCLES

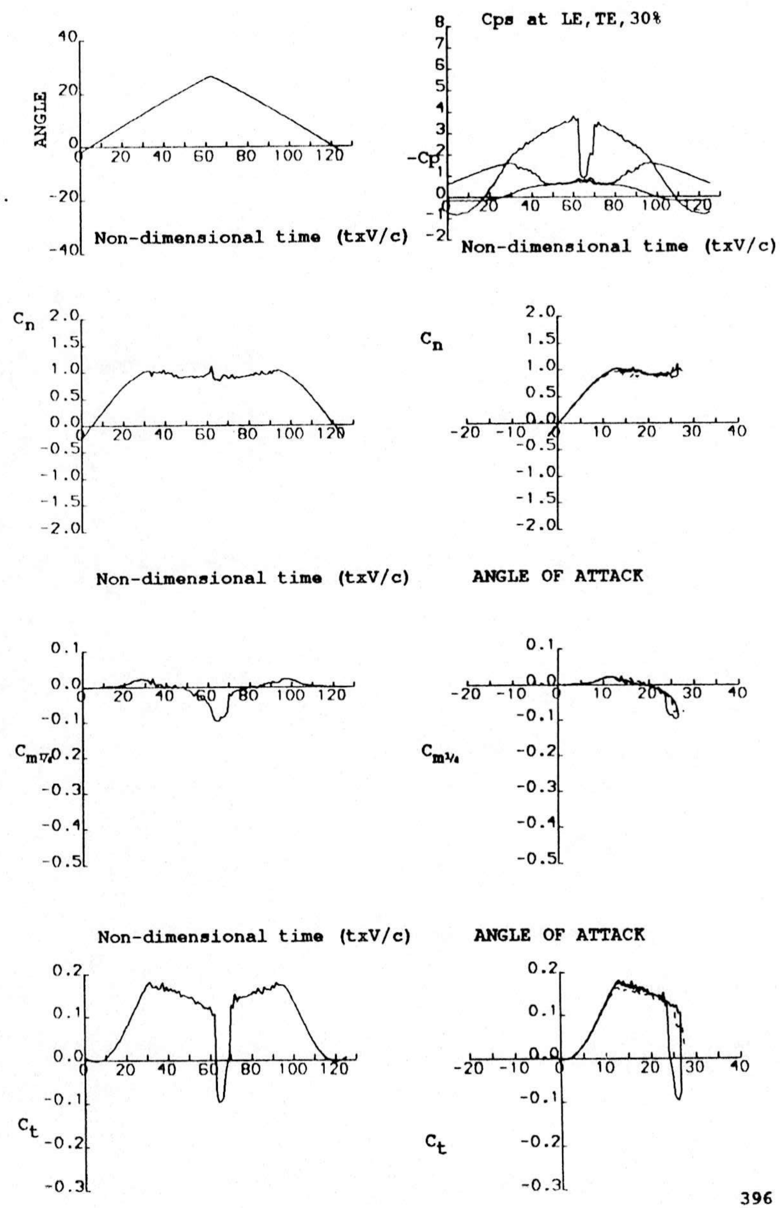




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 3961	DATE OF TEST: 11/11/91
REYNOLDS NUMBER = 2023112.	MACH NUMBER = 0.159
DYNAMIC PRESSURE = 1768.50 Nm^{-2}	AIR TEMPERATURE = 17.3°C
NUMBER OF CYCLES = 1	SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC	AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 4131

REYNOLDS NUMBER = 867139.

DYNAMIC PRESSURE = 334.47 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

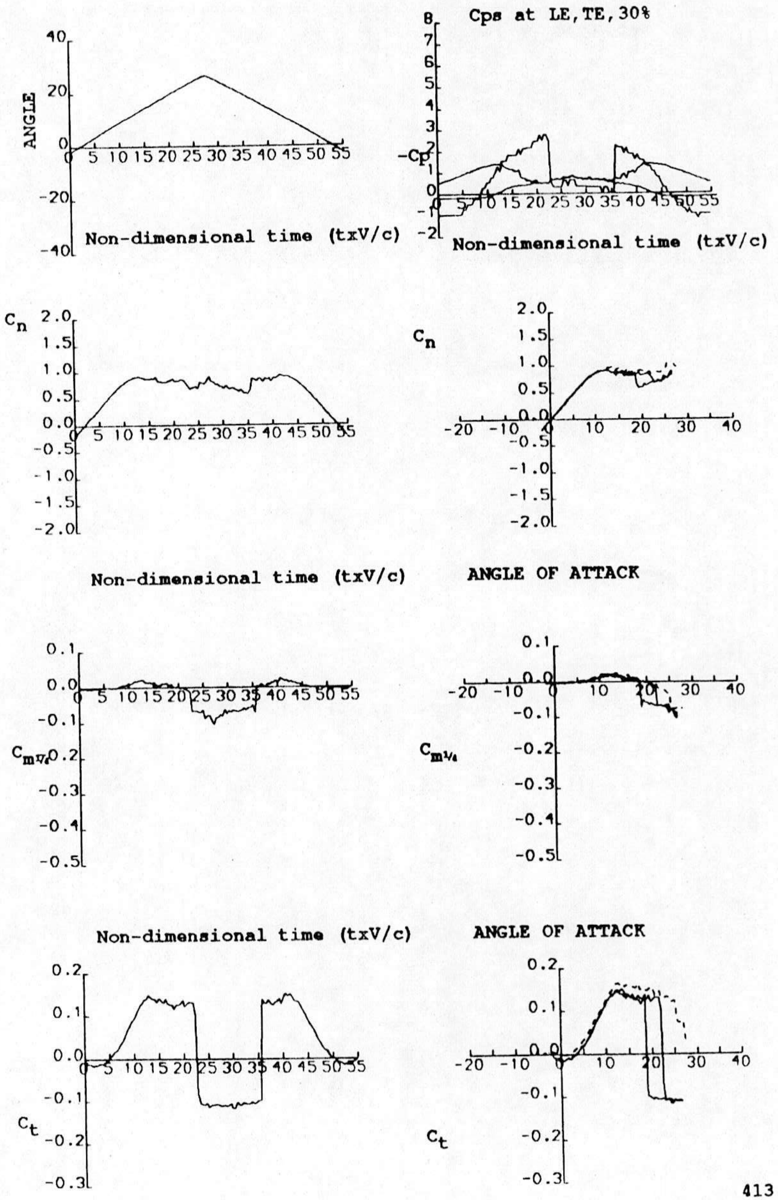
DATE OF TEST: 11/11/91

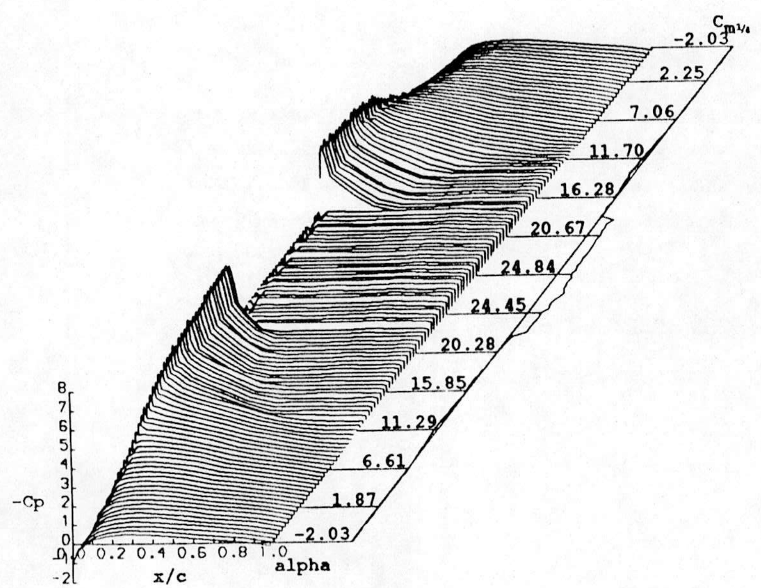
MACH NUMBER = 0.069

AIR TEMPERATURE = 20.6°C

SAMPLING FREQUENCY = 100.00 Hz.

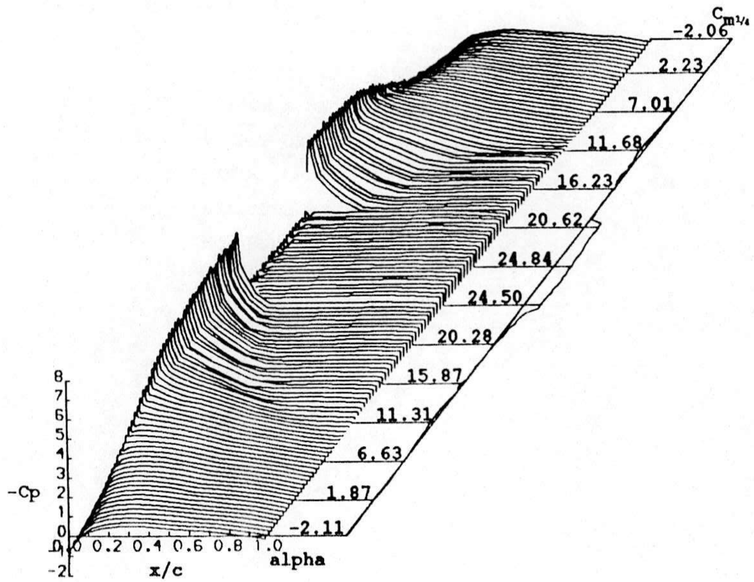
AVERAGED DATA OF 1 CYCLES

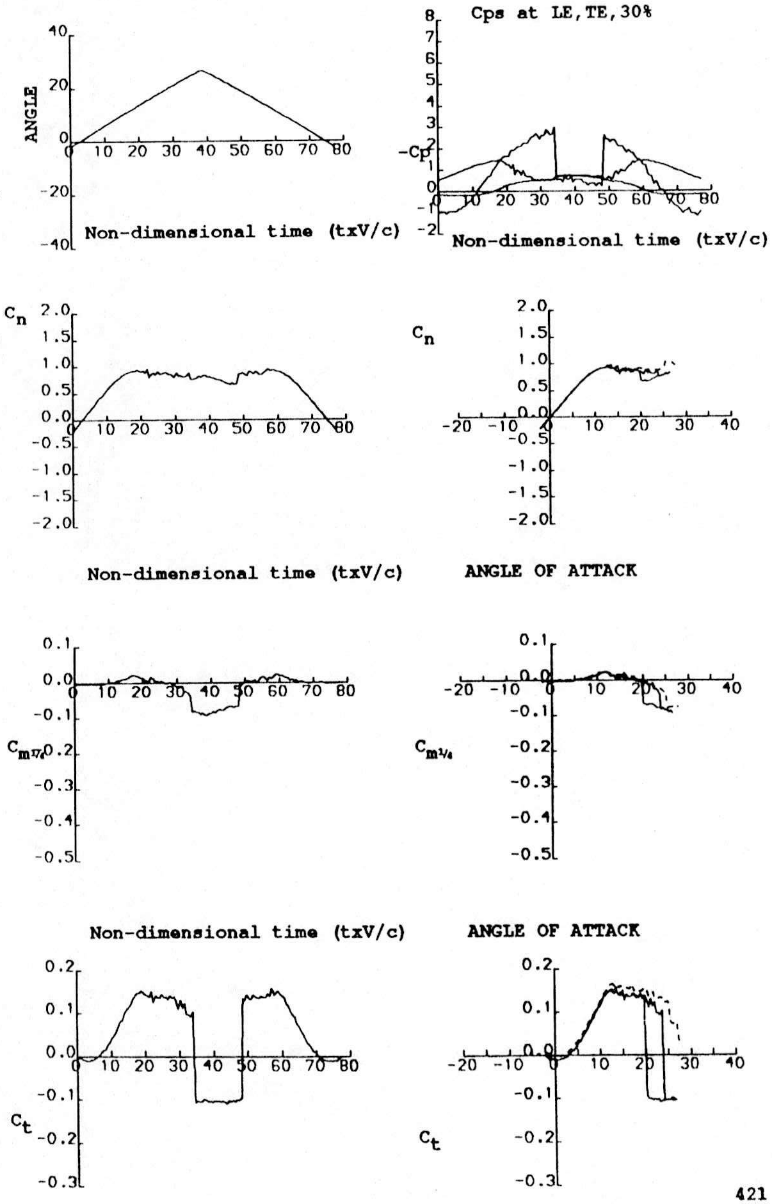




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 4211	DATE OF TEST: 11/11/91
REYNOLDS NUMBER = 1213984.	MACH NUMBER = 0.097
DYNAMIC PRESSURE = 659.00 Nm^{-2}	AIR TEMPERATURE = 21.2°C
NUMBER OF CYCLES = 1	SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC	AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 4291

REYNOLDS NUMBER = 1631961.

DYNAMIC PRESSURE = 1191.95 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

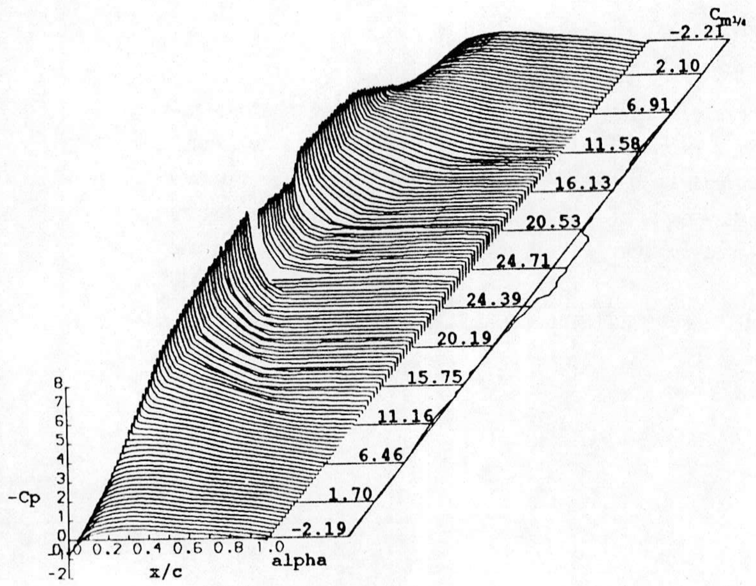
DATE OF TEST: 11/11/91

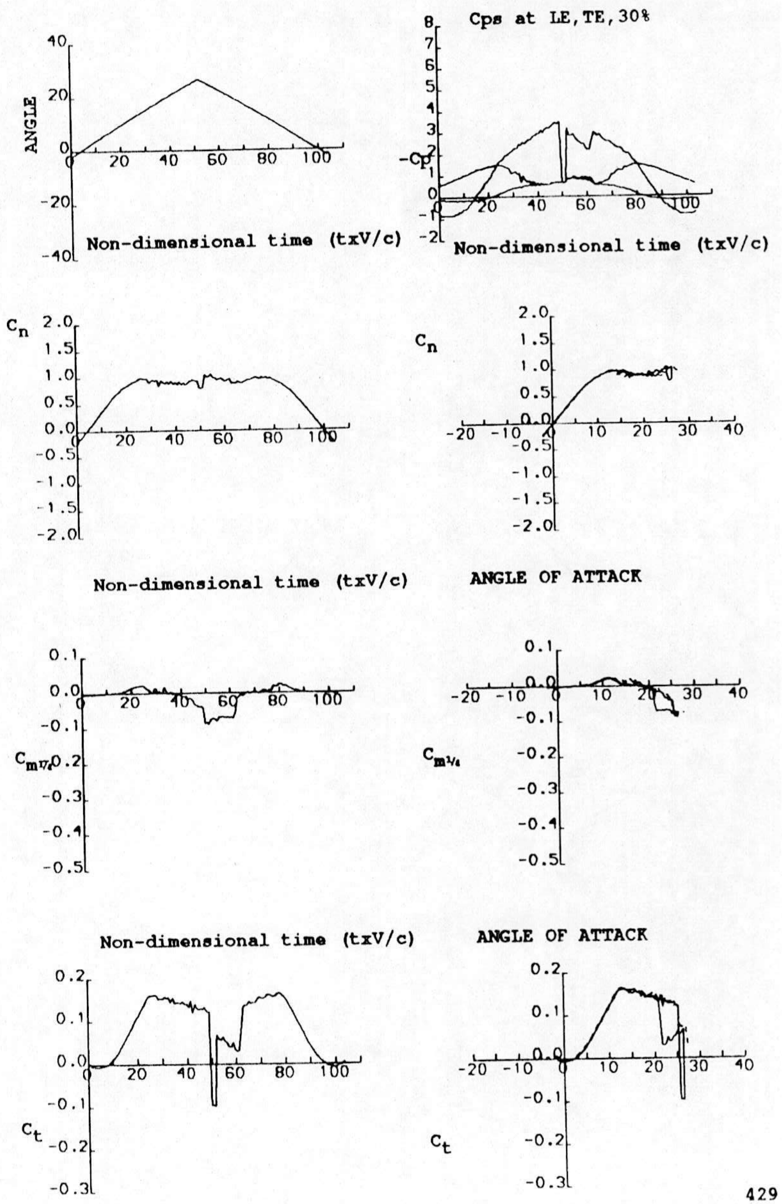
MACH NUMBER = 0.131

AIR TEMPERATURE = 21.3°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 4371

REYNOLDS NUMBER = 2083481.

DYNAMIC PRESSURE = 1898.44 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

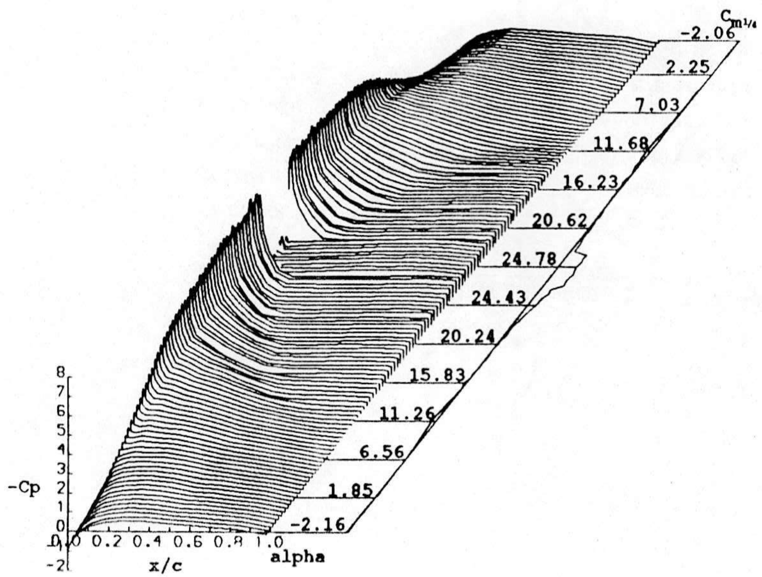
DATE OF TEST: 12/11/91

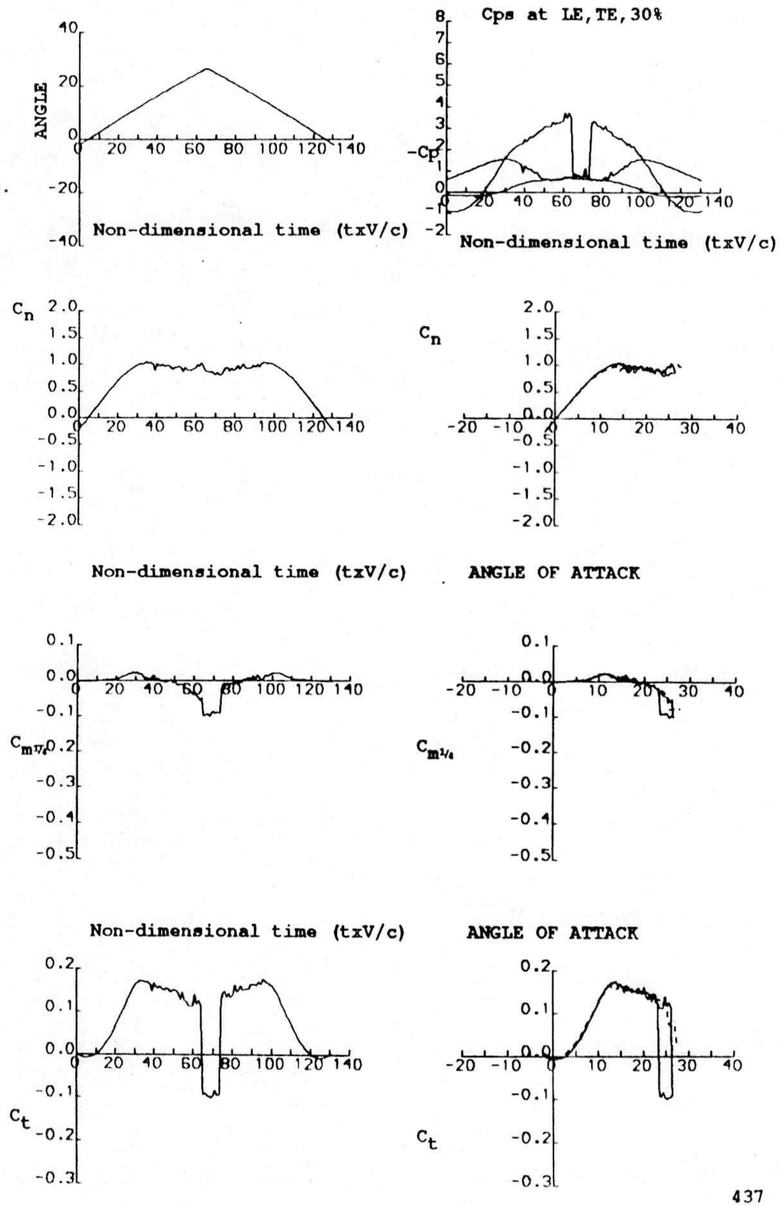
MACH NUMBER = 0.166

AIR TEMPERATURE = 17.3°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 4801

REYNOLDS NUMBER = 860708.

DYNAMIC PRESSURE = 331.45 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

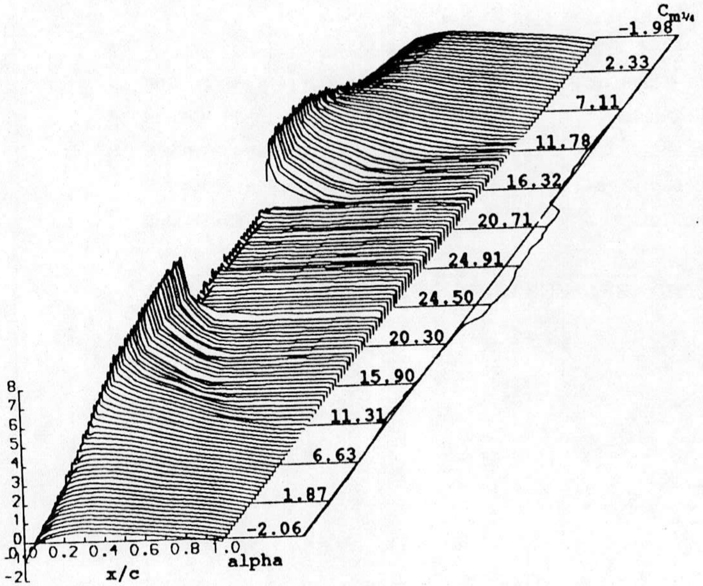
DATE OF TEST: 12/11/91

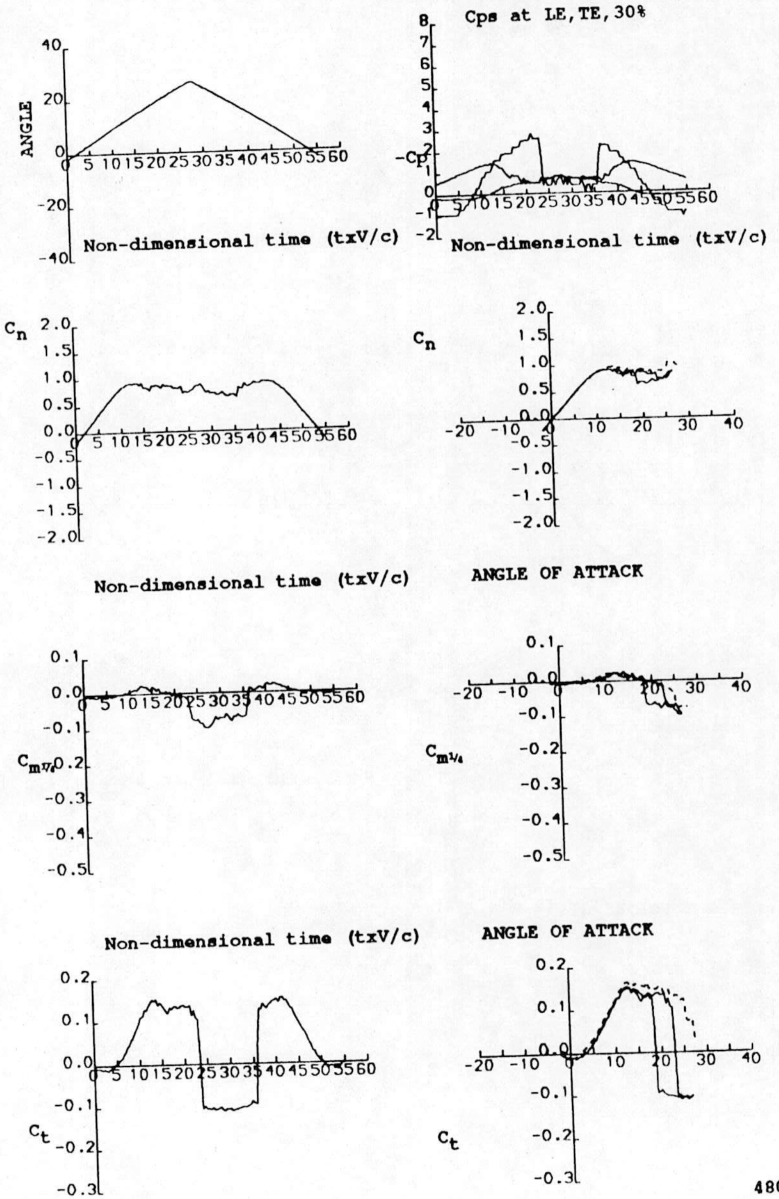
MACH NUMBER = 0.070

AIR TEMPERATURE = 18.8°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 4881

REYNOLDS NUMBER = 1200616.

DYNAMIC PRESSURE = 655.01 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

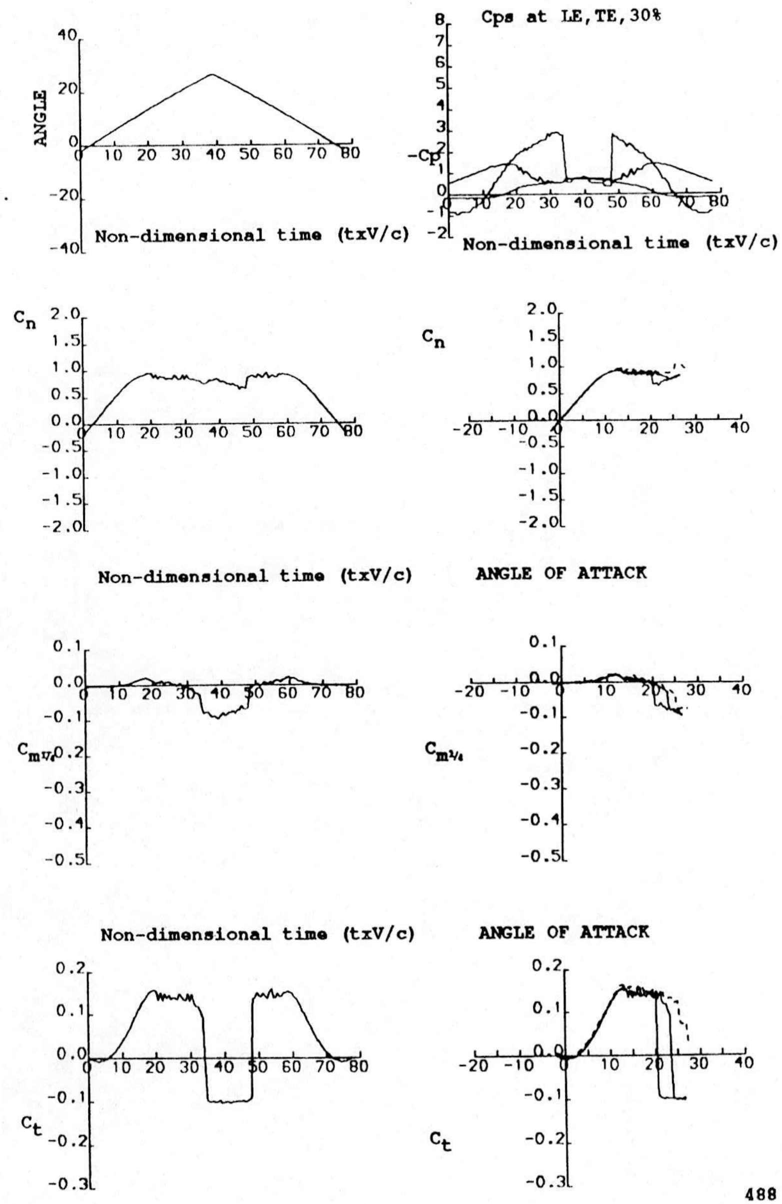
DATE OF TEST: 13/11/91

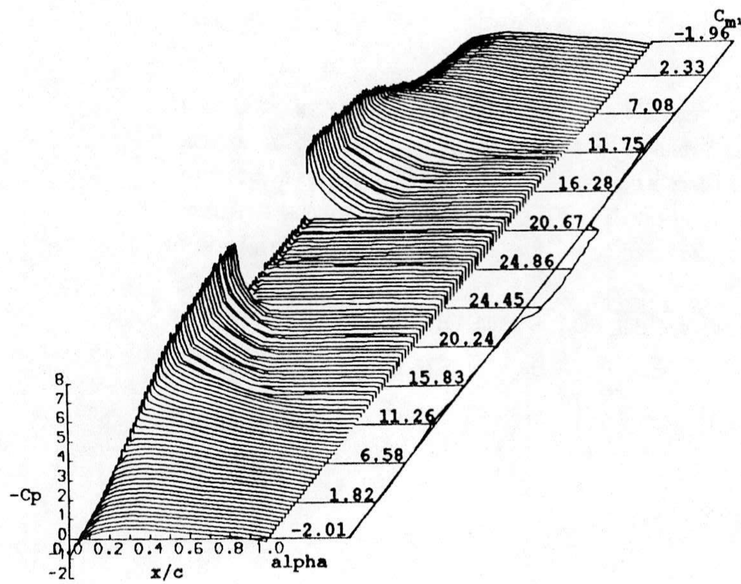
MACH NUMBER = 0.098

AIR TEMPERATURE = 20.8°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 5031

REYNOLDS NUMBER = 2087112.

DYNAMIC PRESSURE = 2096.46 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

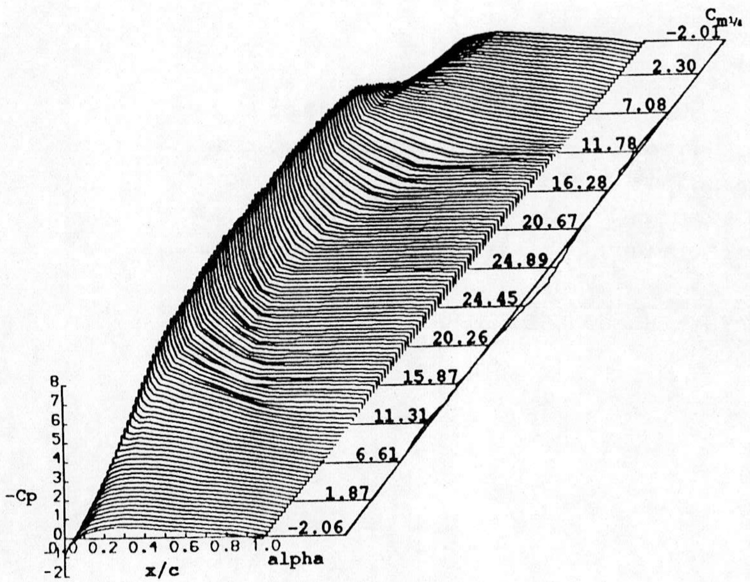
DATE OF TEST: 13/11/91

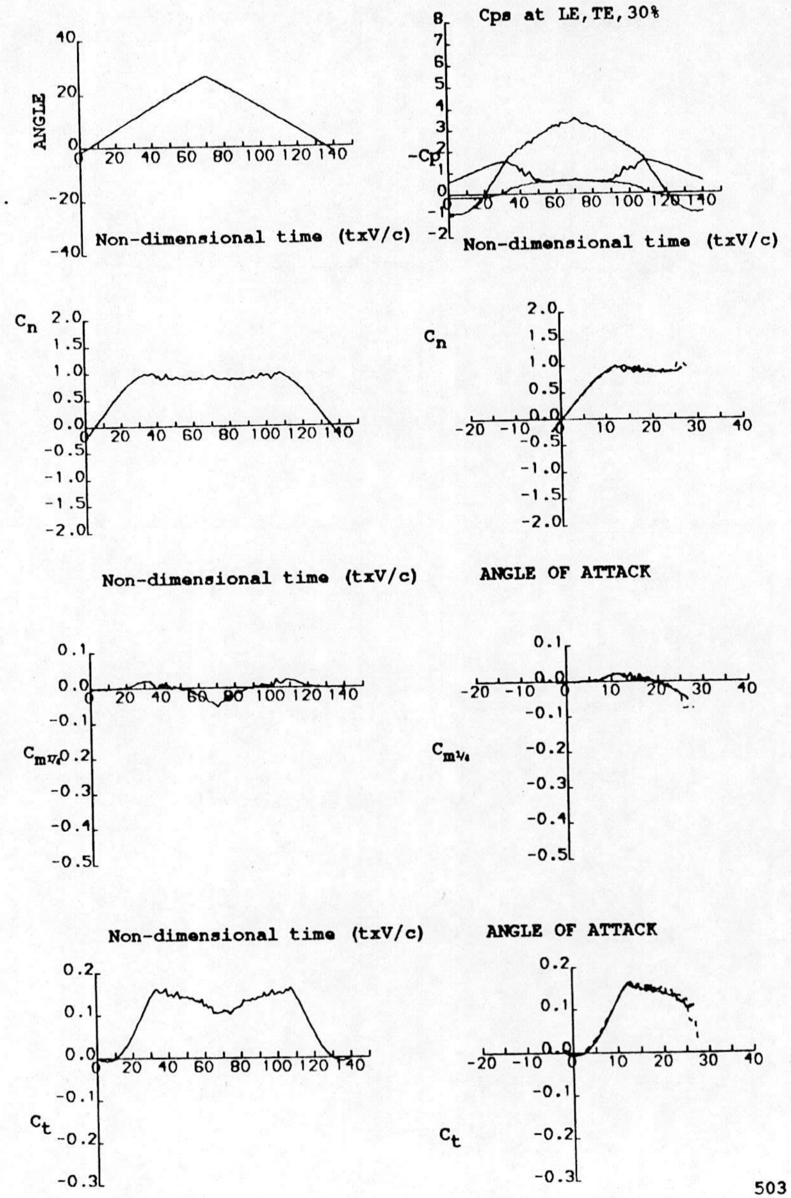
MACH NUMBER = 0.175

AIR TEMPERATURE = 27.3°C

SAMPLING FREQUENCY = 100.00 Hz.

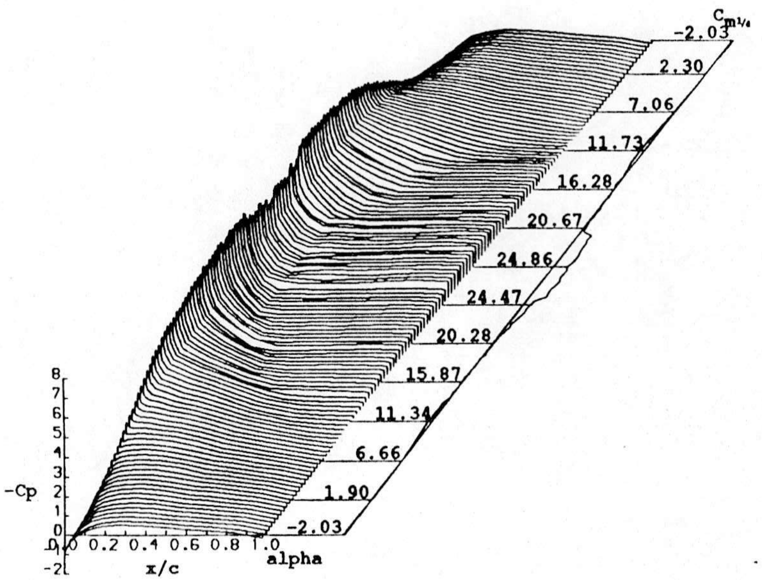
AVERAGED DATA OF 1 CYCLES

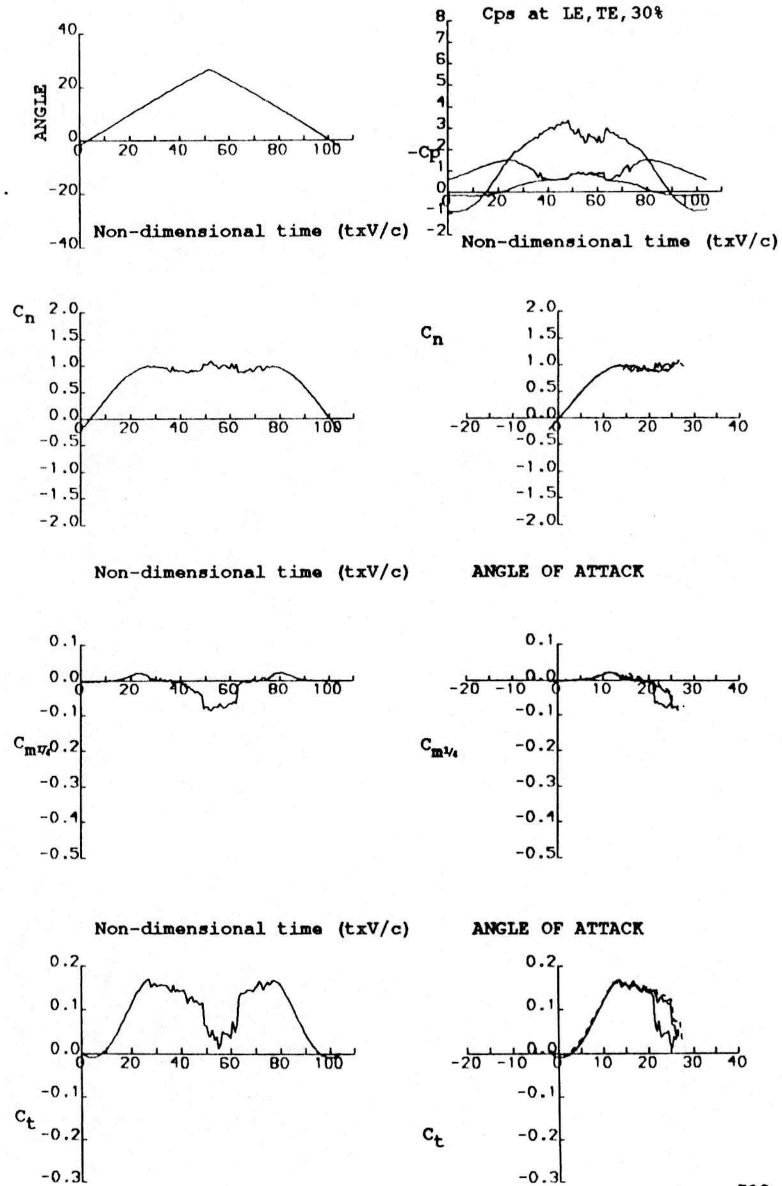




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 5181	DATE OF TEST: 14/11/91
REYNOLDS NUMBER = 1661090.	MACH NUMBER = 0.132
DYNAMIC PRESSURE = 1205.29 Nm^{-2}	AIR TEMPERATURE = 16.9°C
NUMBER OF CYCLES = 1	SAMPLING FREQUENCY = 100.00 Hz.
MOTION TYPE: STATIC	AVERAGED DATA OF 1 CYCLES





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 805541

REYNOLDS NUMBER = 1567557.

DYNAMIC PRESSURE = 1059.48 Nm^{-2}

NUMBER OF CYCLES = 1

MOTION TYPE: STATIC

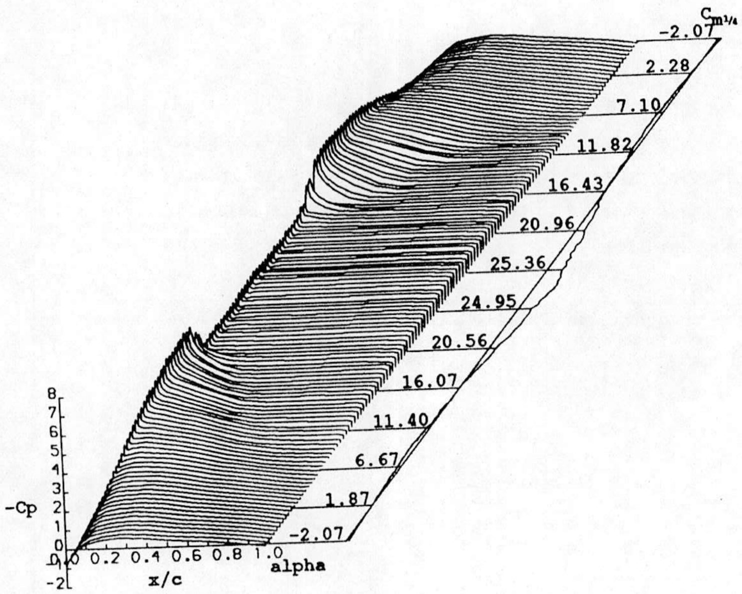
DATE OF TEST: 4/1/92

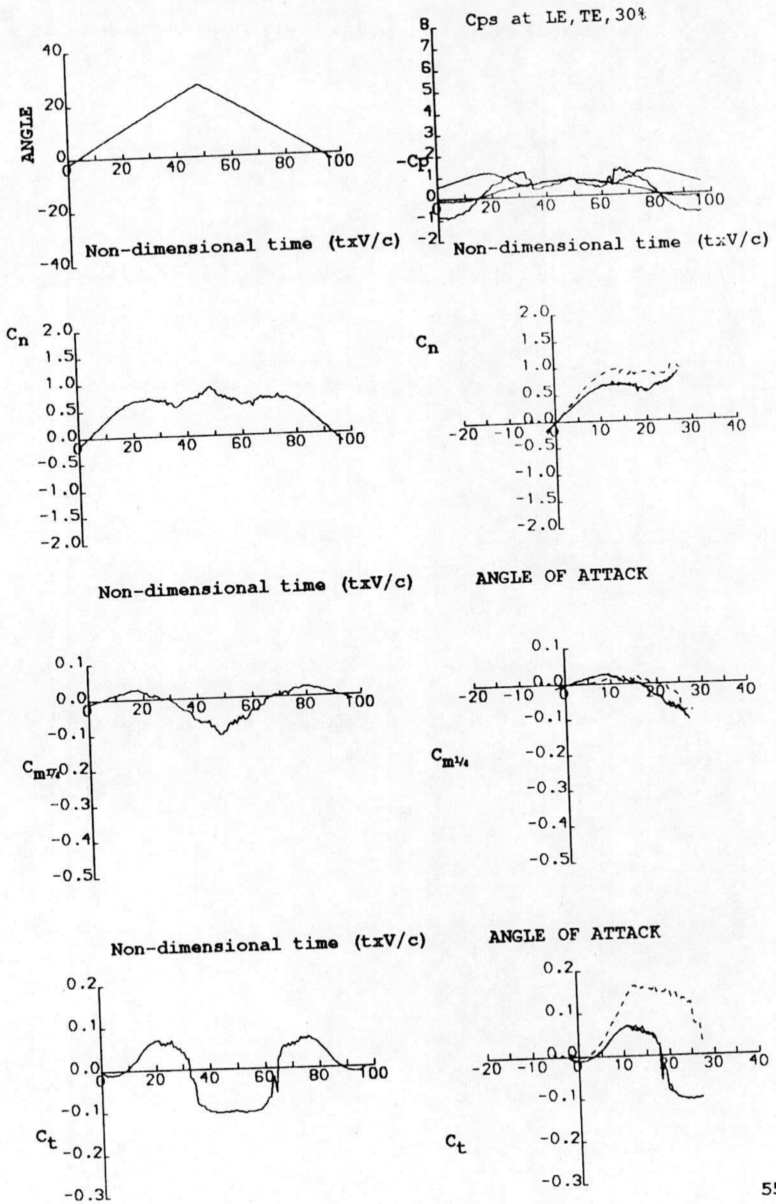
MACH NUMBER = 0.122

AIR TEMPERATURE = 18.6°C

SAMPLING FREQUENCY = 100.00 Hz.

AVERAGED DATA OF 1 CYCLES

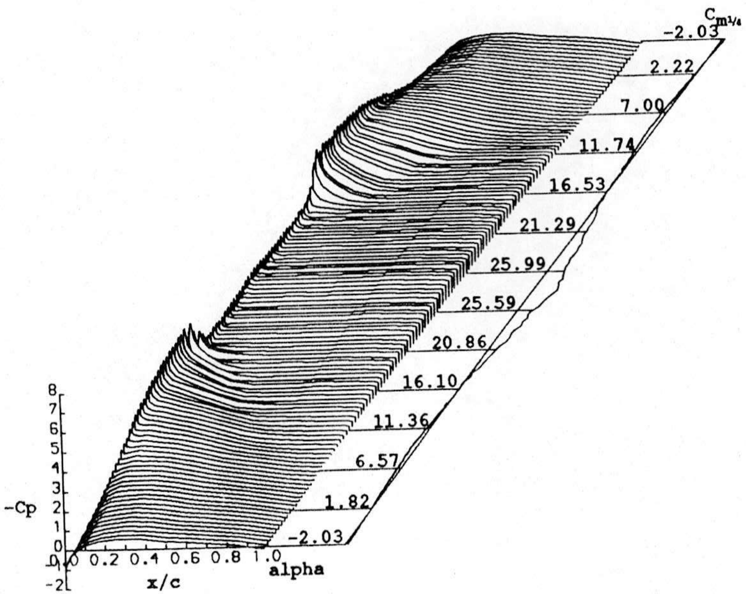


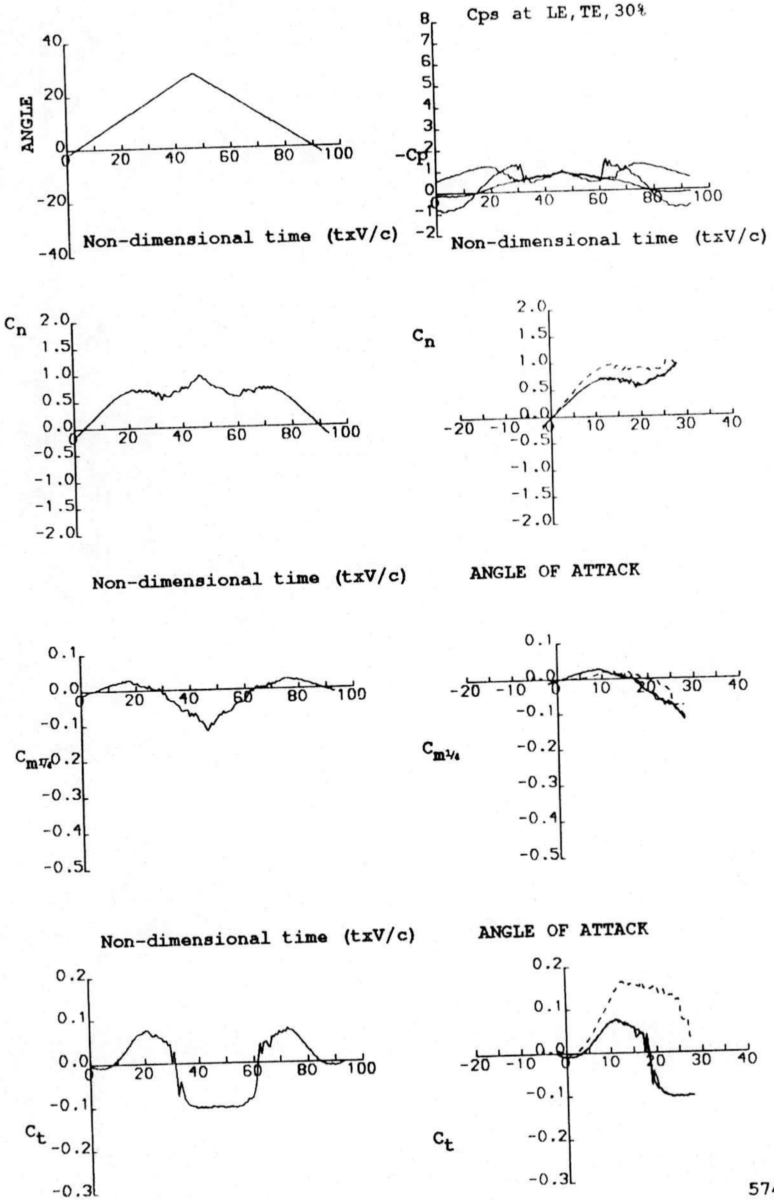


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 805741
REYNOLDS NUMBER = 1530799.
DYNAMIC PRESSURE = 994.80 Nm^{-2}
NUMBER OF CYCLES = 1
MOTION TYPE: STATIC

DATE OF TEST: 5/1/92
MACH NUMBER = 0.118
AIR TEMPERATURE = 17.4°C
SAMPLING FREQUENCY = 100.00 Hz.
AVERAGED DATA OF 1 CYCLES





G.U. Aero Report 9214

UNIVERSITY OF GLASGOW

DEPARTMENT OF AEROSPACE ENGINEERING

PRESSURE DATA FROM

OSCILLATORY EXPERIMENTS

DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14141

REYNOLDS NUMBER = 869347.

DYNAMIC PRESSURE = 335.88 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

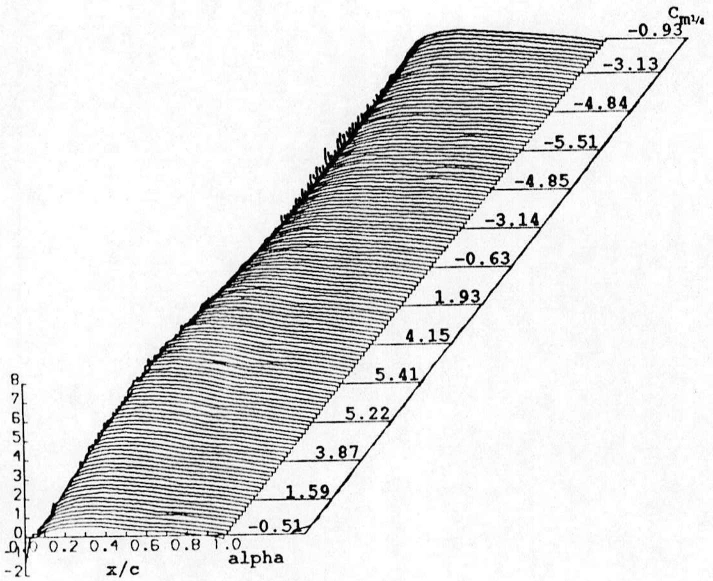
MACH NUMBER = 0.069

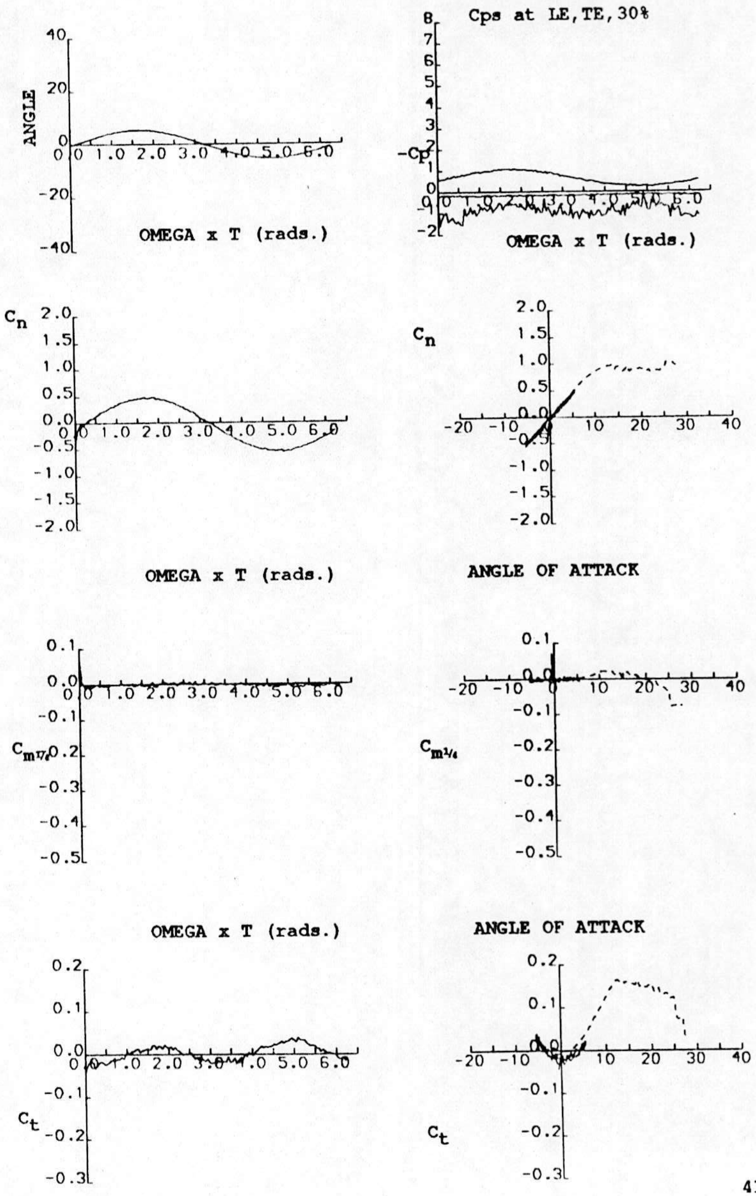
AIR TEMPERATURE = 20.5°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54811

REYNOLDS NUMBER = 863195.

DYNAMIC PRESSURE = 334.25 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

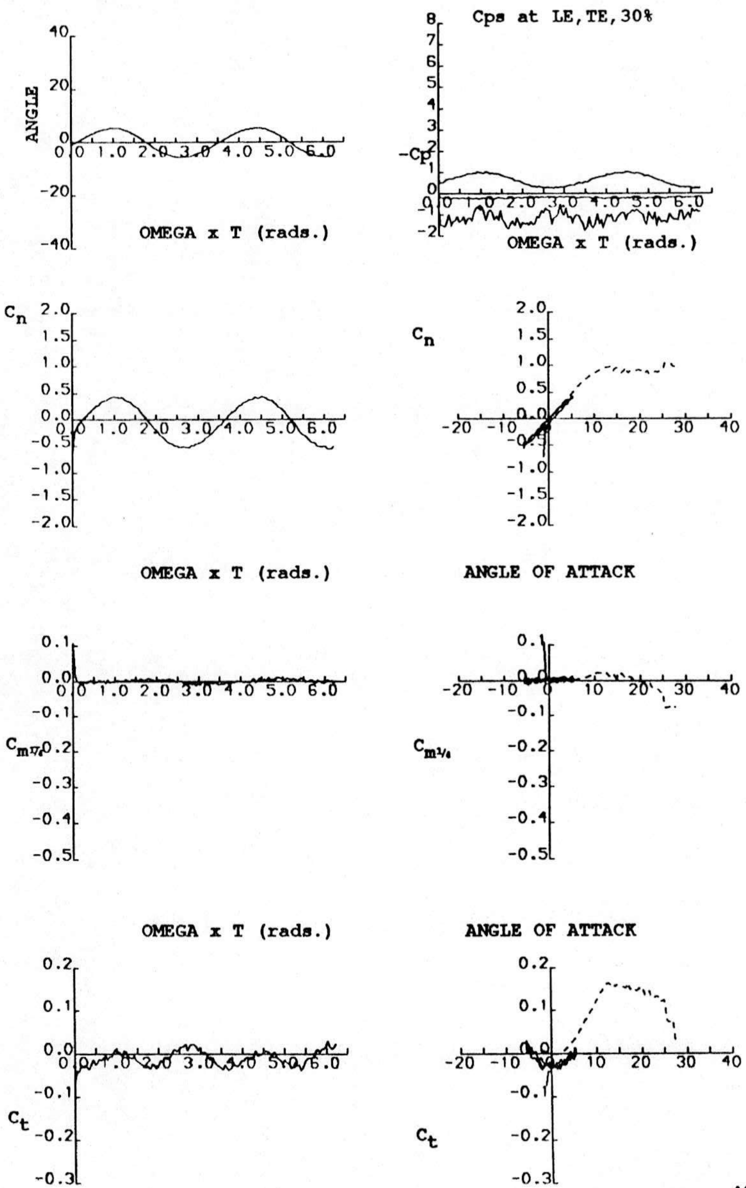
MACH NUMBER = 0.070

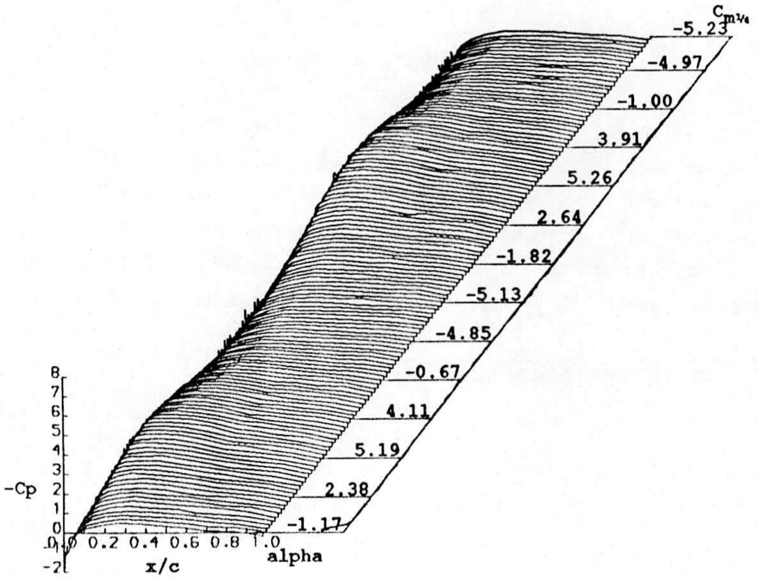
AIR TEMPERATURE = 19.1°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 5.40°

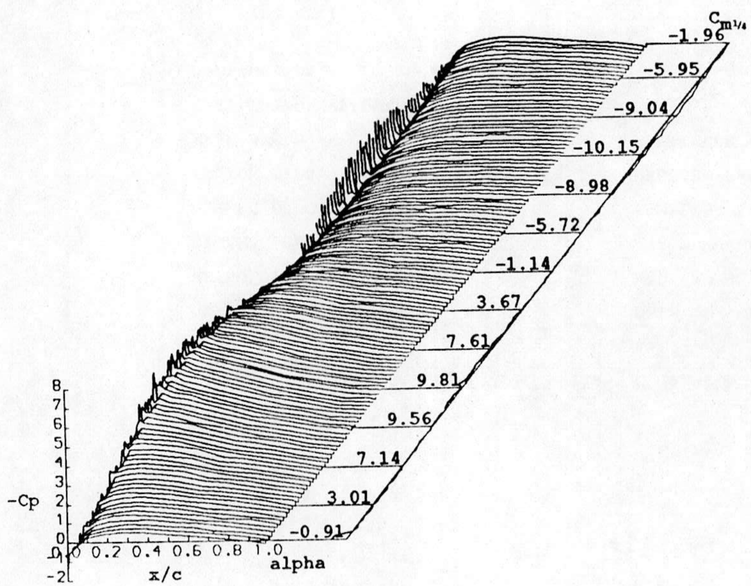


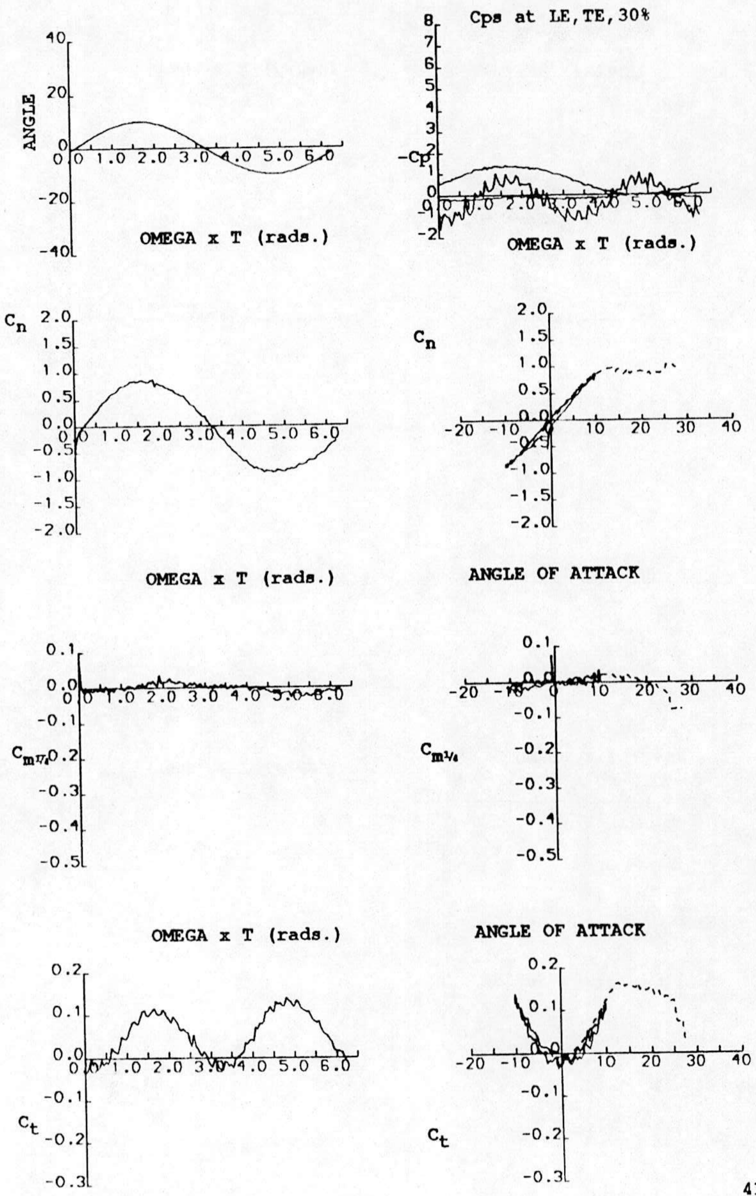


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14151
REYNOLDS NUMBER = 868967.
DYNAMIC PRESSURE = 335.88 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.650 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91
MACH NUMBER = 0.069
AIR TEMPERATURE = 20.6°C
SAMPLING FREQUENCY = 83.20 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54821

REYNOLDS NUMBER = 862816.

DYNAMIC PRESSURE = 334.25 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

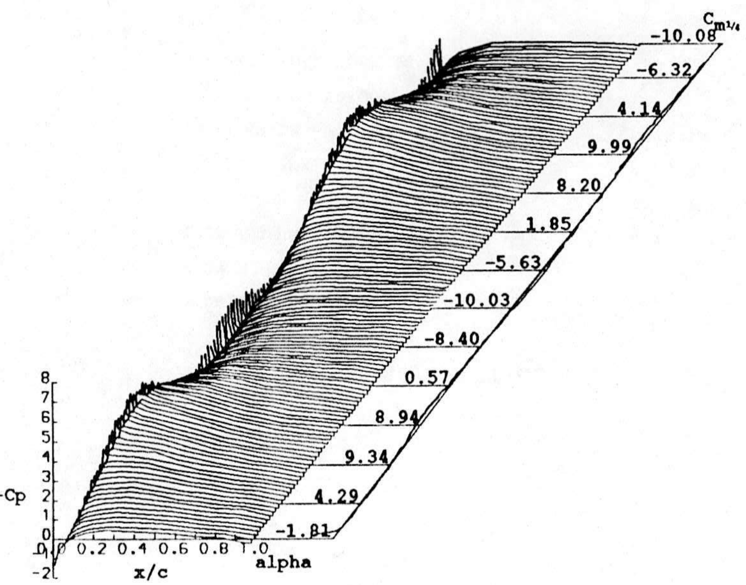
MACH NUMBER = 0.070

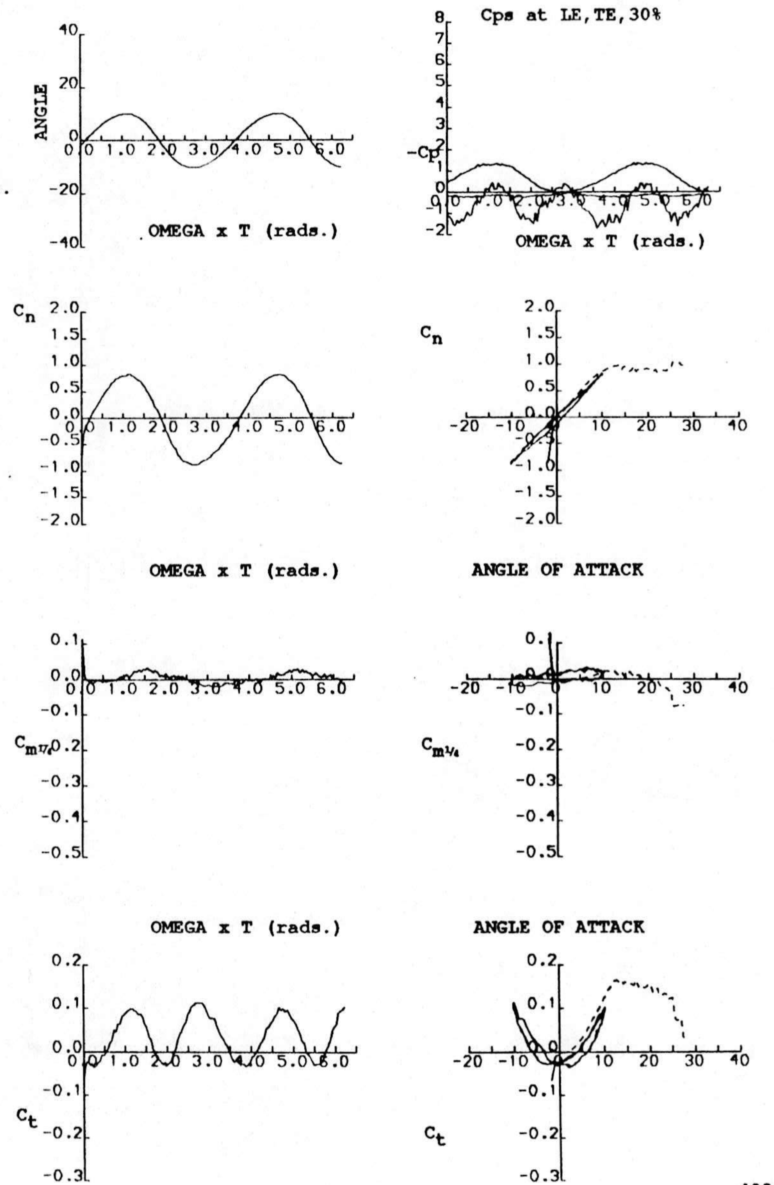
AIR TEMPERATURE = 19.2°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14161

REYNOLDS NUMBER = 868967.

DYNAMIC PRESSURE = 335.88 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

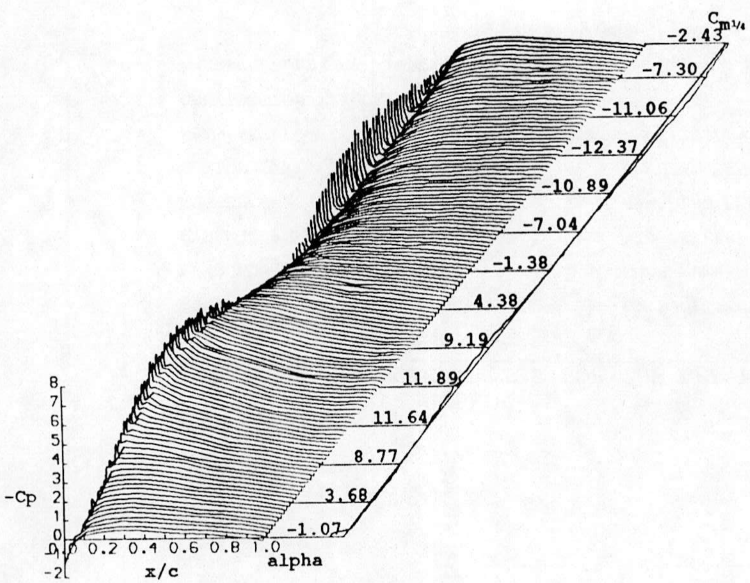
MACH NUMBER = 0.069

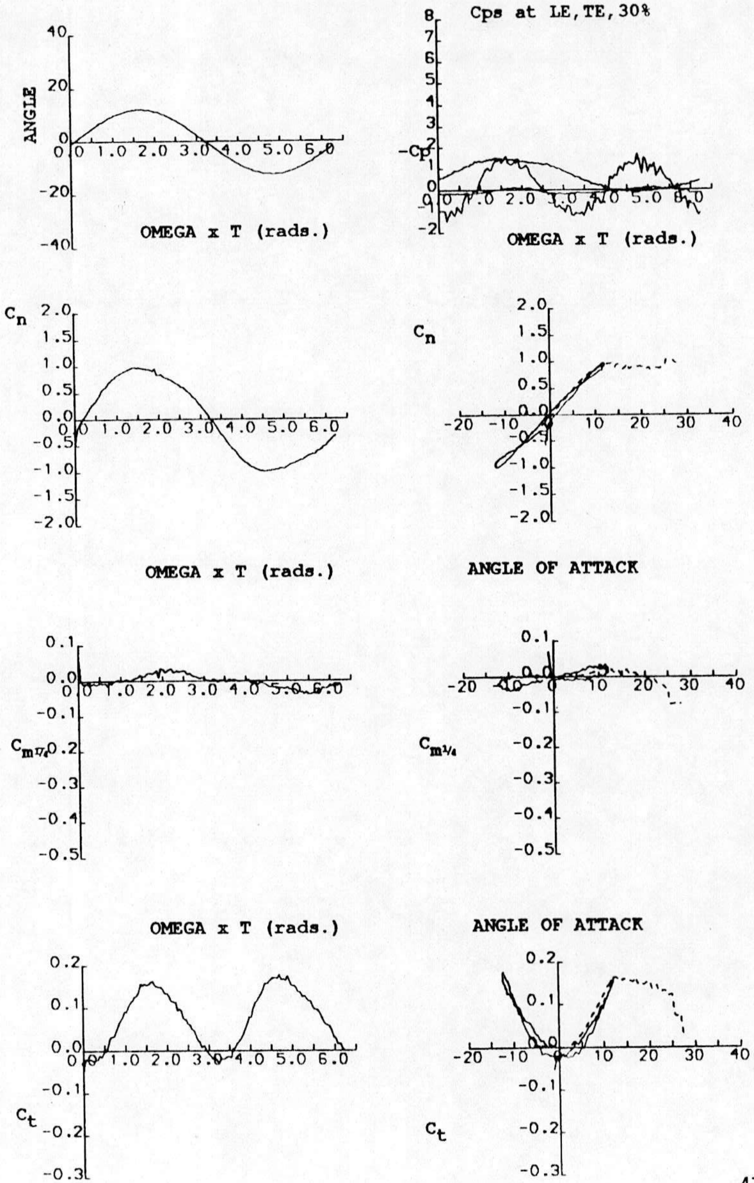
AIR TEMPERATURE = 20.6°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

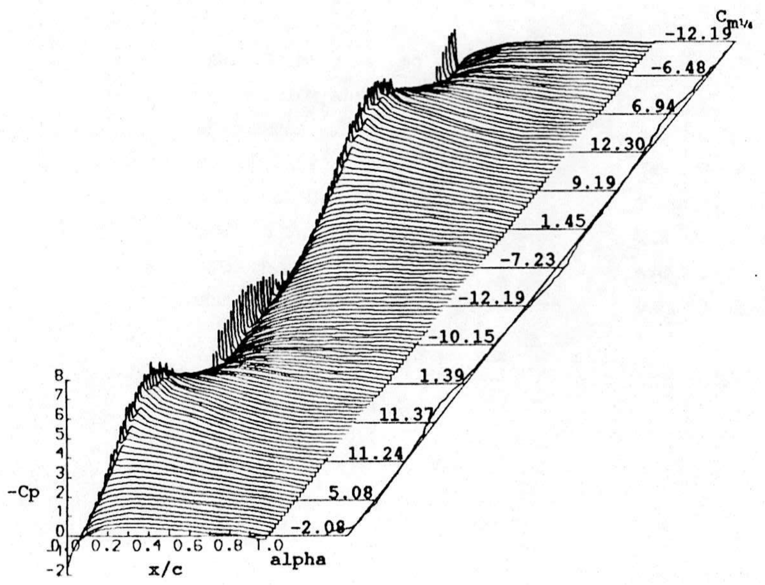
AMPLITUDE = 12.20°

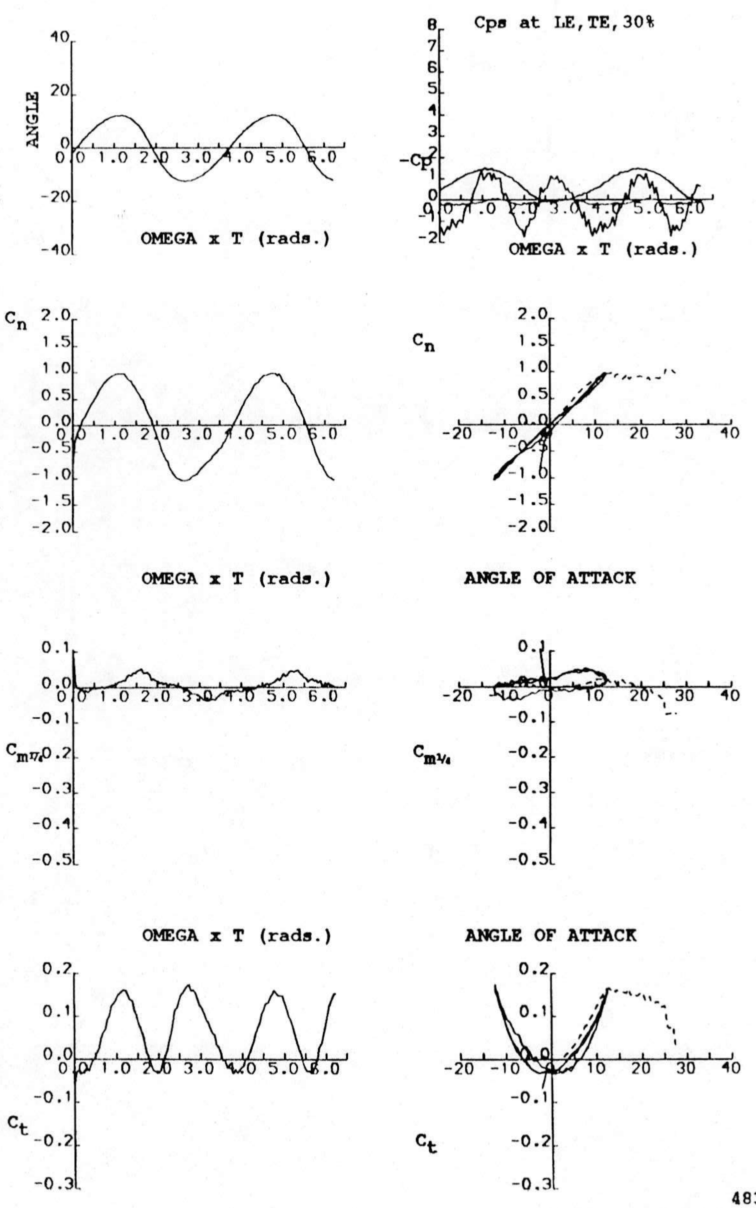




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54831	DATE OF TEST: 12/11/91
REYNOLDS NUMBER = 862057.	MACH NUMBER = 0.070
DYNAMIC PRESSURE = 334.25 Nm^{-2}	AIR TEMPERATURE = 19.4°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 83.20 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.047
MEAN ANGLE = 0.00°	AMPLITUDE = 12.20°
OSCILLATION FREQUENCY = 0.650 Hz.	
AVERAGED DATA OF 10 CYCLES	

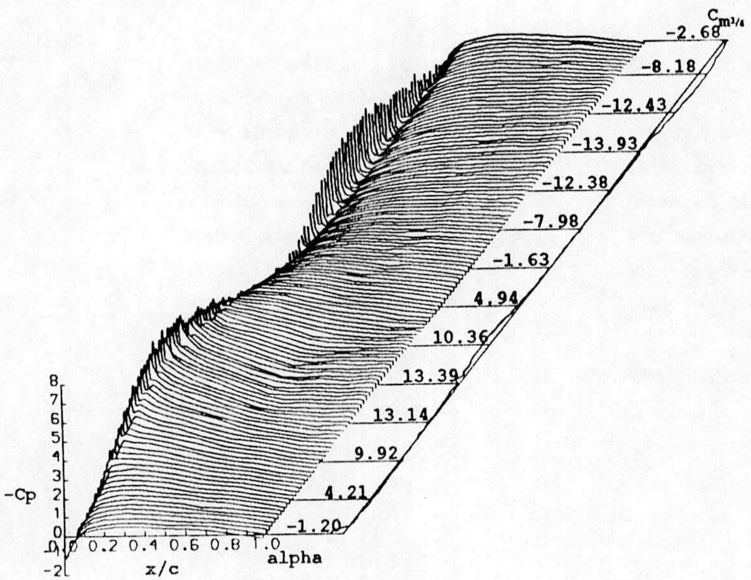


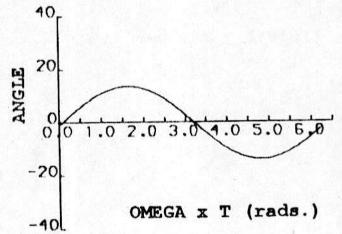


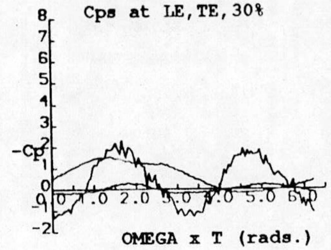
DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

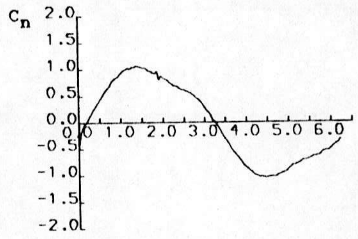
RUN REFERENCE NUMBER: 14171
REYNOLDS NUMBER = 868587.
DYNAMIC PRESSURE = 335.88 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.650 Hz.
AVERAGED DATA OF 10 CYCLES

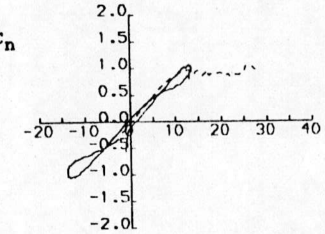
DATE OF TEST: 11/11/91
MACH NUMBER = 0.069
AIR TEMPERATURE = 20.7°C
SAMPLING FREQUENCY = 83.20 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 13.80°

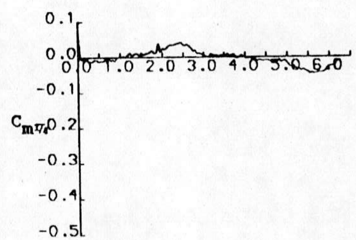


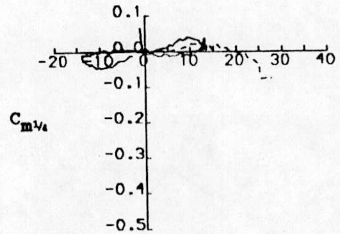


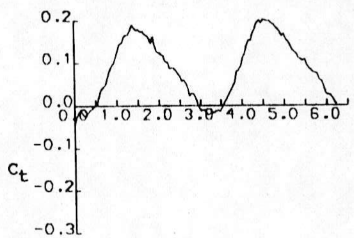


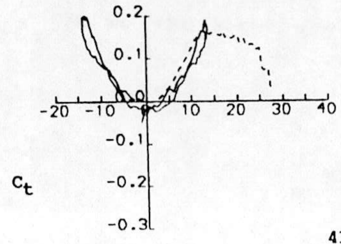






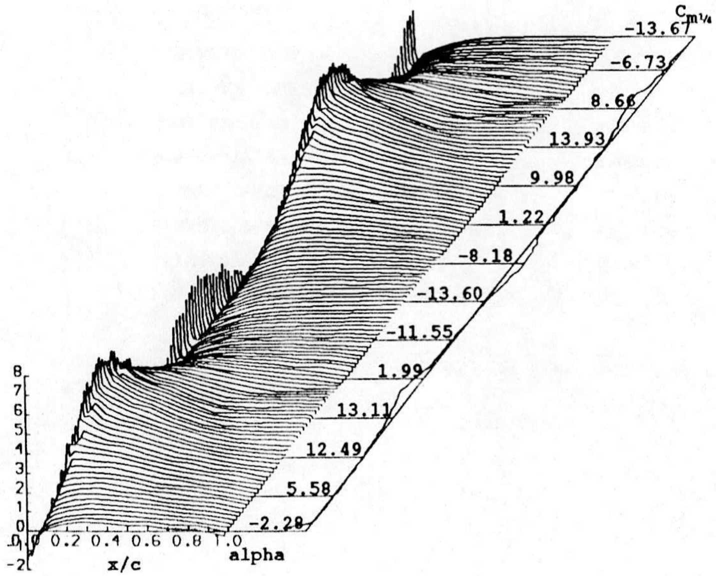


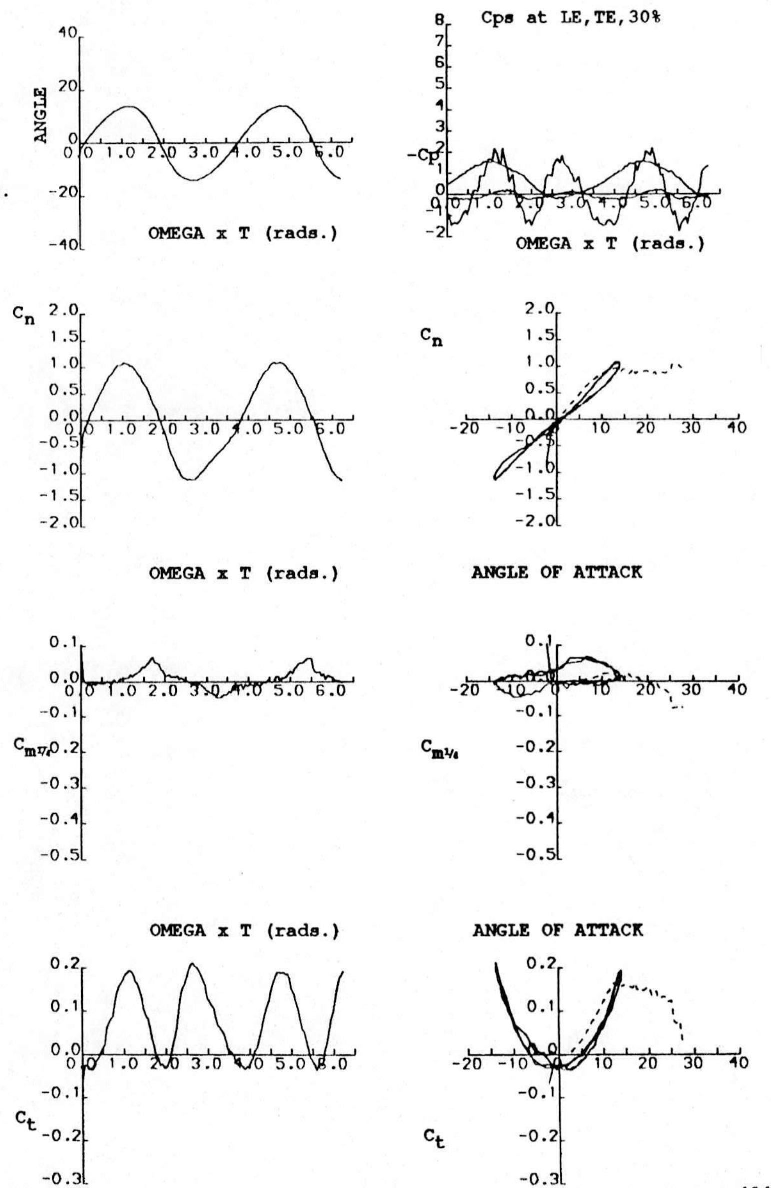




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54841	DATE OF TEST: 12/11/91
REYNOLDS NUMBER = 862057.	MACH NUMBER = 0.070
DYNAMIC PRESSURE = 334.25 Nm^{-2}	AIR TEMPERATURE = 19.4°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 83.20 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.047
MEAN ANGLE = 0.00°	AMPLITUDE = 13.80°
OSCILLATION FREQUENCY = 0.650 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14181

REYNOLDS NUMBER = 868587.

DYNAMIC PRESSURE = 335.88 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

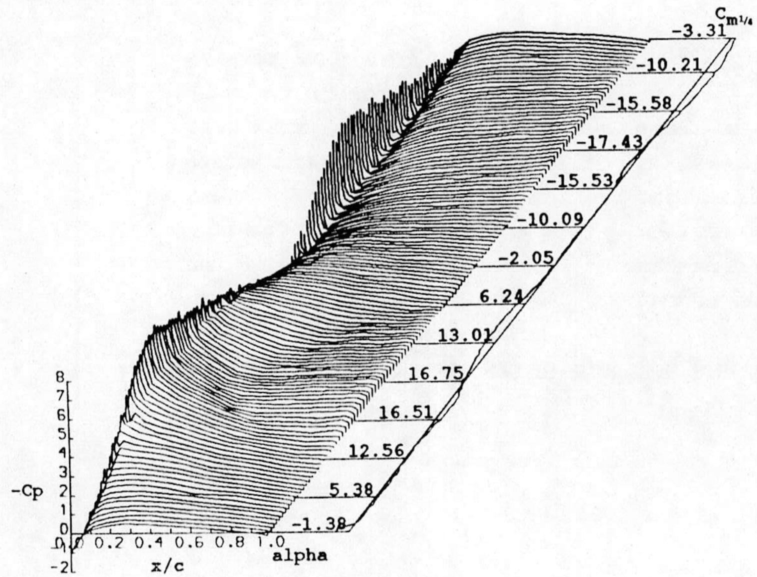
MACH NUMBER = 0.069

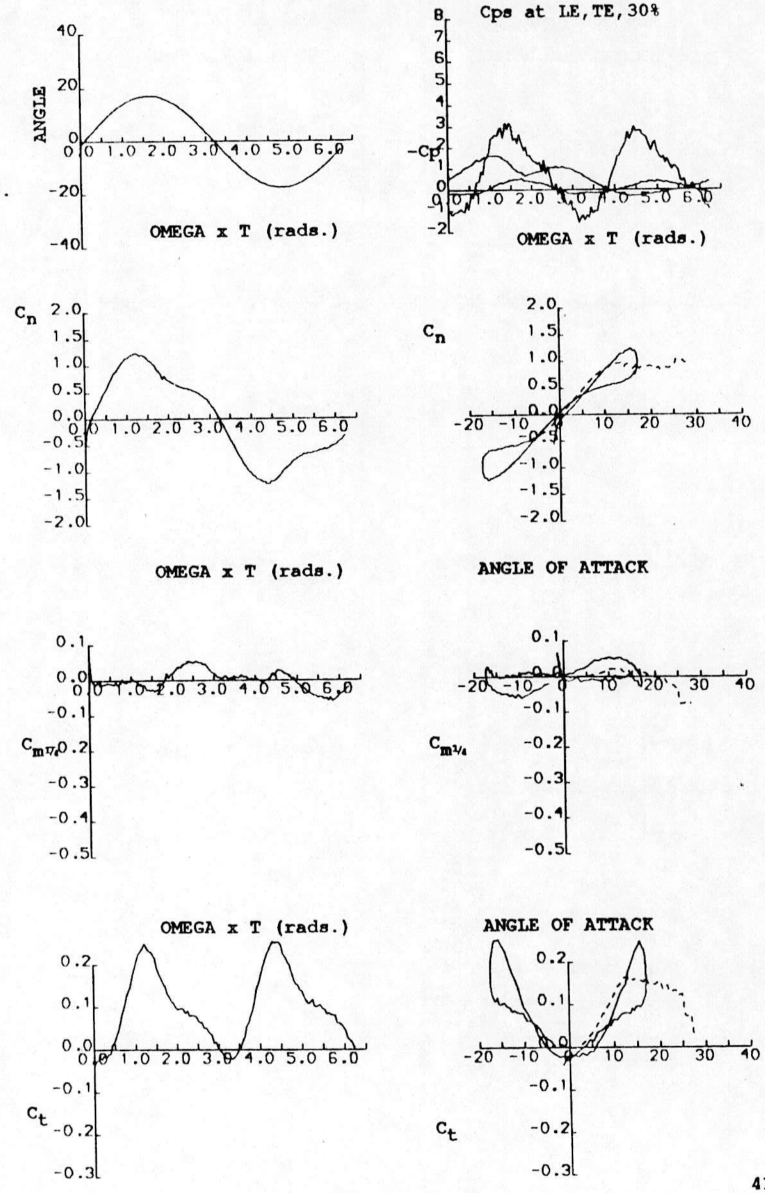
AIR TEMPERATURE = 20.7°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 17.40°

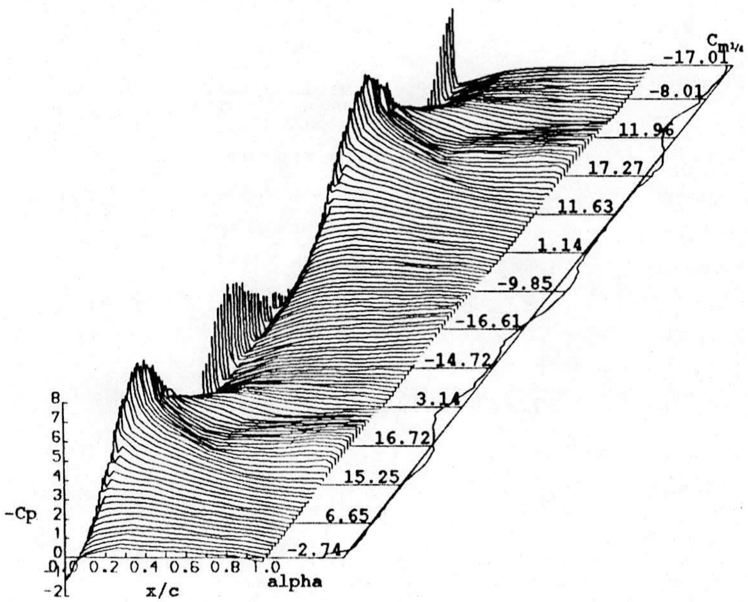


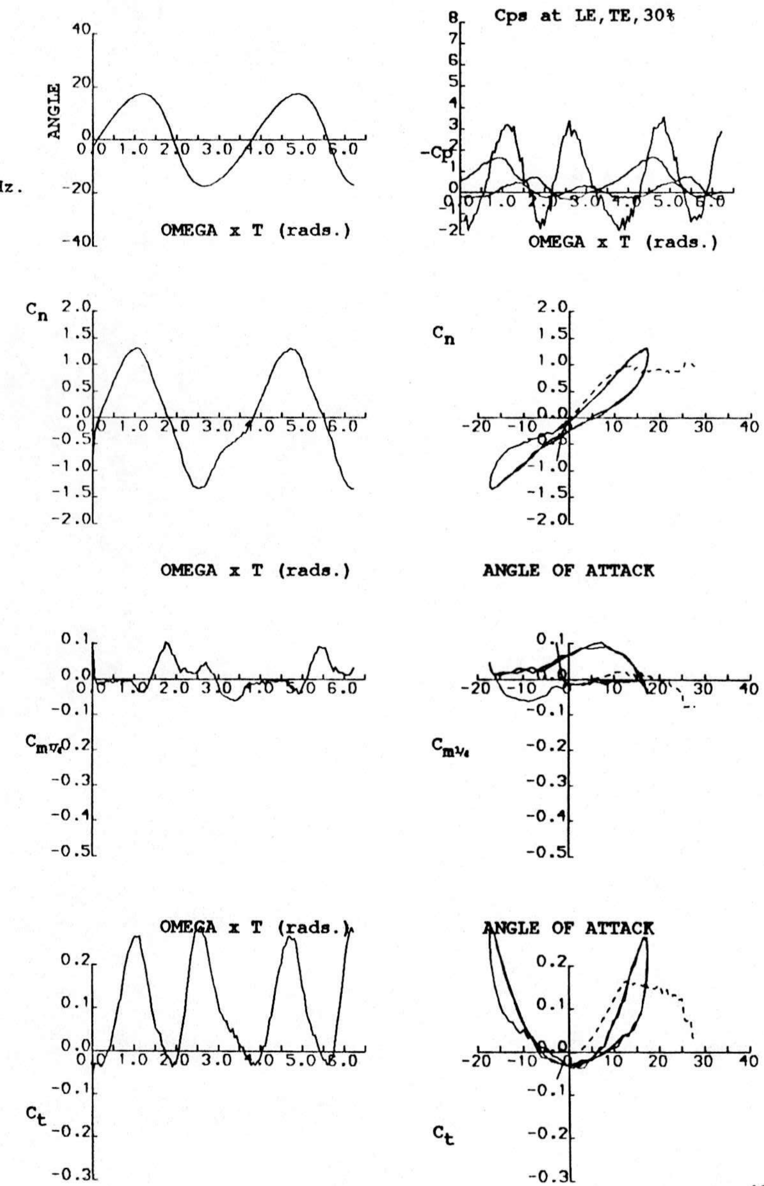


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54851
REYNOLDS NUMBER = 861679.
DYNAMIC PRESSURE = 334.25 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.650 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.070
AIR TEMPERATURE = 19.5°C
SAMPLING FREQUENCY = 83.20 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14191

REYNOLDS NUMBER = 868587.

DYNAMIC PRESSURE = 335.88 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

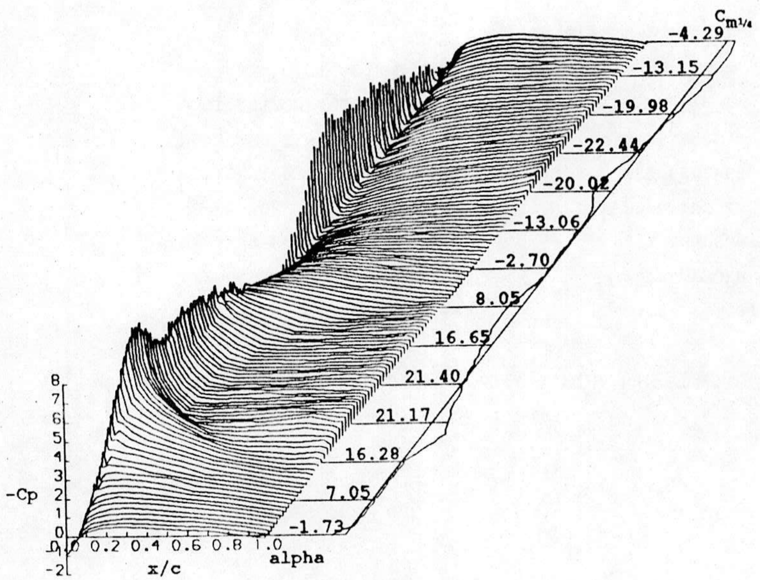
MACH NUMBER = 0.069

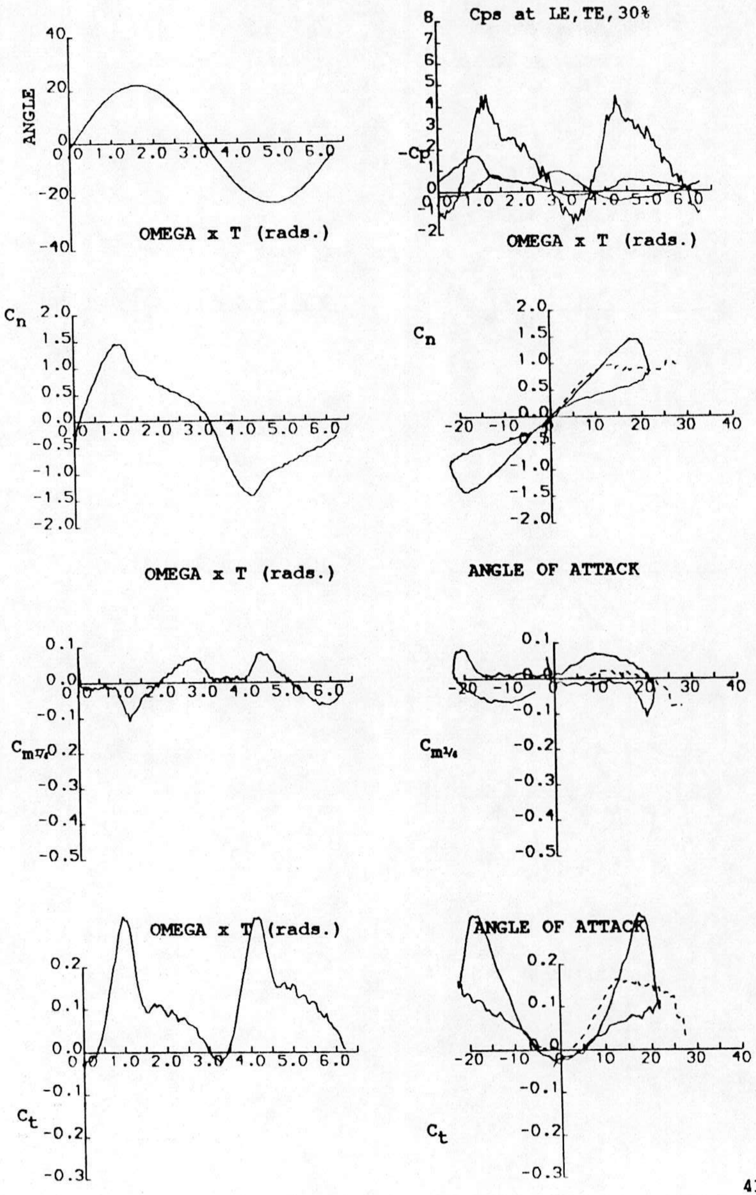
AIR TEMPERATURE = 20.7°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 22.60°

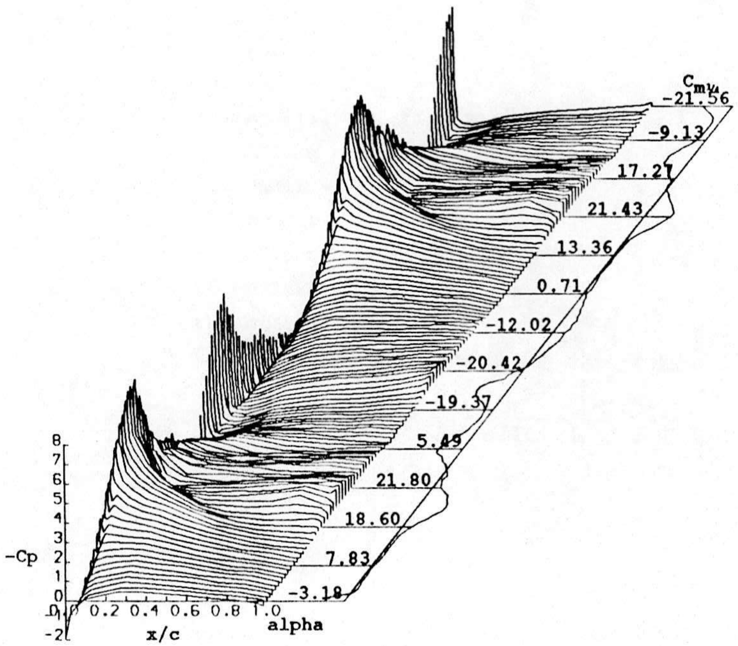


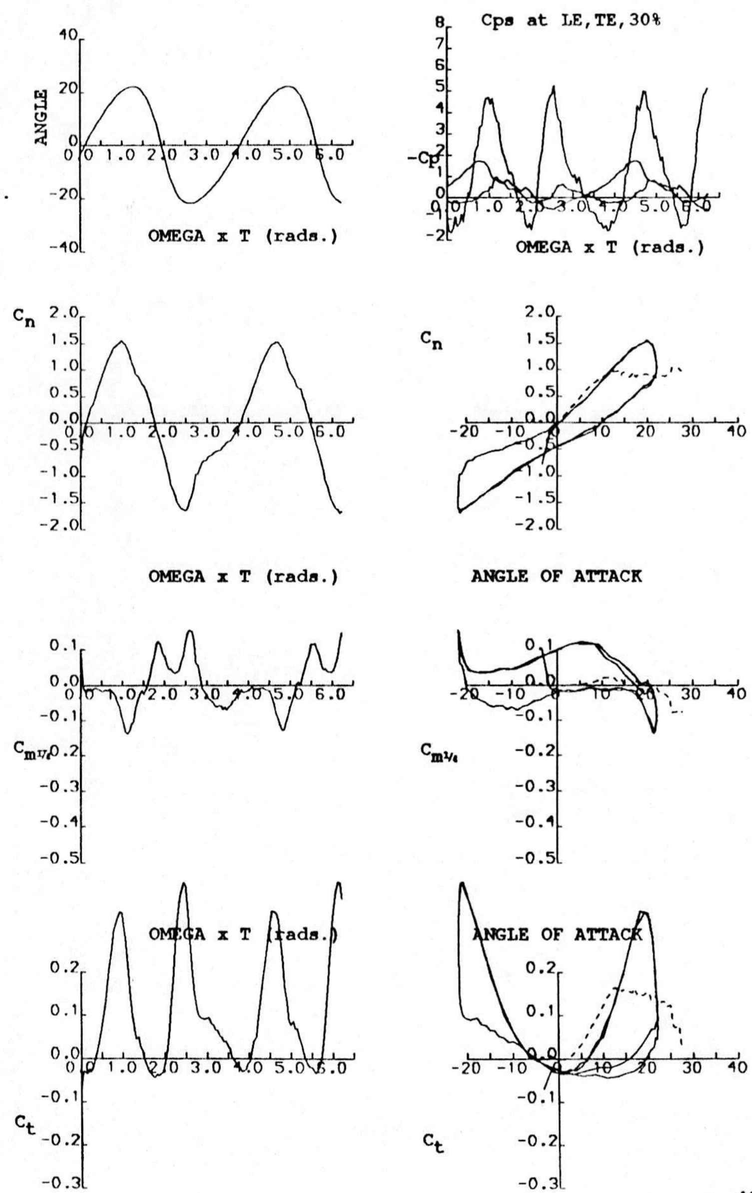


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54861
REYNOLDS NUMBER = 861679.
DYNAMIC PRESSURE = 334.25 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.650 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.070
AIR TEMPERATURE = 19.5°C
SAMPLING FREQUENCY = 83.20 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14201

REYNOLDS NUMBER = 868207.

DYNAMIC PRESSURE = 335.88 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

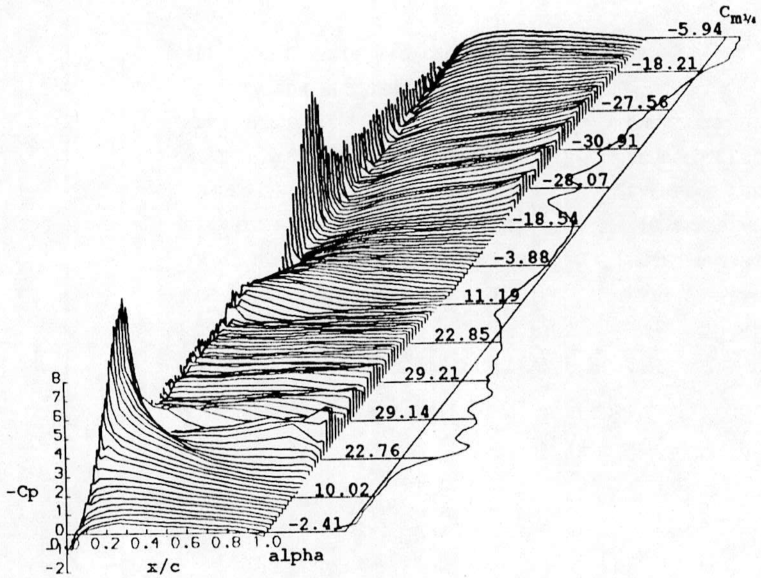
MACH NUMBER = 0.069

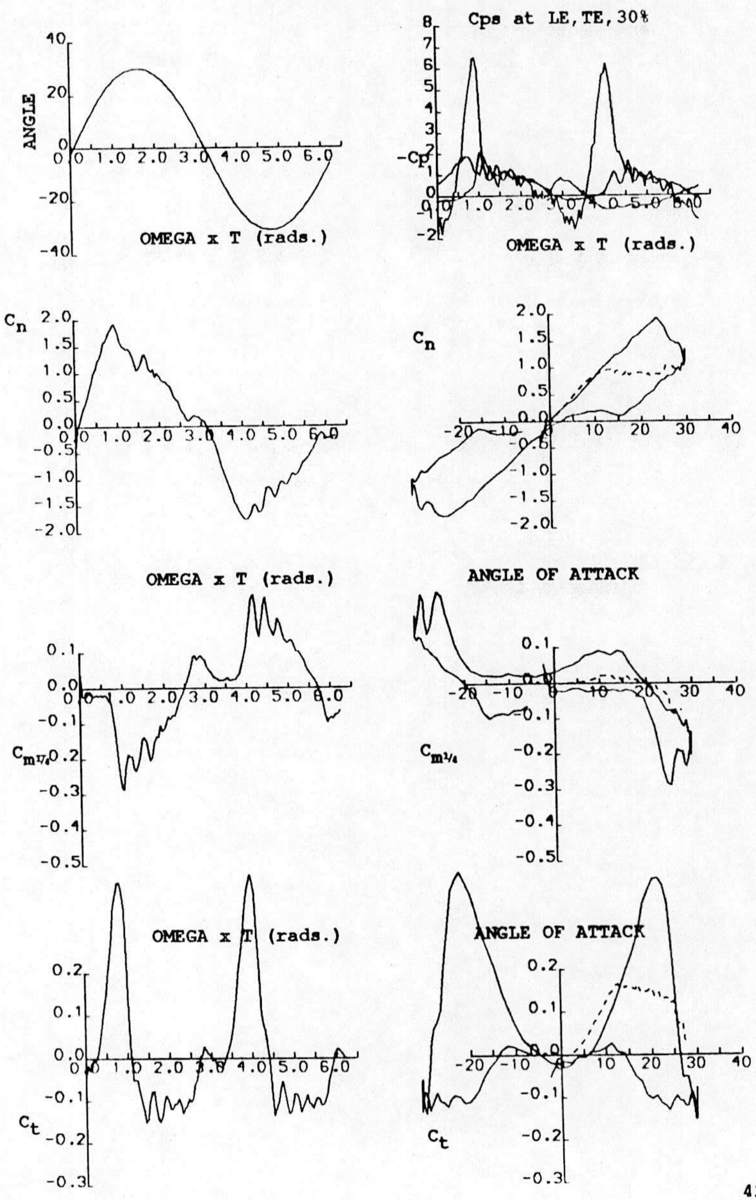
AIR TEMPERATURE = 20.8°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 32.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54871

REYNOLDS NUMBER = 860922.

DYNAMIC PRESSURE = 334.25 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.650 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

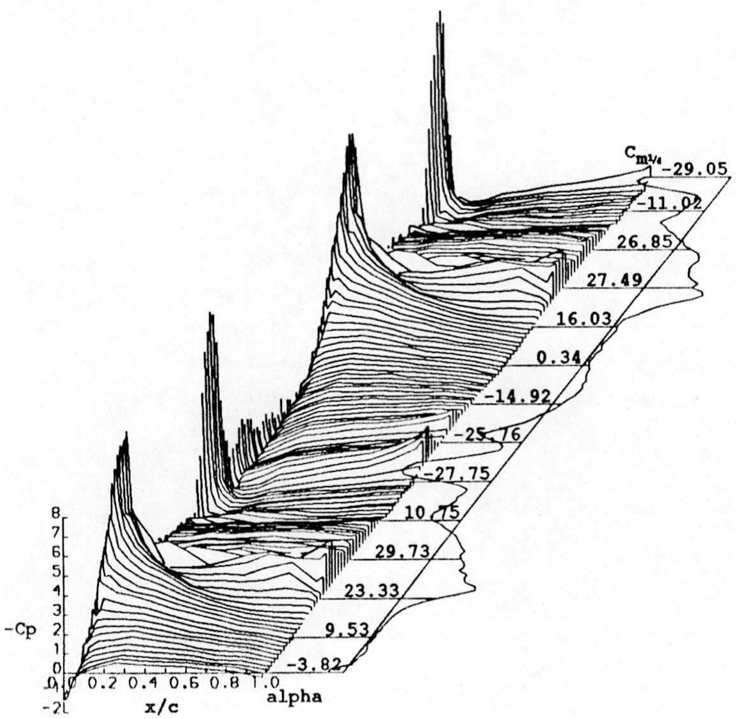
MACH NUMBER = 0.070

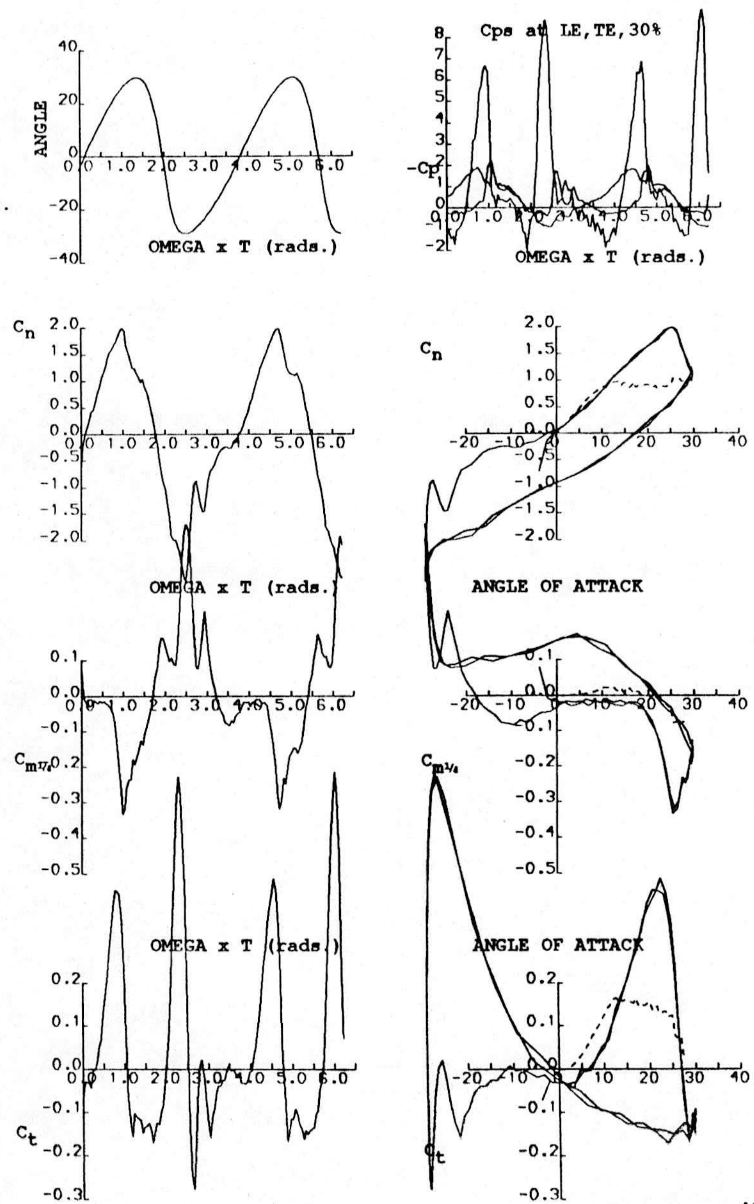
AIR TEMPERATURE = 19.7°C

SAMPLING FREQUENCY = 83.20 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 32.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14221

REYNOLDS NUMBER = 1204218.

DYNAMIC PRESSURE = 648.44 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

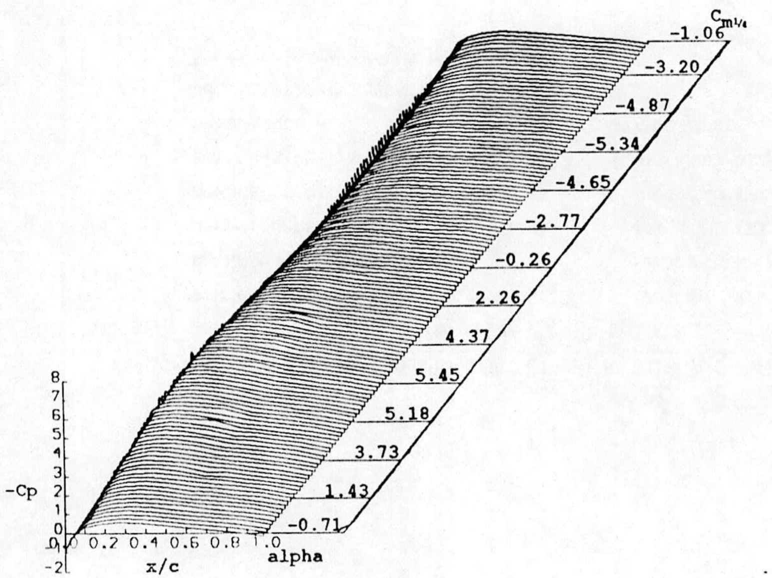
MACH NUMBER = 0.096

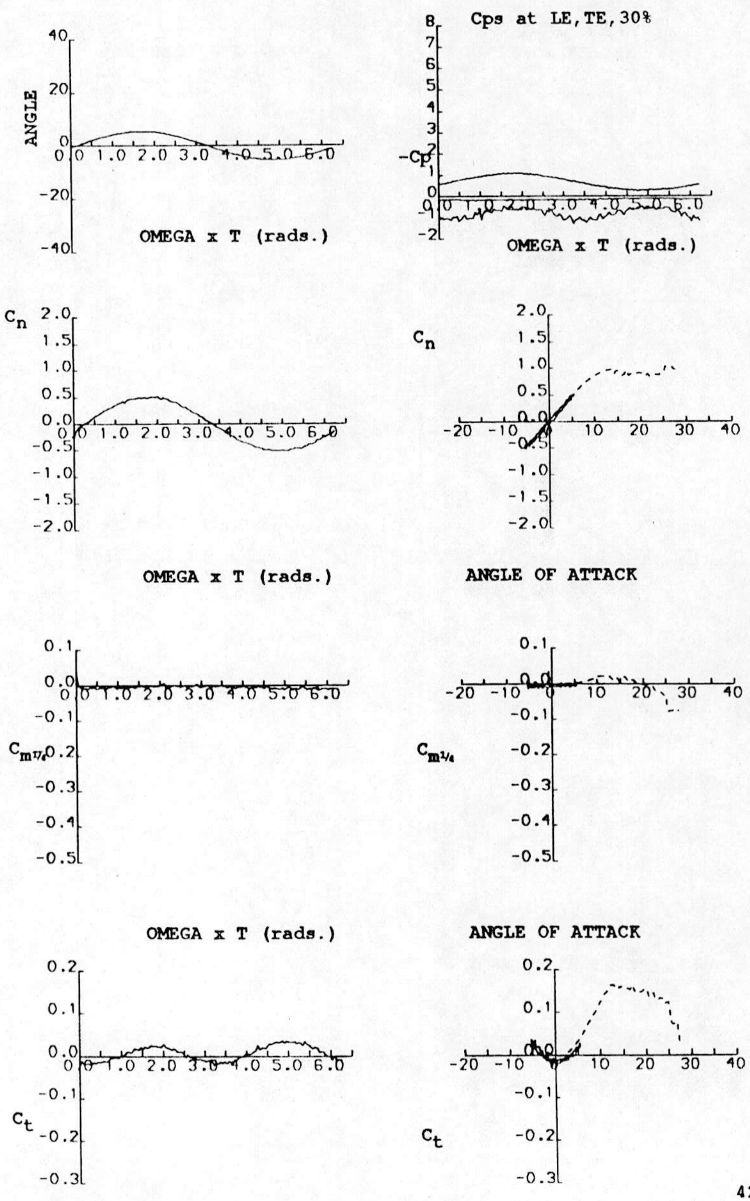
AIR TEMPERATURE = 21.2°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54891

REYNOLDS NUMBER = 1197490.

DYNAMIC PRESSURE = 656.17 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

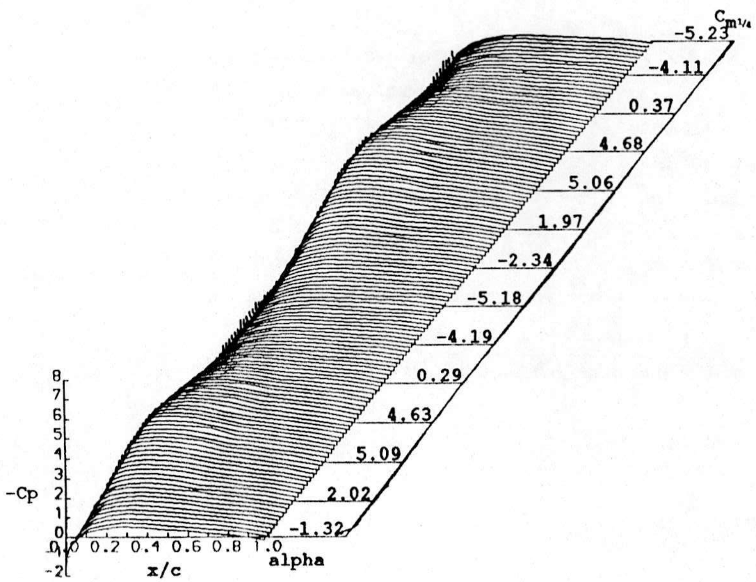
MACH NUMBER = 0.098

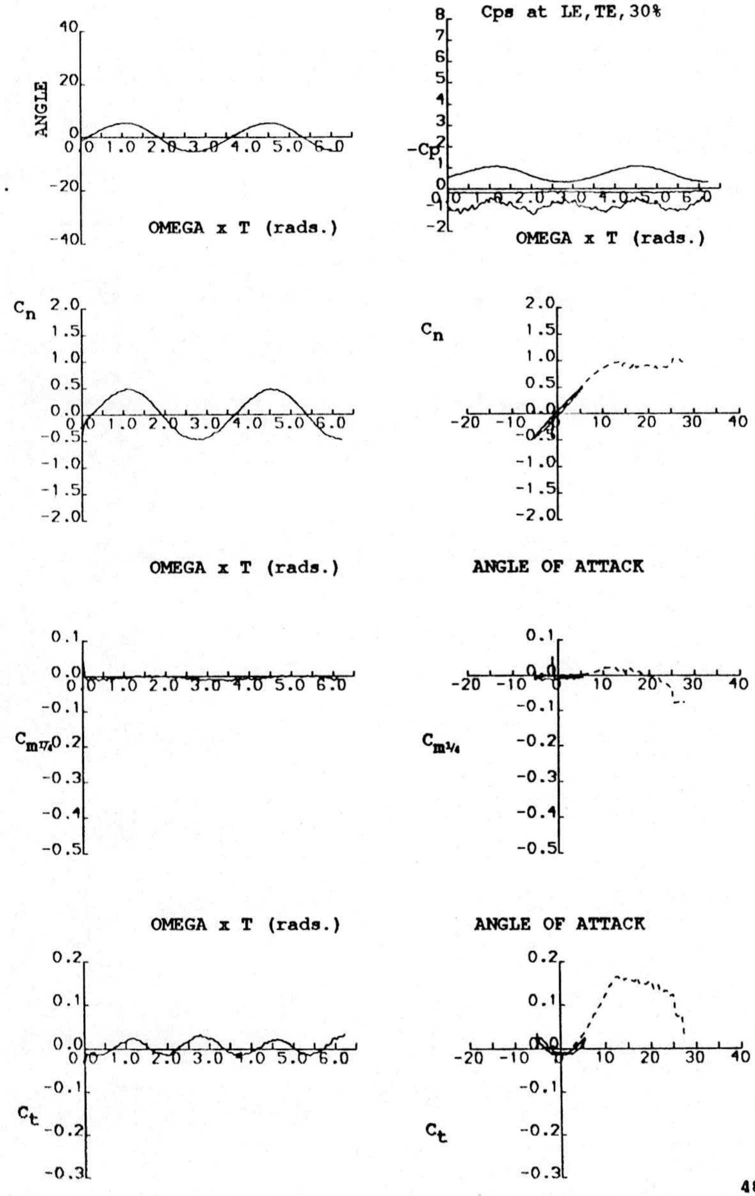
AIR TEMPERATURE = 21.6°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14231

REYNOLDS NUMBER = 1202120.

DYNAMIC PRESSURE = 648.44 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

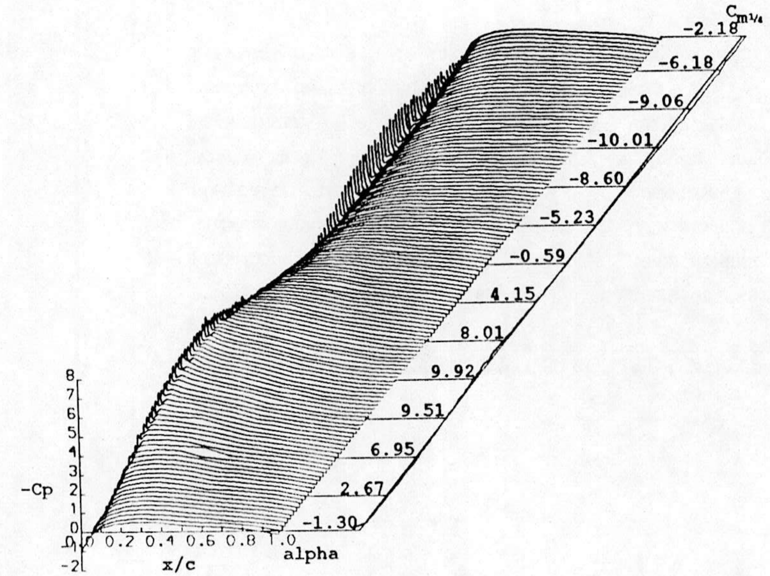
MACH NUMBER = 0.096

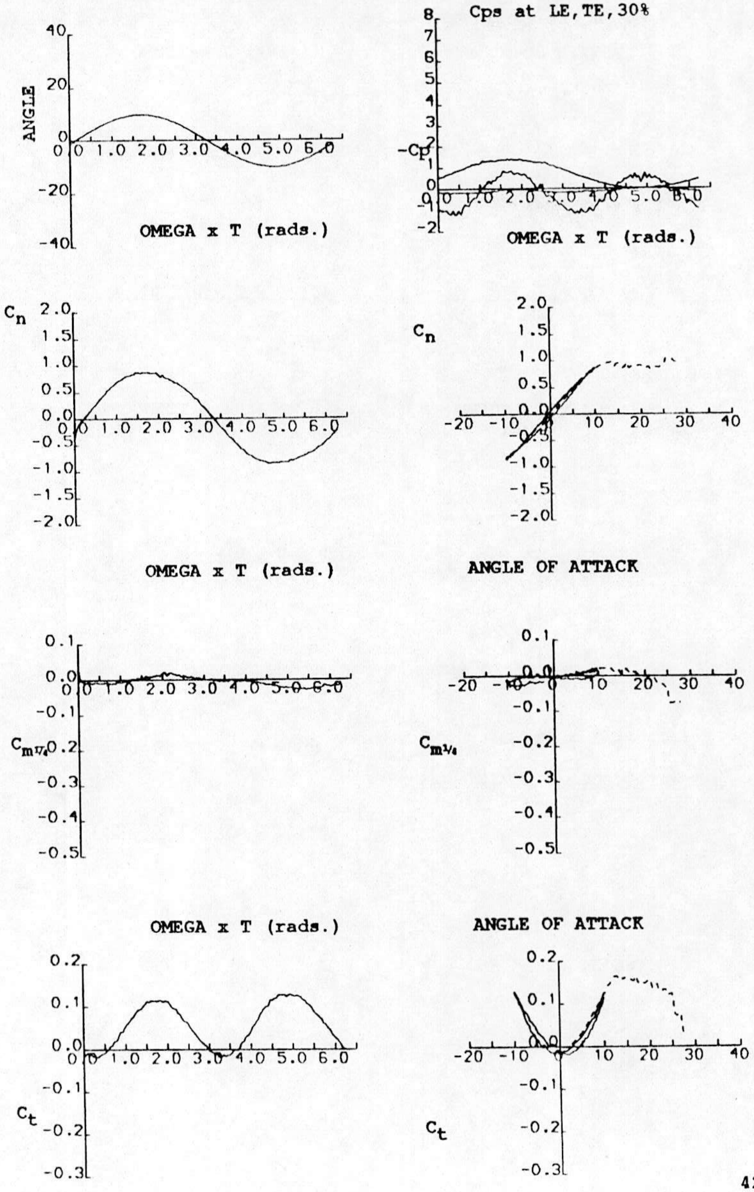
AIR TEMPERATURE = 21.6°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 10.00°

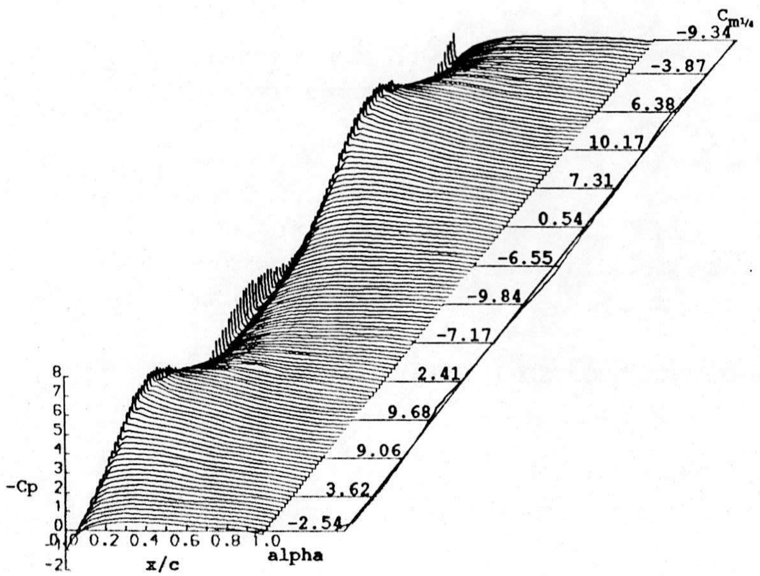


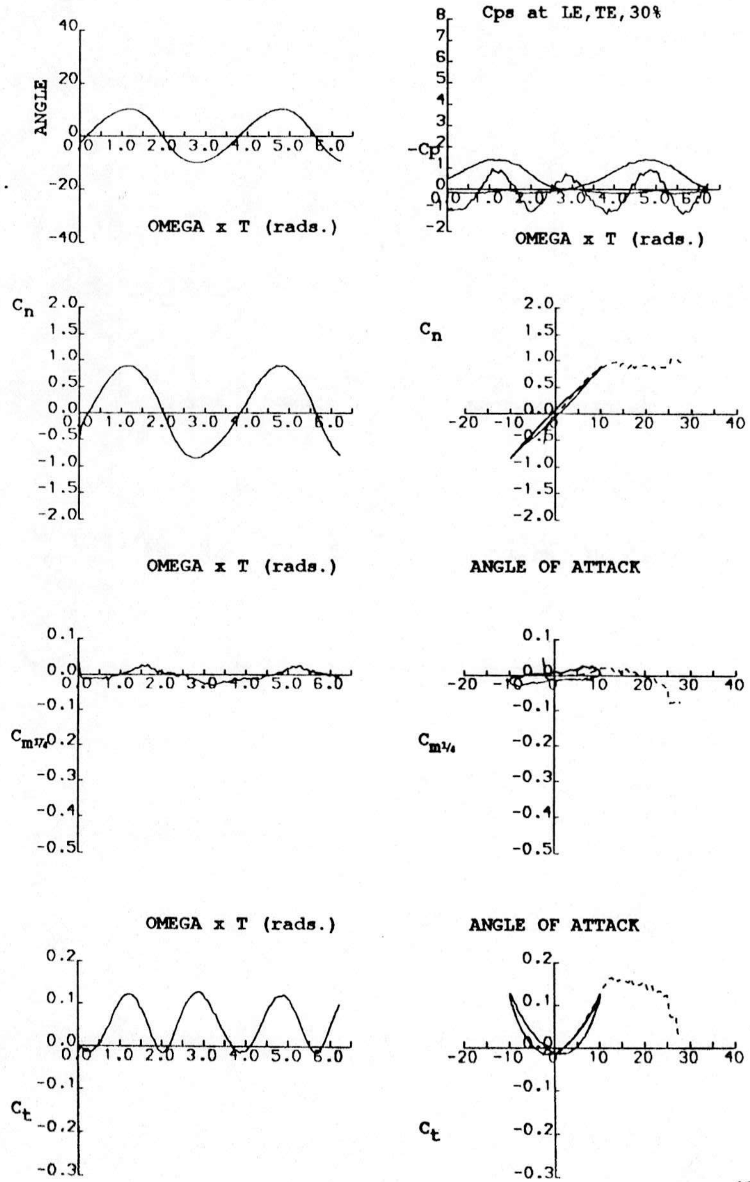


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54901
REYNOLDS NUMBER = 1195927.
DYNAMIC PRESSURE = 656.17 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.098
AIR TEMPERATURE = 21.9°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 10.00°

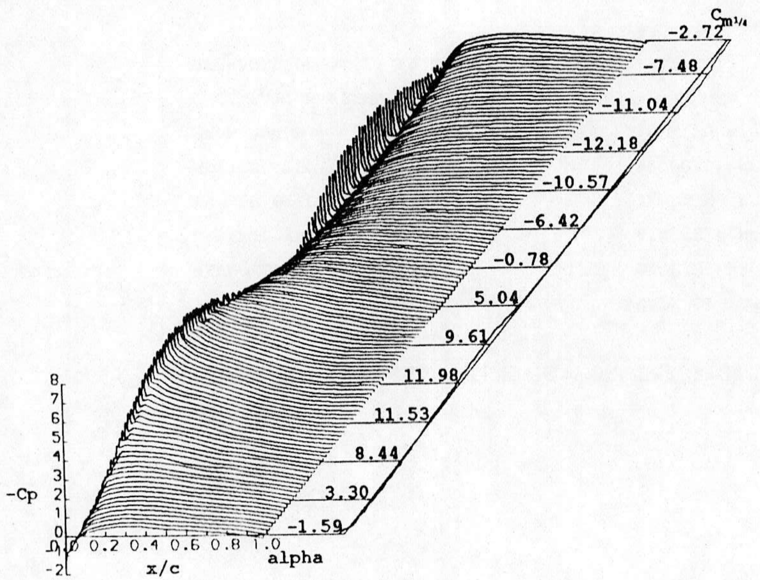


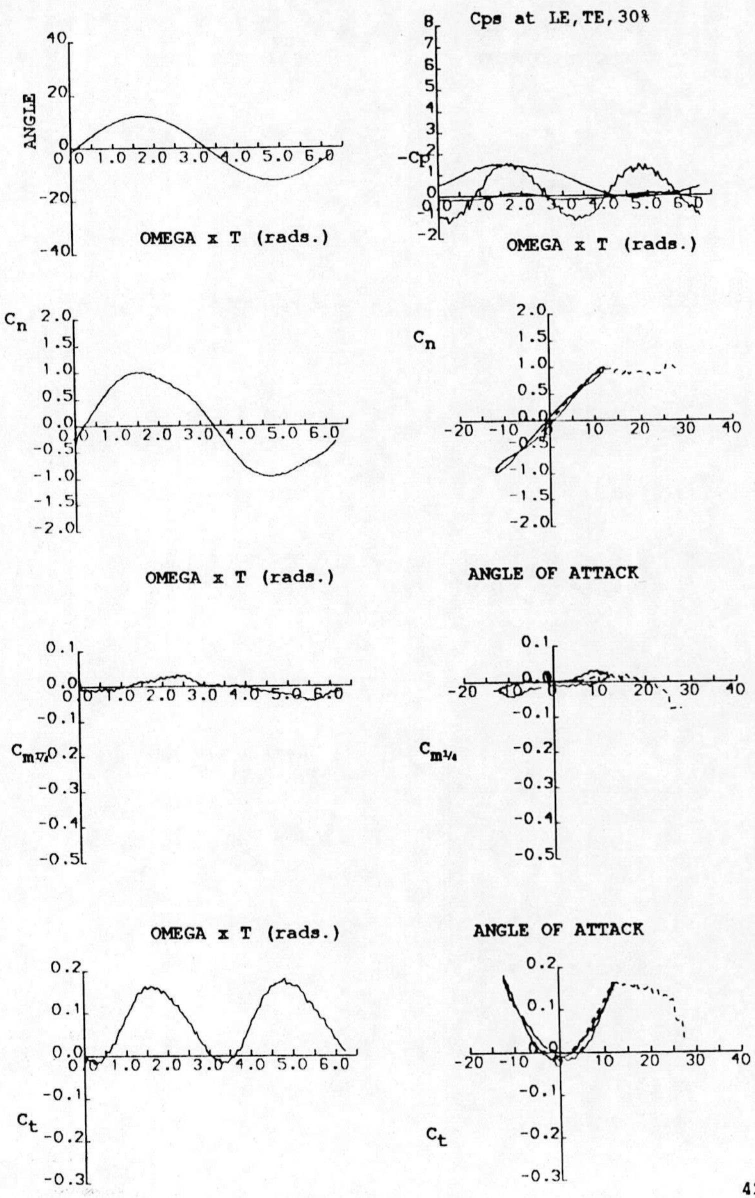


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14241
REYNOLDS NUMBER = 1201596.
DYNAMIC PRESSURE = 648.44 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91
MACH NUMBER = 0.096
AIR TEMPERATURE = 21.7°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54911

REYNOLDS NUMBER = 1194887.

DYNAMIC PRESSURE = 656.17 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

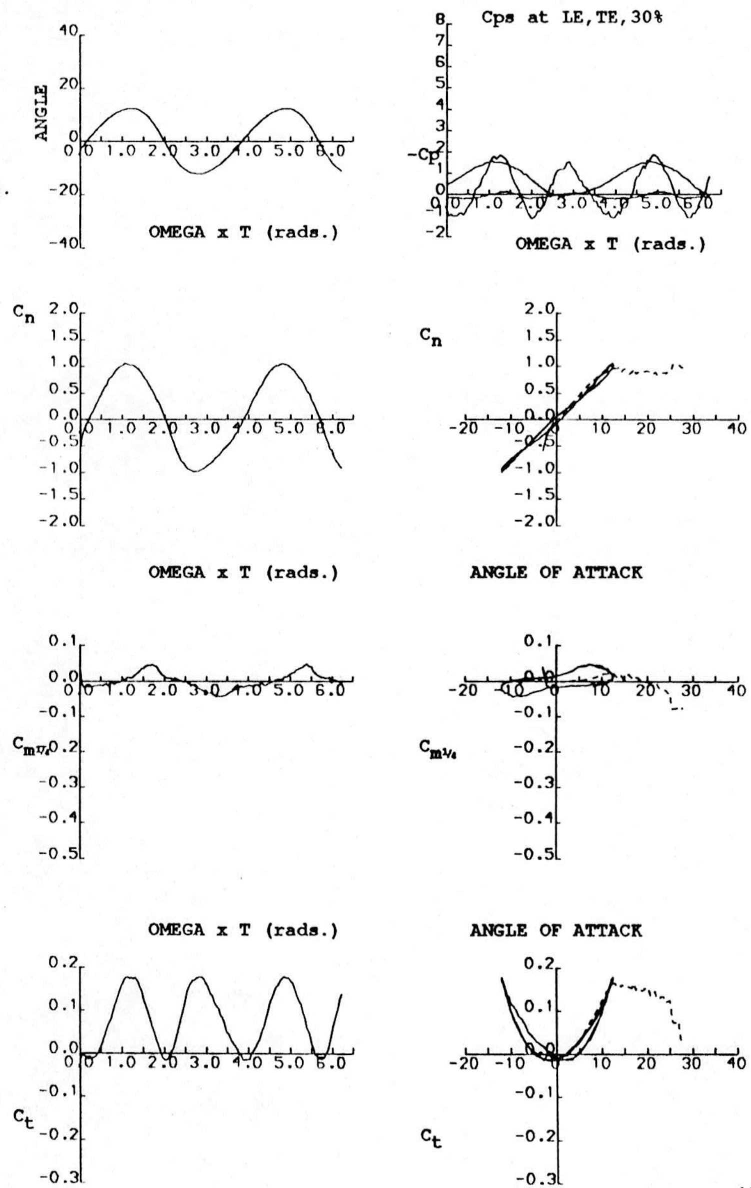
MACH NUMBER = 0.098

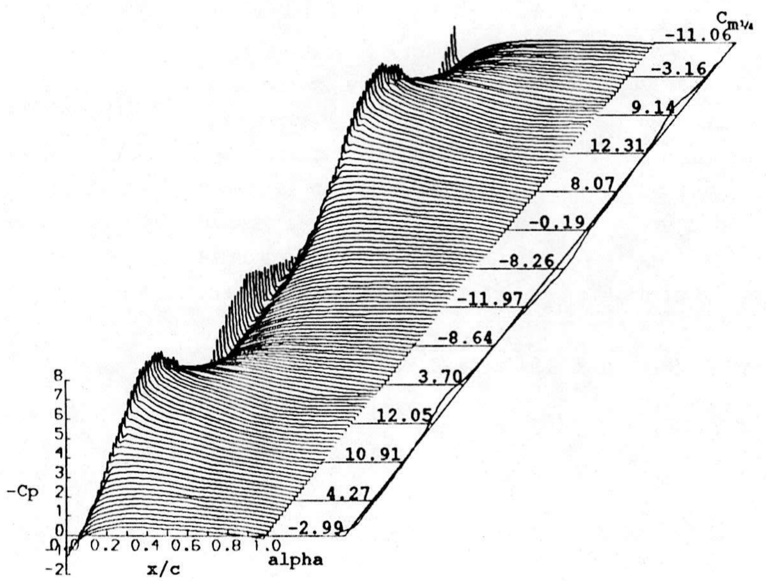
AIR TEMPERATURE = 22.1°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14251

REYNOLDS NUMBER = 1201073.

DYNAMIC PRESSURE = 648.44 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.894 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

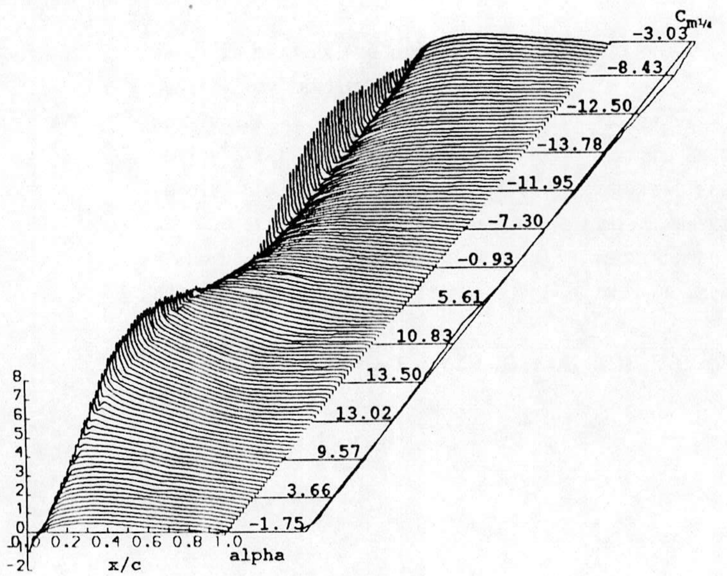
MACH NUMBER = 0.096

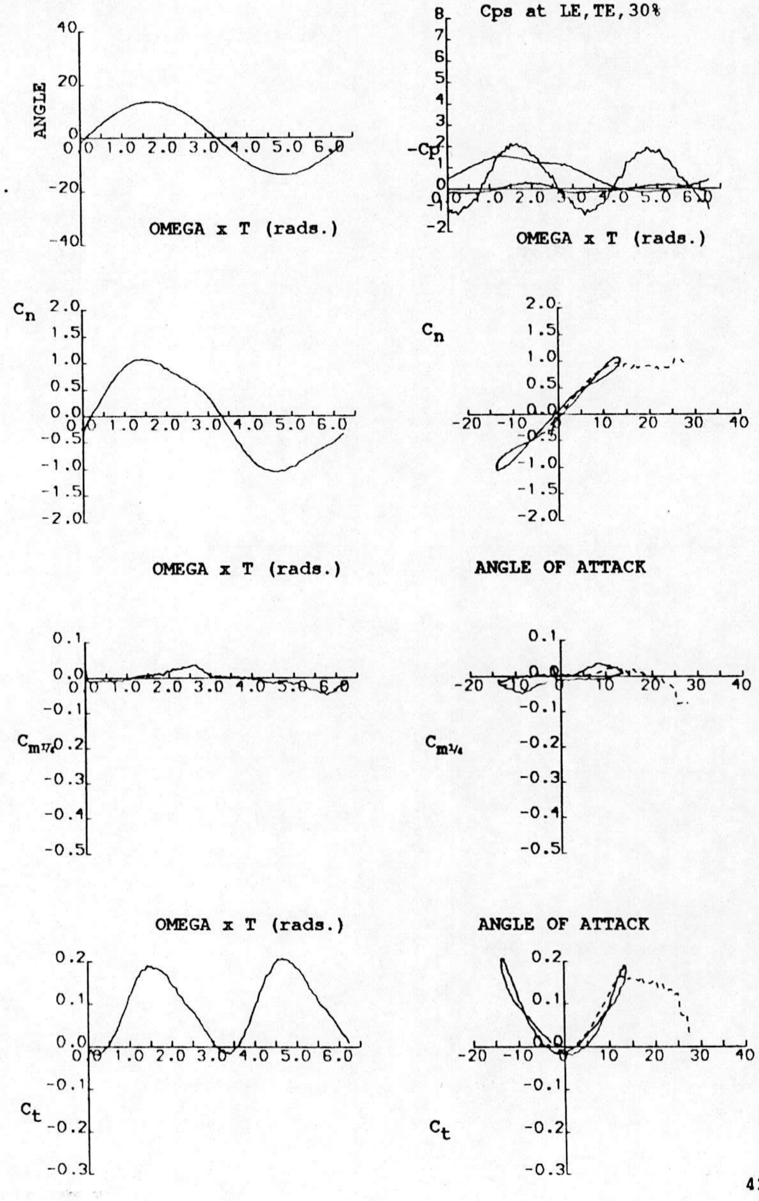
AIR TEMPERATURE = 21.8°C

SAMPLING FREQUENCY = 114.43 Hz.

REDUCED FREQUENCY = 0.047

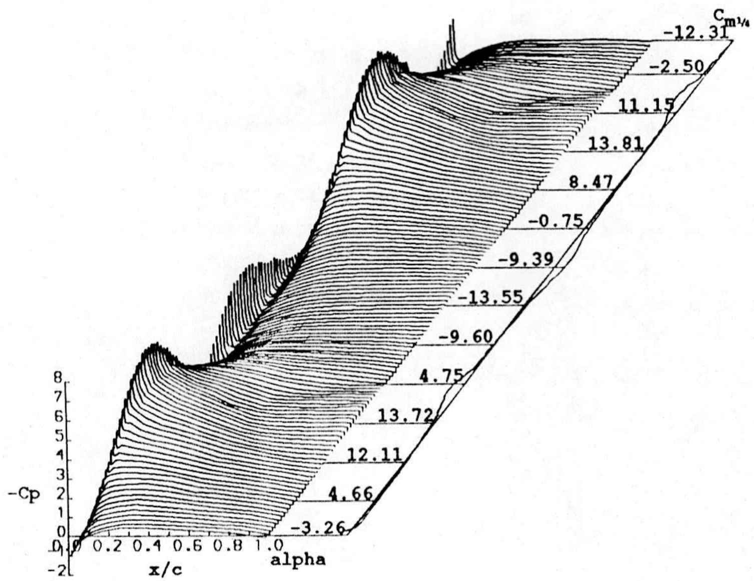
AMPLITUDE = 13.80°

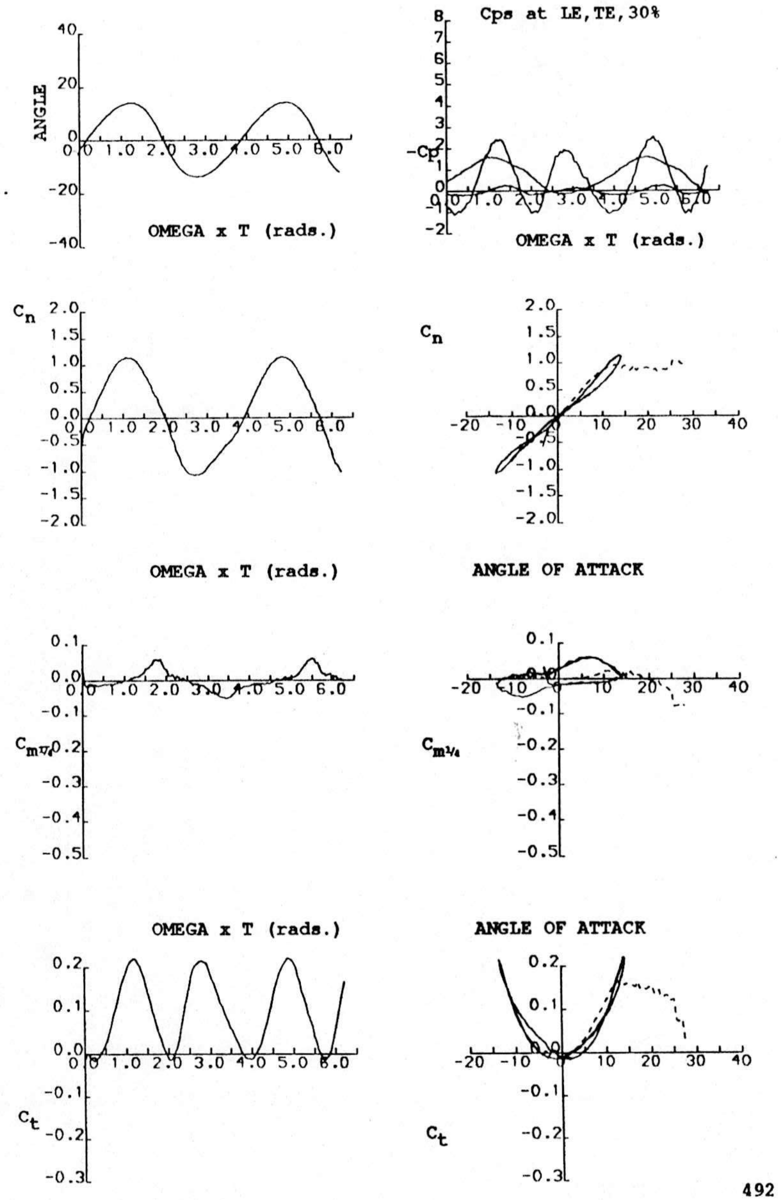




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54921	DATE OF TEST: 13/11/91
REYNOLDS NUMBER = 1193849.	MACH NUMBER = 0.098
DYNAMIC PRESSURE = 656.17 Nm^{-2}	AIR TEMPERATURE = 22.3°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 114.43 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.046
MEAN ANGLE = 0.00°	AMPLITUDE = 13.80°
OSCILLATION FREQUENCY = 0.894 Hz.	
AVERAGED DATA OF 10 CYCLES	

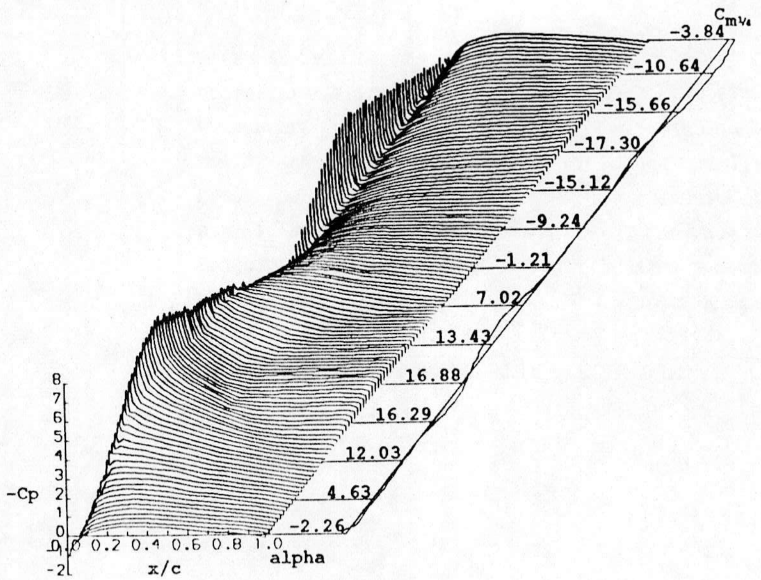


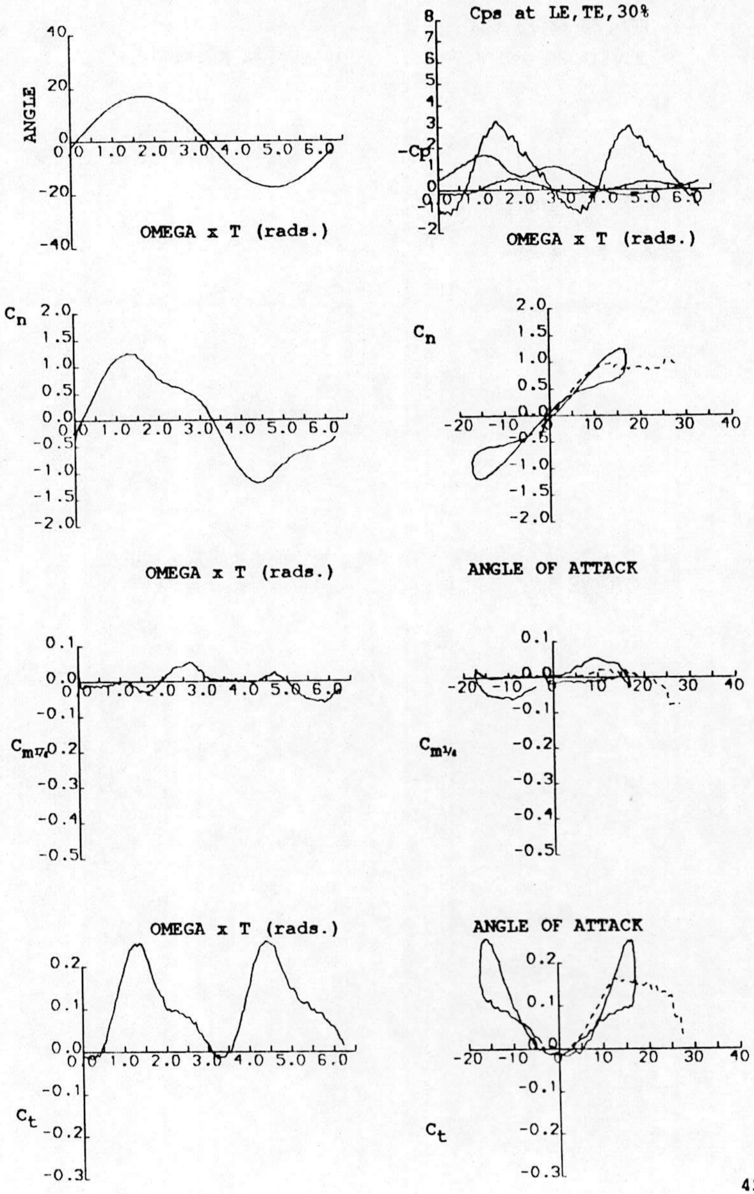


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14261
REYNOLDS NUMBER = 1200551.
DYNAMIC PRESSURE = 648.44 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91
MACH NUMBER = 0.096
AIR TEMPERATURE = 21.9°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 17.40°

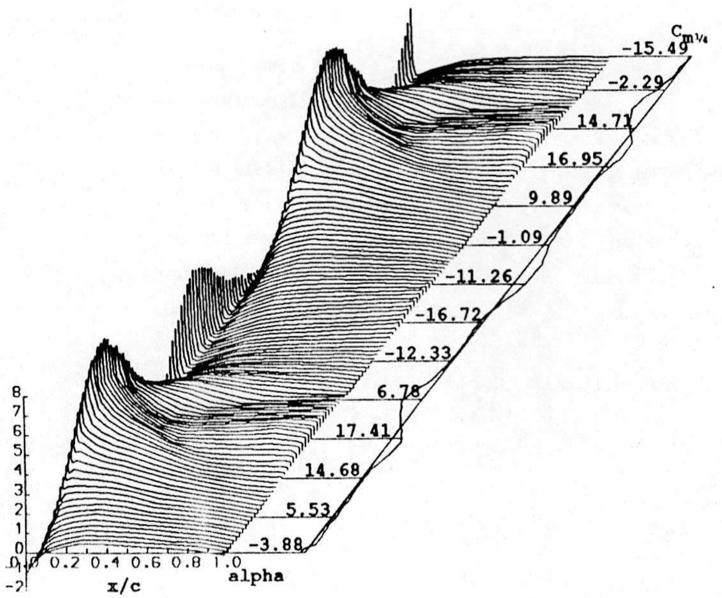


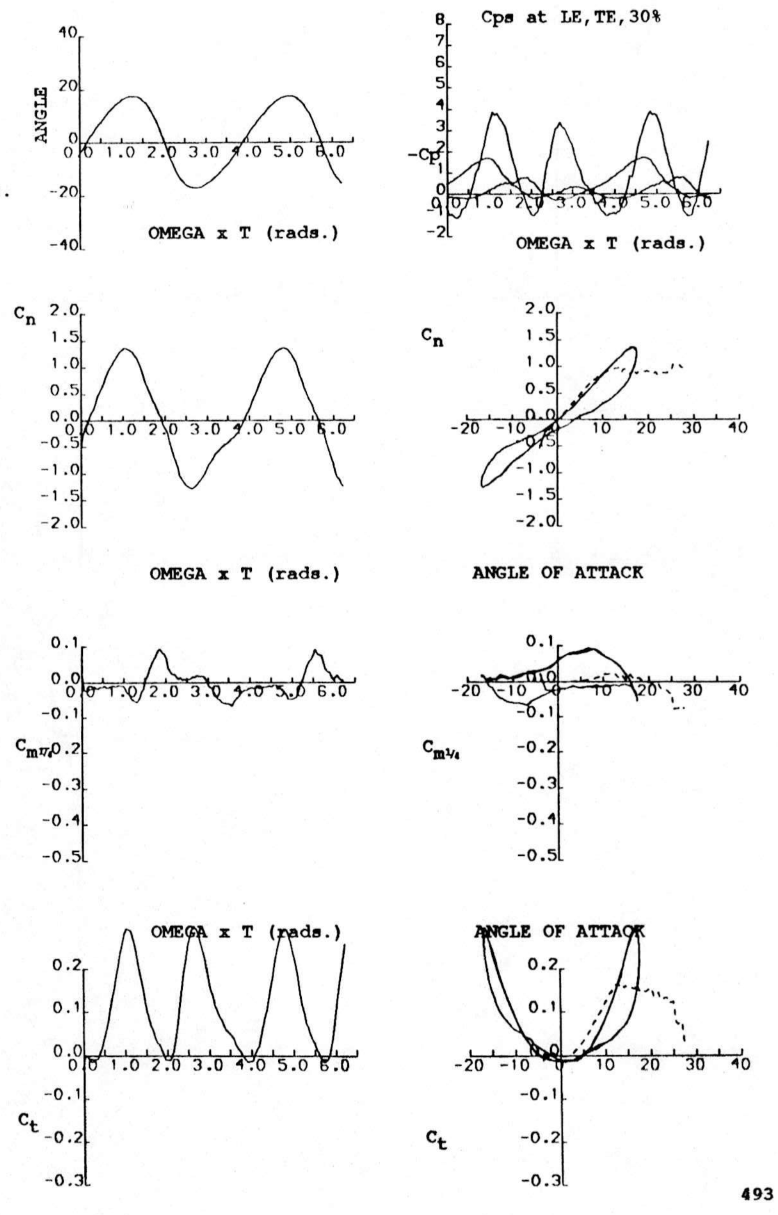


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54931
REYNOLDS NUMBER = 1192295.
DYNAMIC PRESSURE = 656.17 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.098
AIR TEMPERATURE = 22.6°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 17.40°

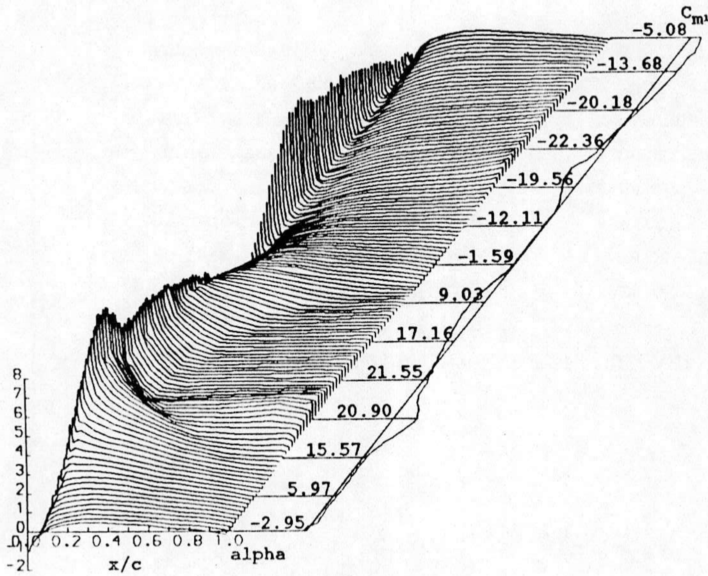


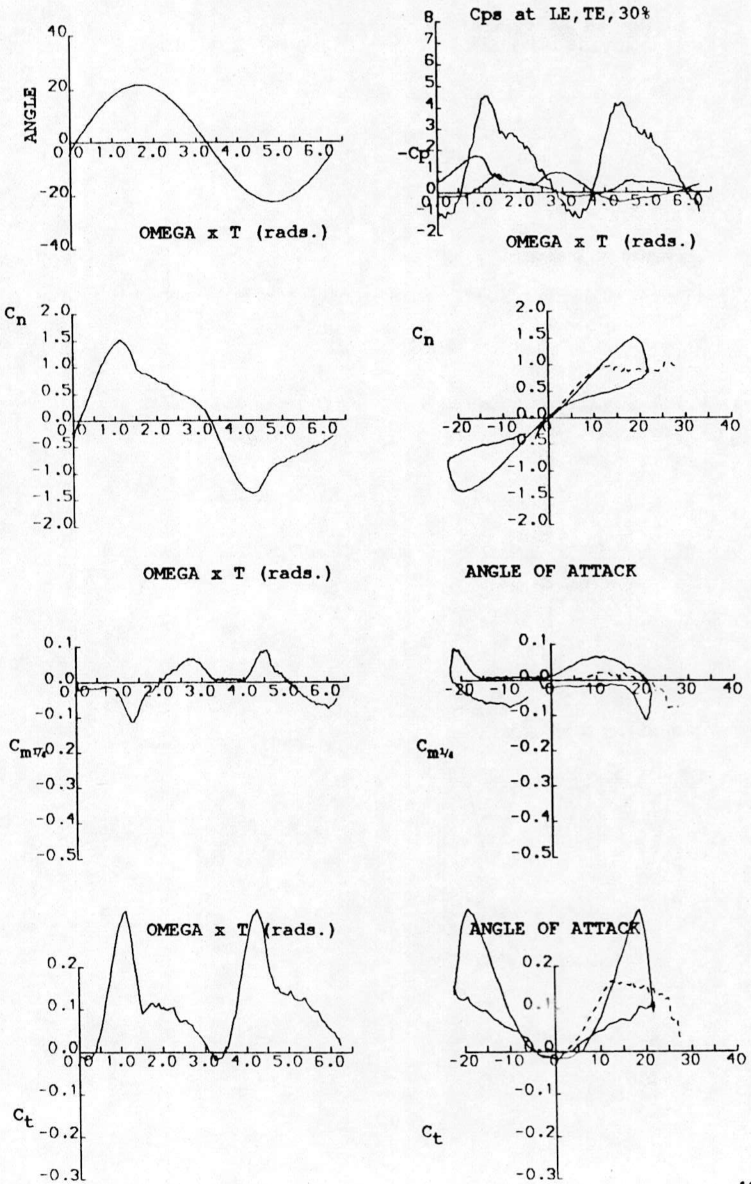


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14271
REYNOLDS NUMBER = 1200028.
DYNAMIC PRESSURE = 648.44 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91
MACH NUMBER = 0.096
AIR TEMPERATURE = 22.0°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 22.60°

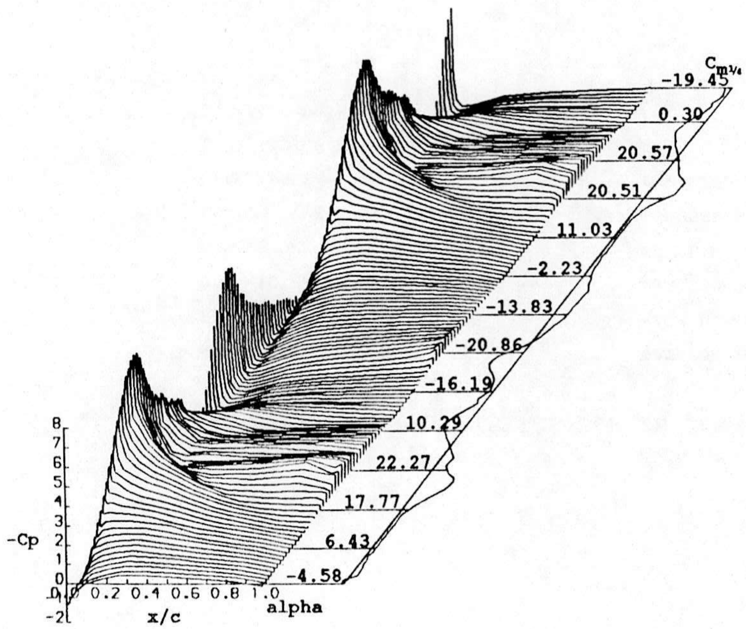


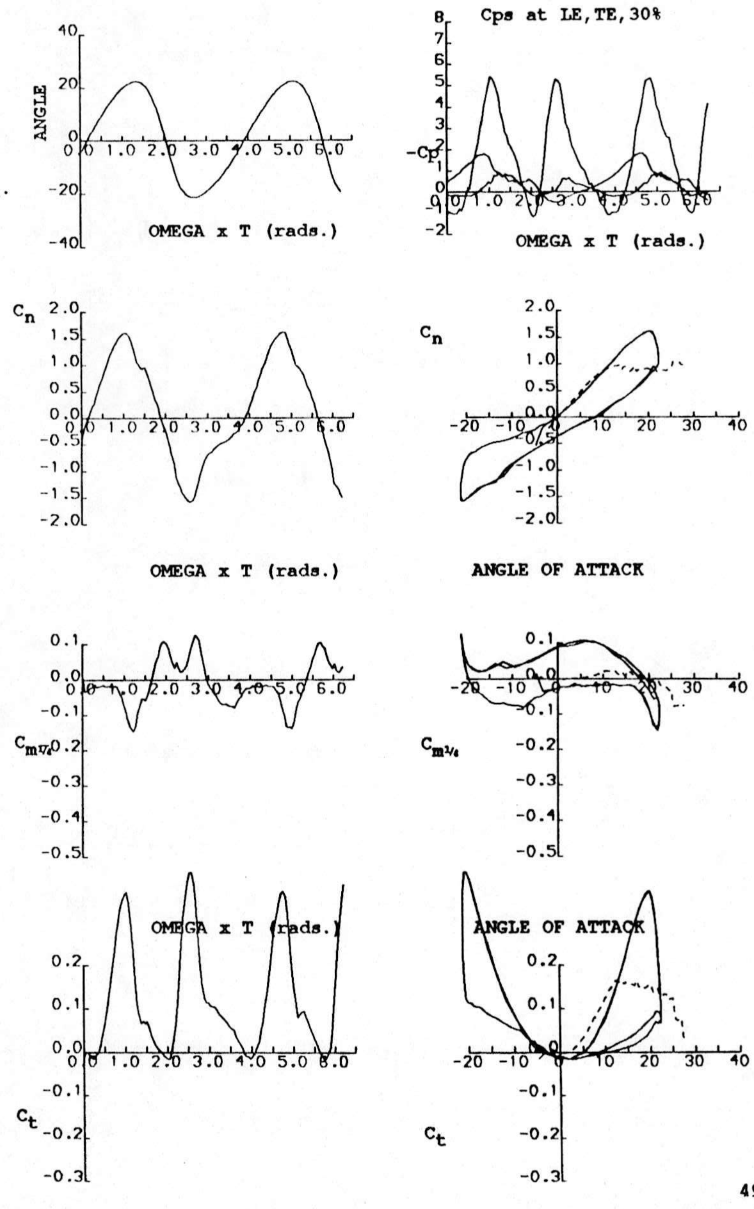


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54941
REYNOLDS NUMBER = 1191777.
DYNAMIC PRESSURE = 656.17 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

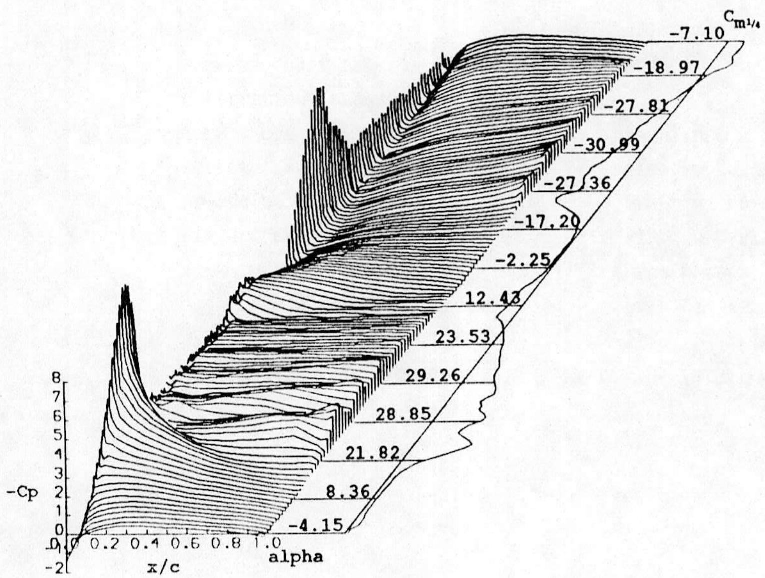
DATE OF TEST: 13/11/91
MACH NUMBER = 0.098
AIR TEMPERATURE = 22.7°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 22.60°

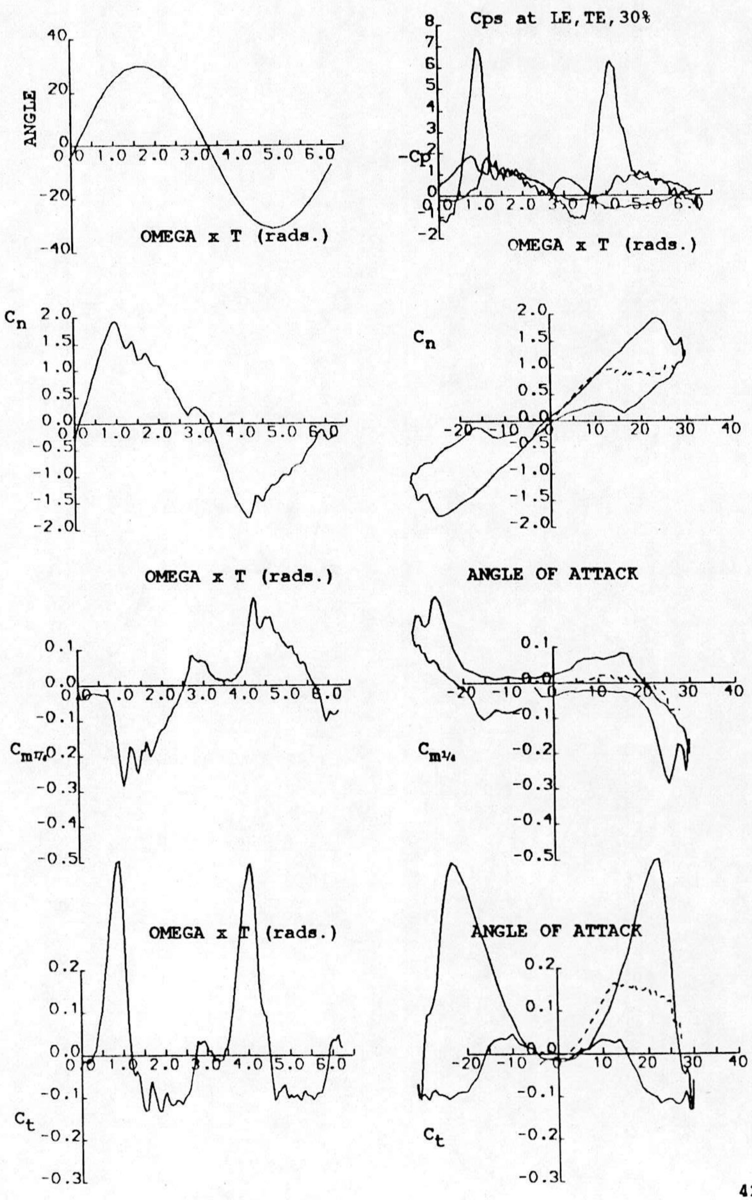




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14281	DATE OF TEST: 11/11/91
REYNOLDS NUMBER = 1199507.	MACH NUMBER = 0.096
DYNAMIC PRESSURE = 648.44 Nm^{-2}	AIR TEMPERATURE = 22.1°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 114.43 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.047
MEAN ANGLE = 0.00°	AMPLITUDE = 32.00°
OSCILLATION FREQUENCY = 0.894 Hz.	
AVERAGED DATA OF 10 CYCLES	

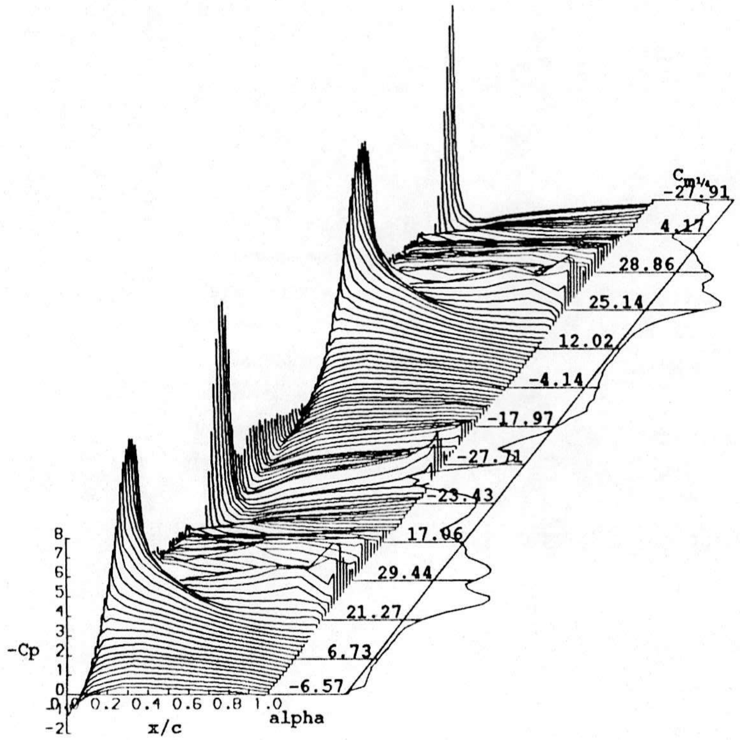


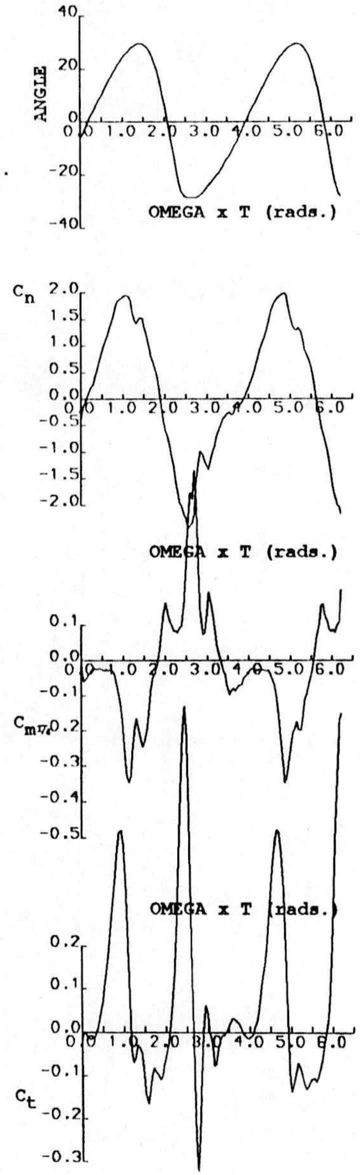


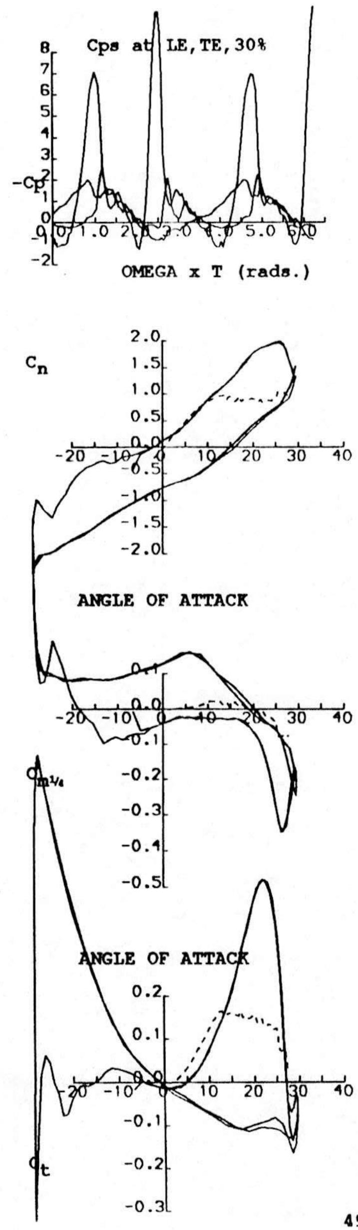
DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54951
REYNOLDS NUMBER = 1191261.
DYNAMIC PRESSURE = 656.17 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.894 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.098
AIR TEMPERATURE = 22.8°C
SAMPLING FREQUENCY = 114.43 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 32.80°







DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14301

REYNOLDS NUMBER = 1603725.

DYNAMIC PRESSURE = 1167.19 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

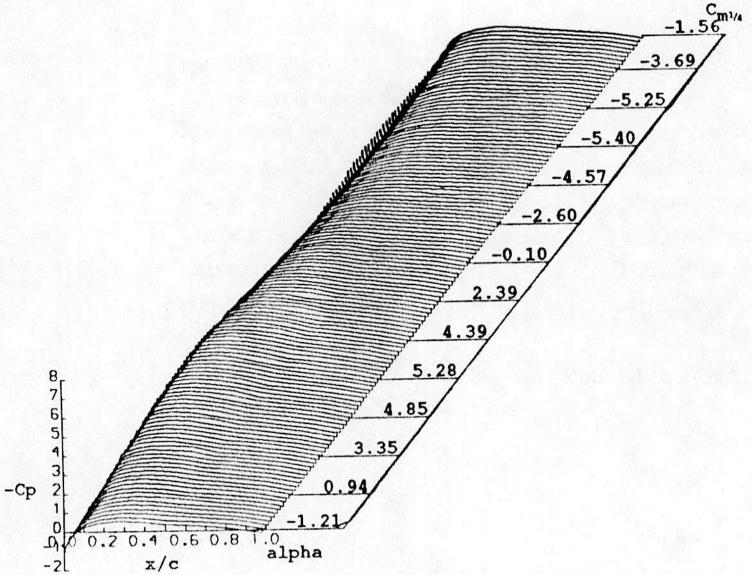
MACH NUMBER = 0.129

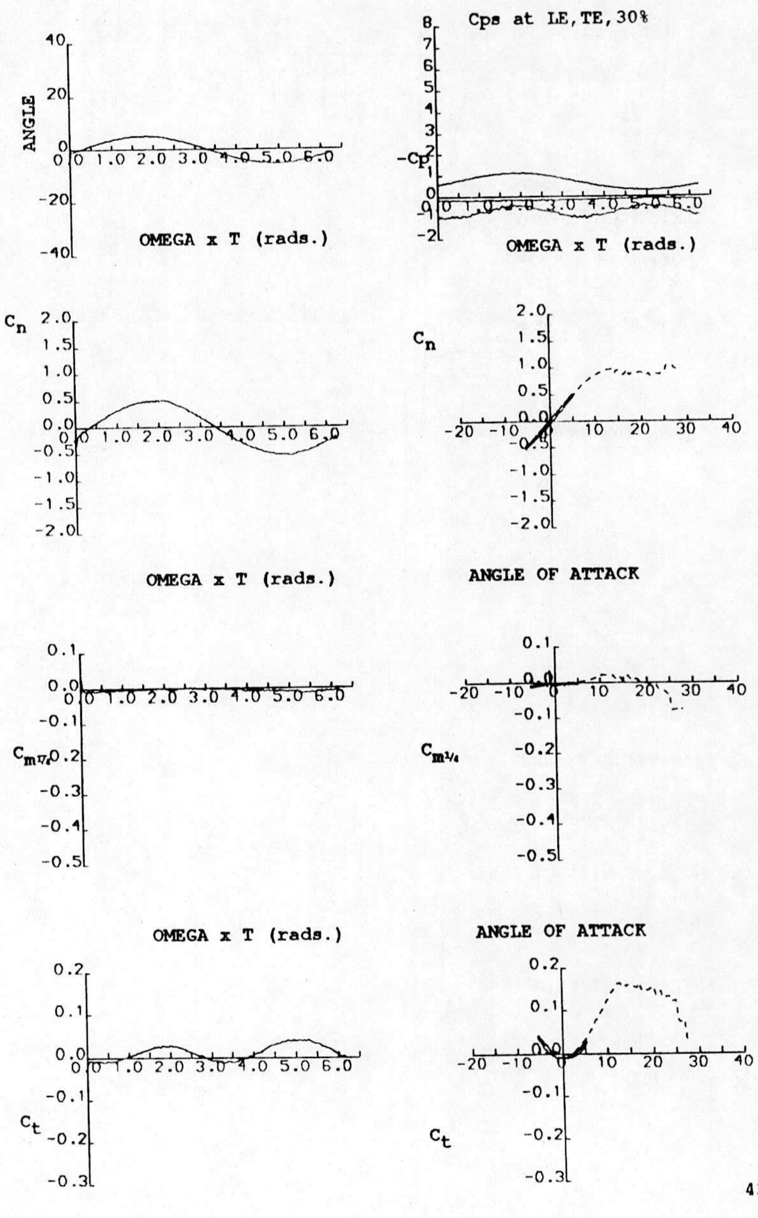
AIR TEMPERATURE = 22.9°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54961

REYNOLDS NUMBER = 1601500.

DYNAMIC PRESSURE = 1195.20 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

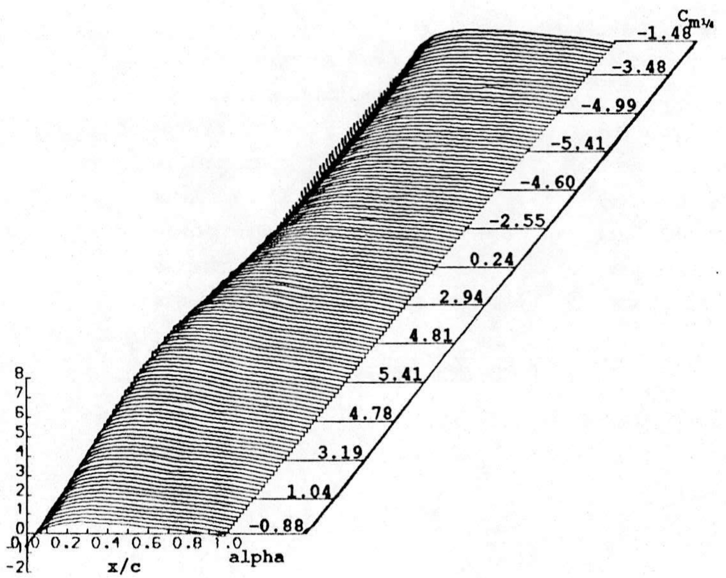
MACH NUMBER = 0.132

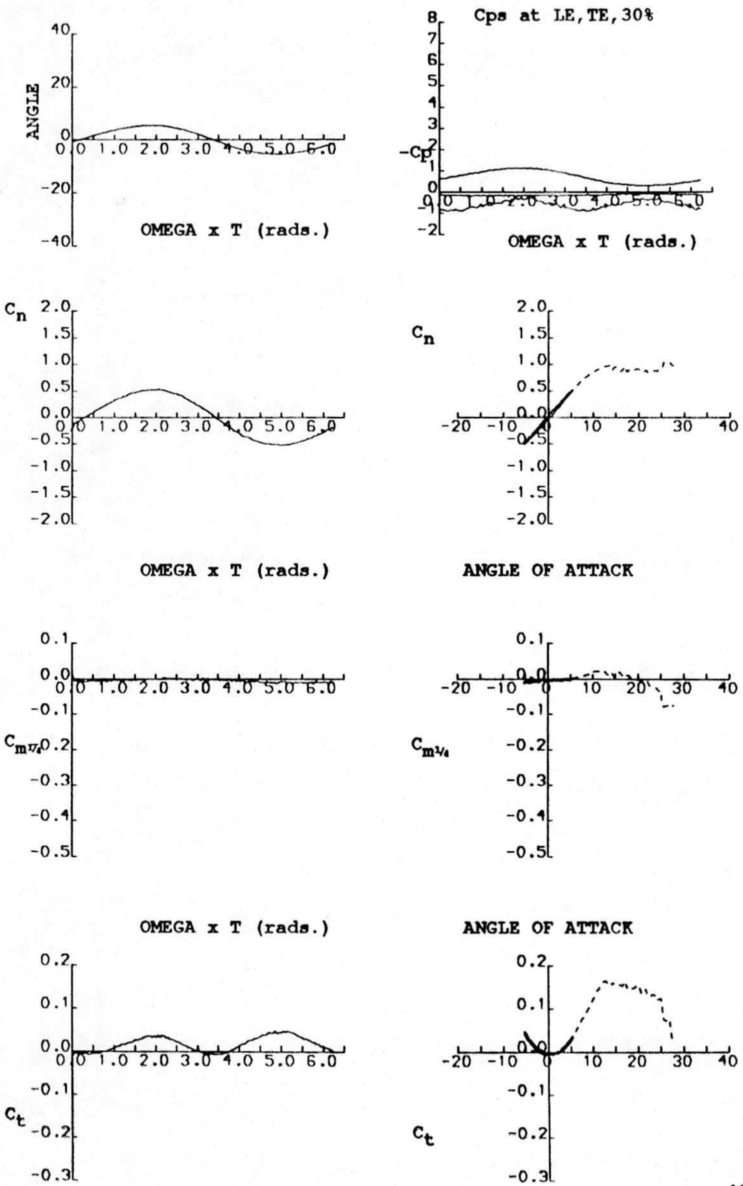
AIR TEMPERATURE = 23.7°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14311

REYNOLDS NUMBER = 1600950.

DYNAMIC PRESSURE = 1167.19 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

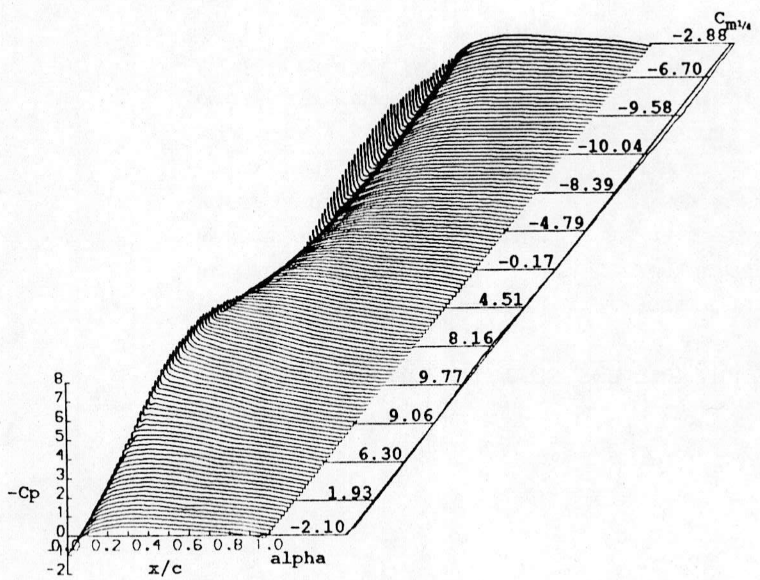
MACH NUMBER = 0.129

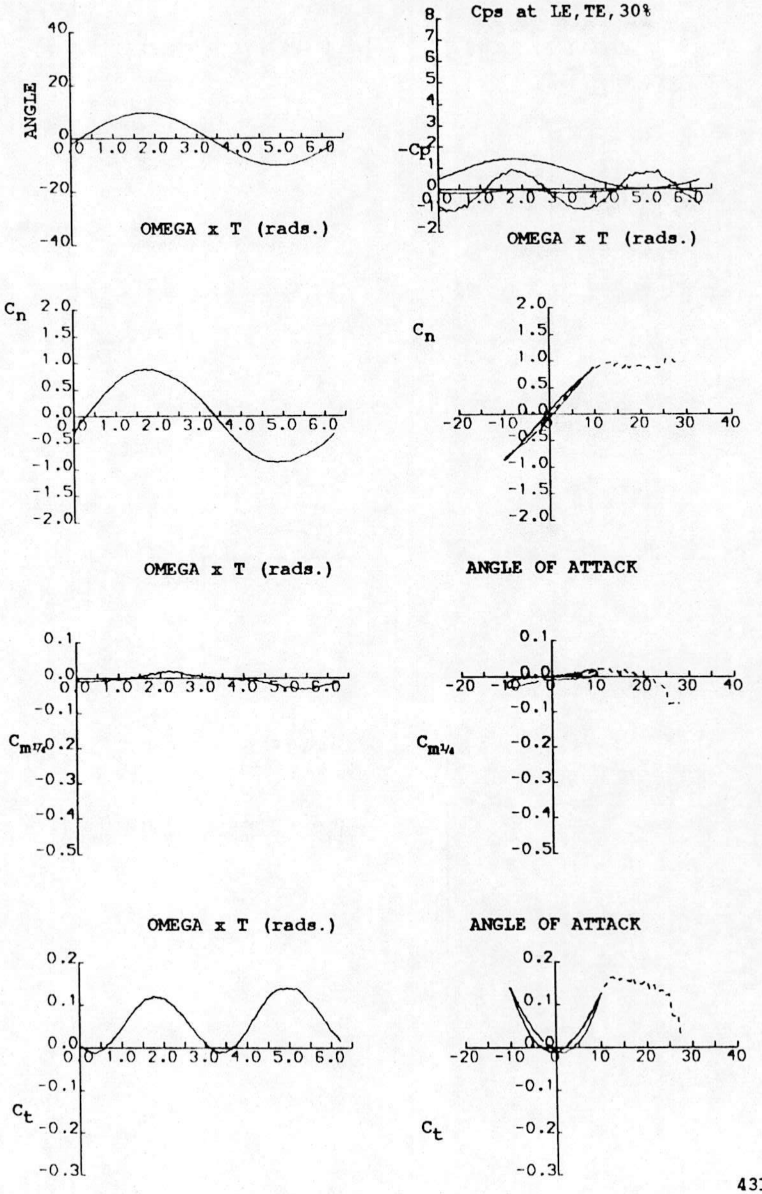
AIR TEMPERATURE = 23.3°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 10.00°

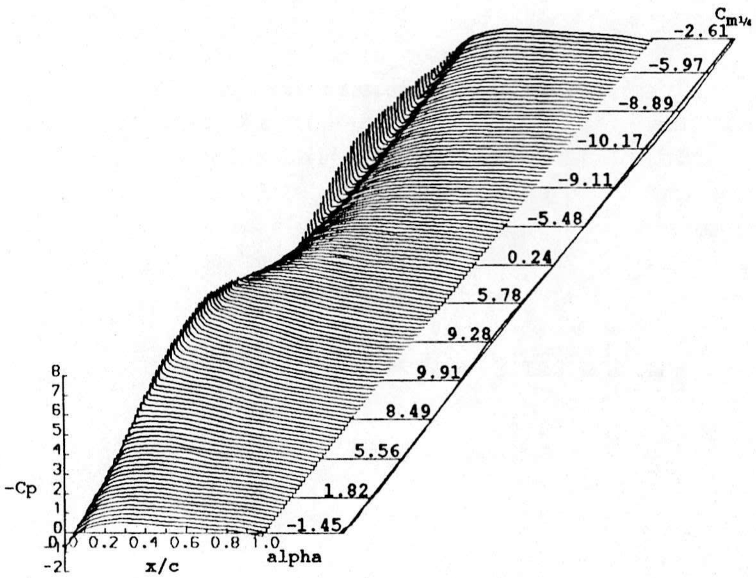


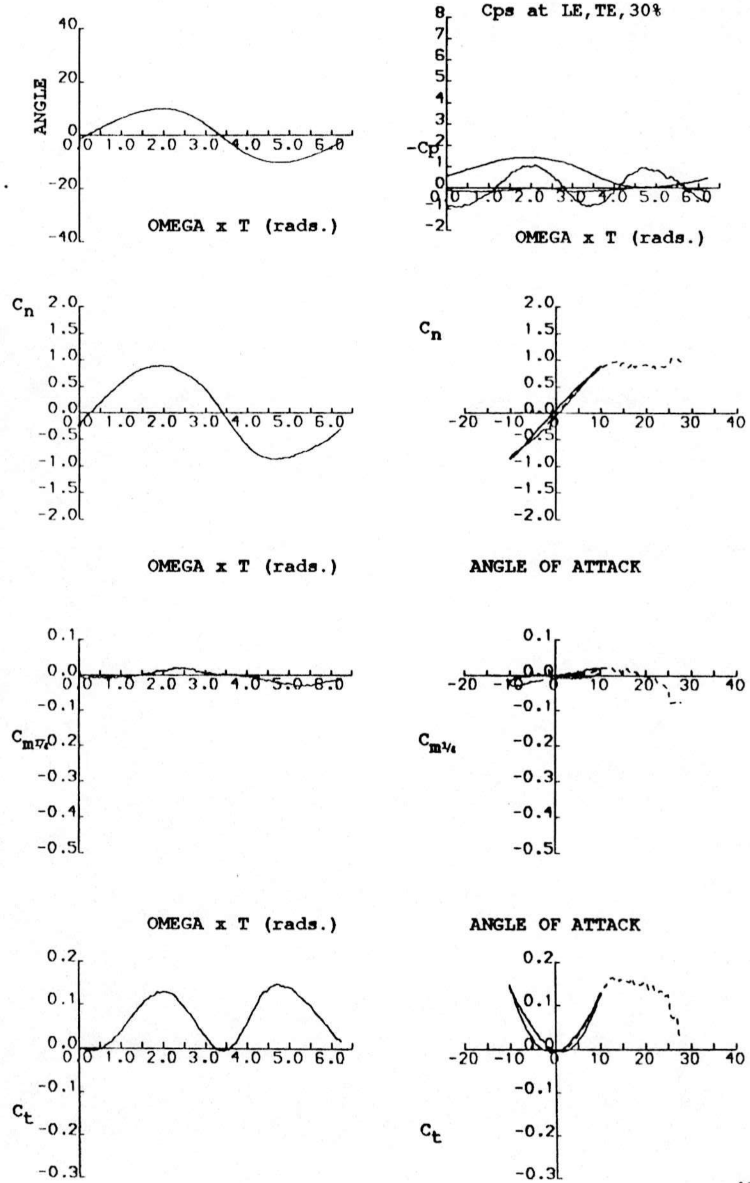


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54971
REYNOLDS NUMBER = 1598047.
DYNAMIC PRESSURE = 1195.20 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

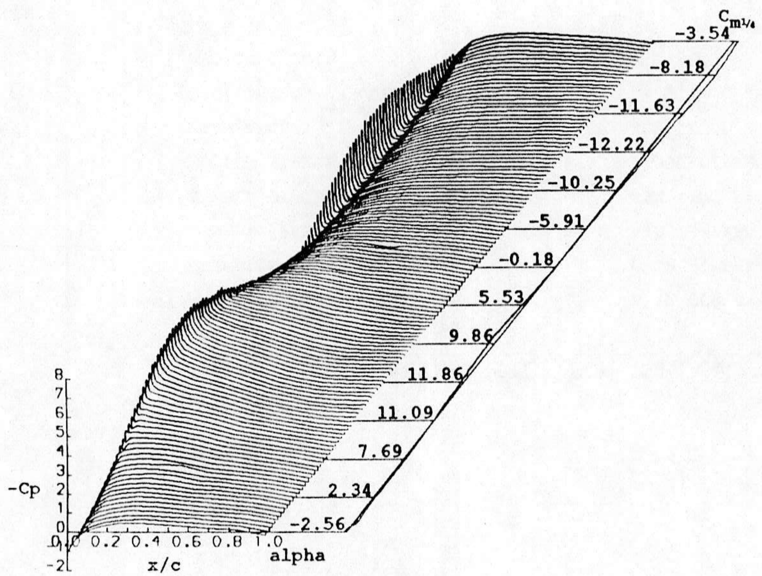
DATE OF TEST: 13/11/91
MACH NUMBER = 0.132
AIR TEMPERATURE = 24.2°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 10.00°

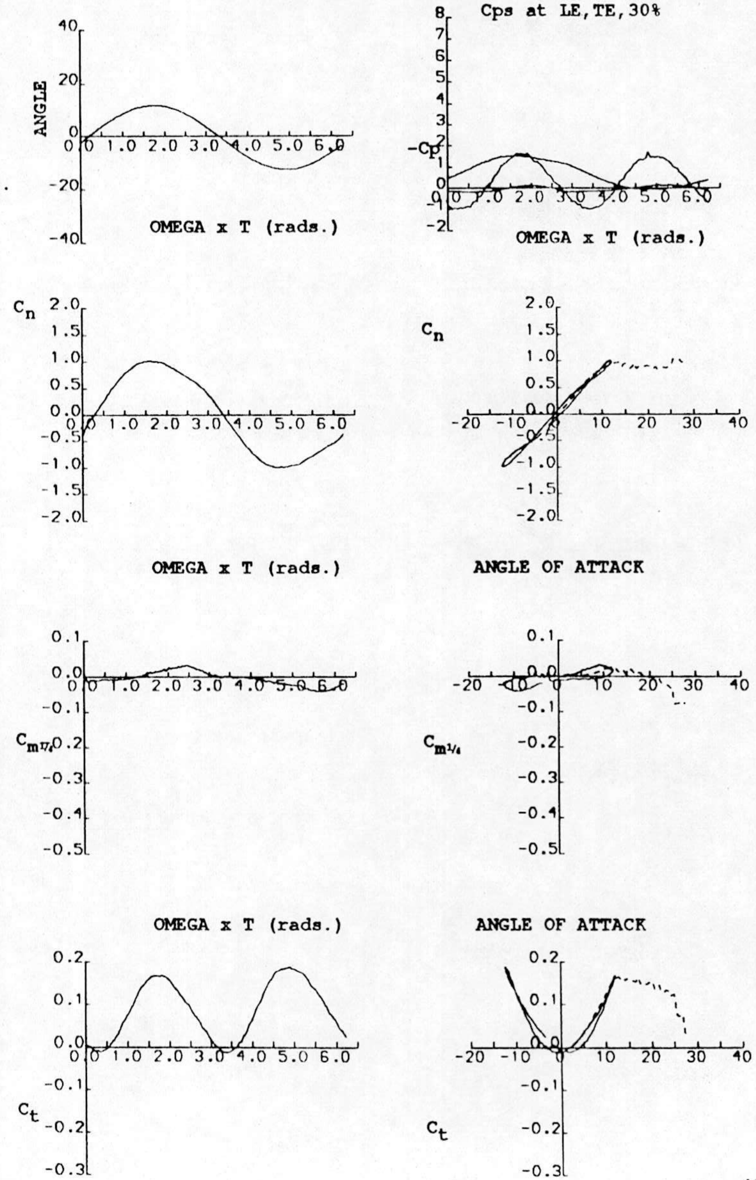




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14321	DATE OF TEST: 11/11/91
REYNOLDS NUMBER = 1599565.	MACH NUMBER = 0.129
DYNAMIC PRESSURE = 1167.19 Nm^{-2}	AIR TEMPERATURE = 23.5°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 155.91 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.047
MEAN ANGLE = 0.00°	AMPLITUDE = 12.20°
OSCILLATION FREQUENCY = 1.218 Hz.	
AVERAGED DATA OF 10 CYCLES	

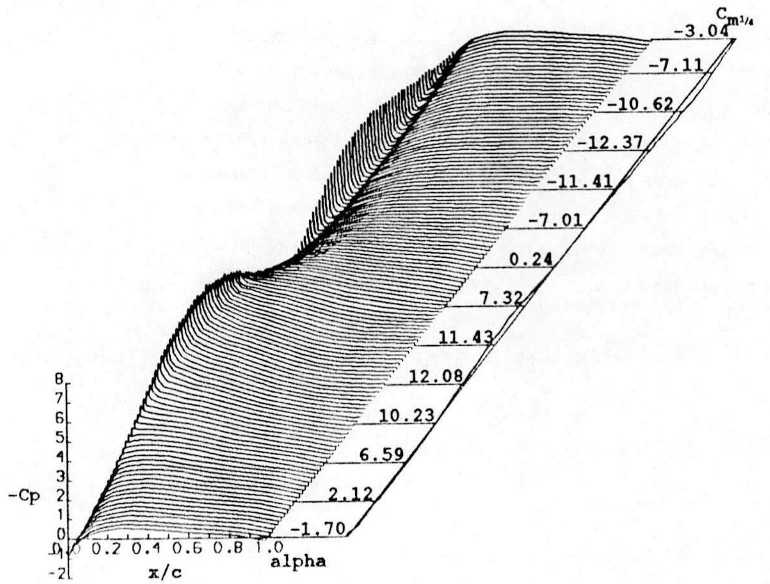


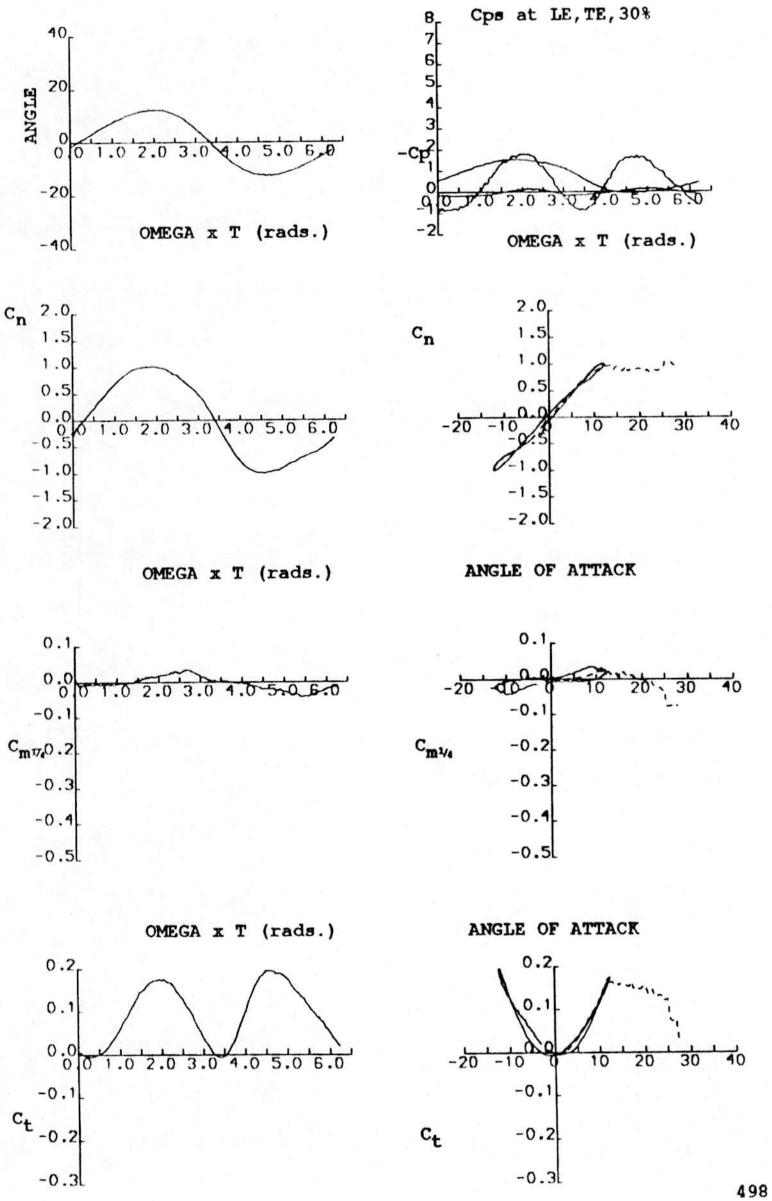


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 54981
REYNOLDS NUMBER = 1595294.
DYNAMIC PRESSURE = 1195.20 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.132
AIR TEMPERATURE = 24.6°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14331

REYNOLDS NUMBER = 1597492.

DYNAMIC PRESSURE = 1167.19 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

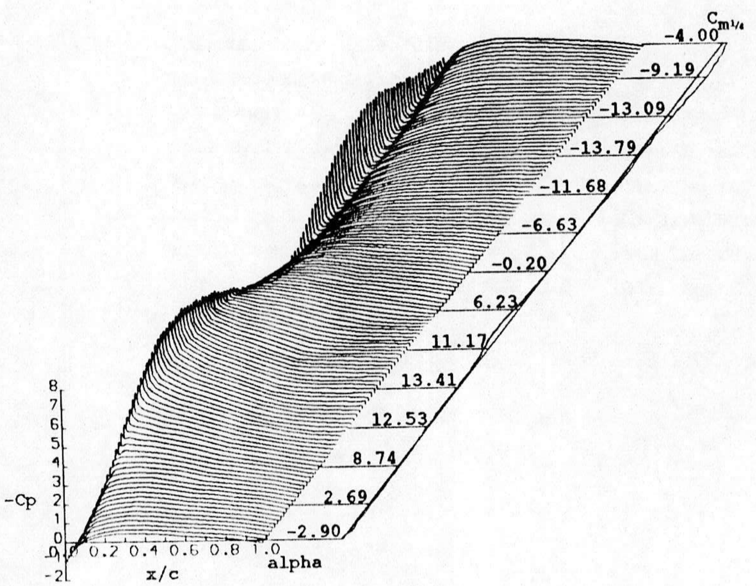
MACH NUMBER = 0.129

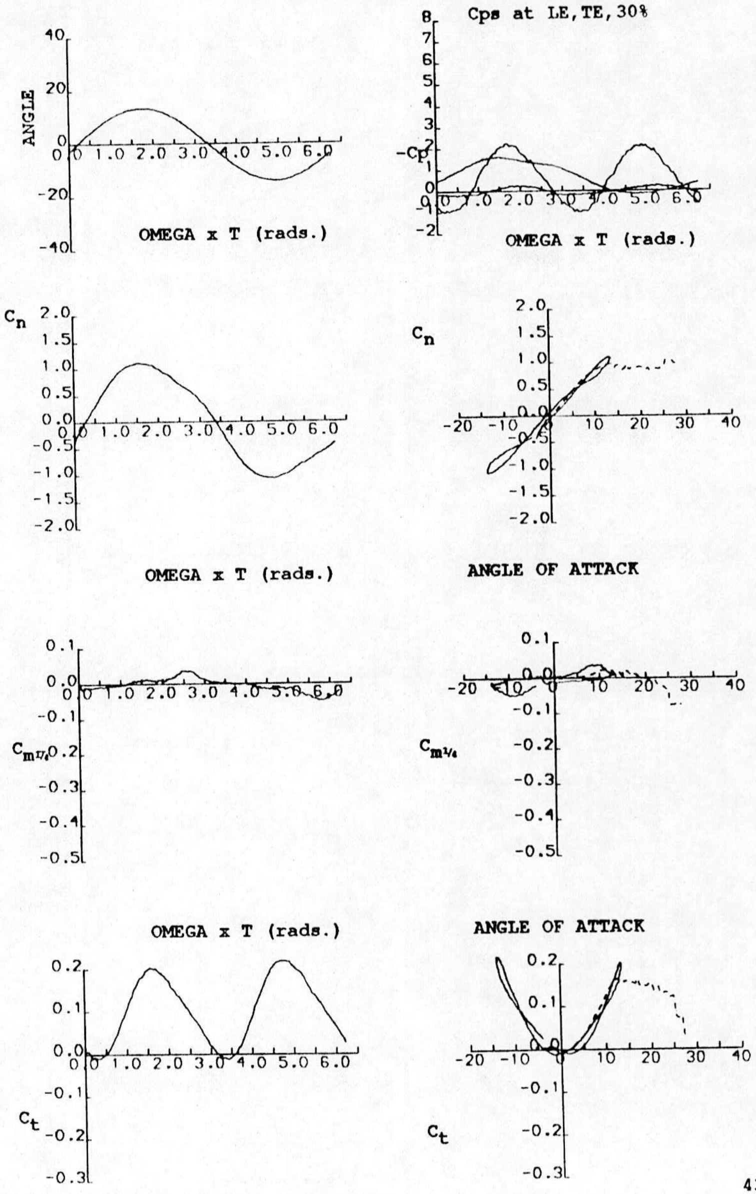
AIR TEMPERATURE = 23.8°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

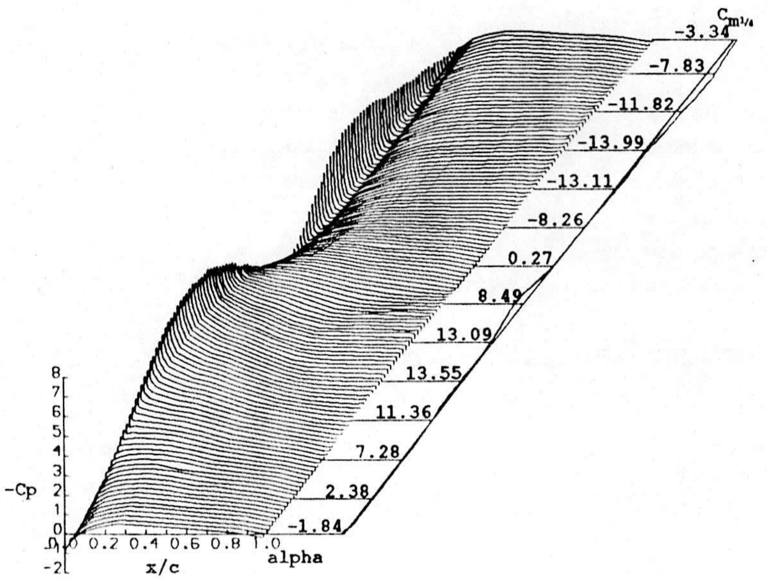
AMPLITUDE = 13.80°

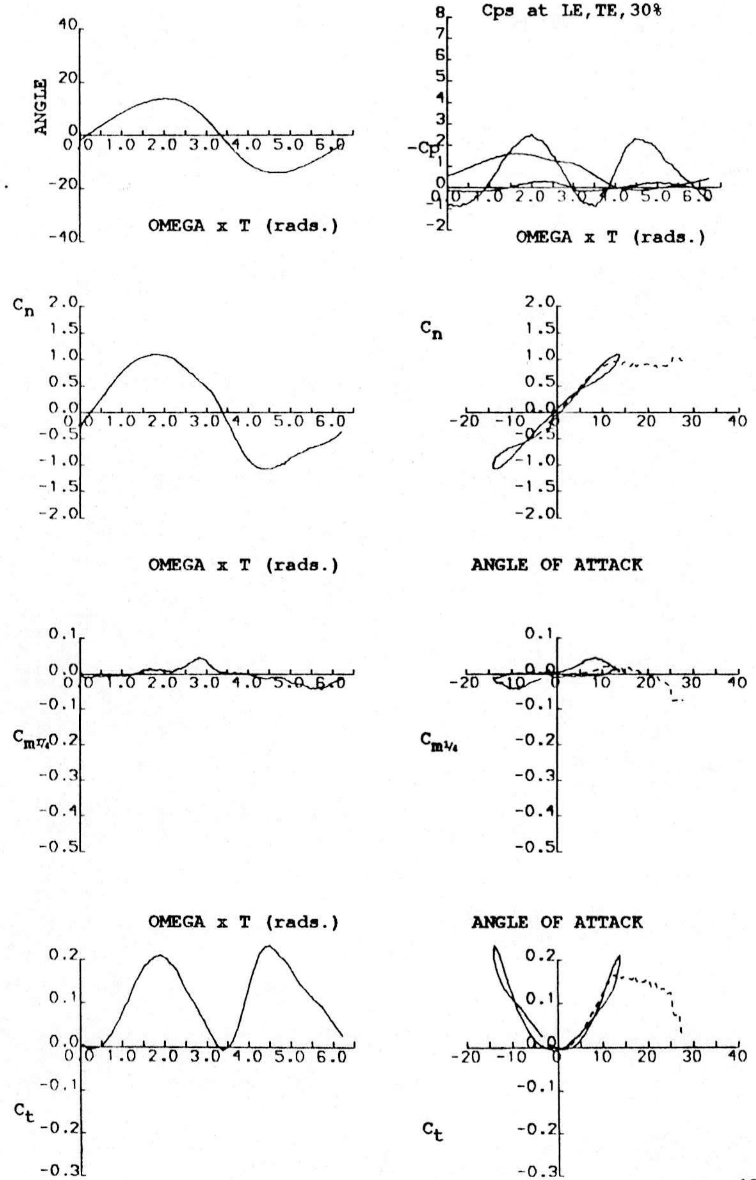




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

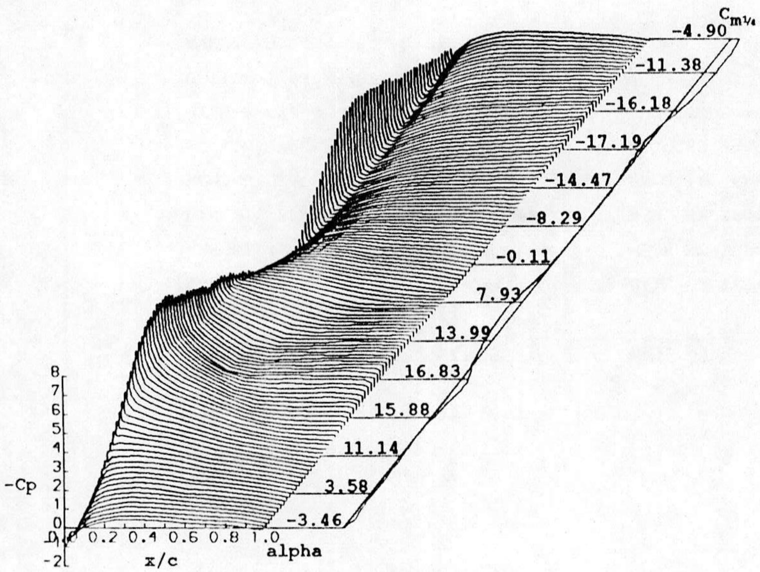
RUN REFERENCE NUMBER: 54991	DATE OF TEST: 13/11/91
REYNOLDS NUMBER = 1589817.	MACH NUMBER = 0.132
DYNAMIC PRESSURE = 1195.20 Nm^{-2}	AIR TEMPERATURE = 25.4°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 155.91 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.046
MEAN ANGLE = 0.00°	AMPLITUDE = 13.80°
OSCILLATION FREQUENCY = 1.218 Hz.	
AVERAGED DATA OF 10 CYCLES	

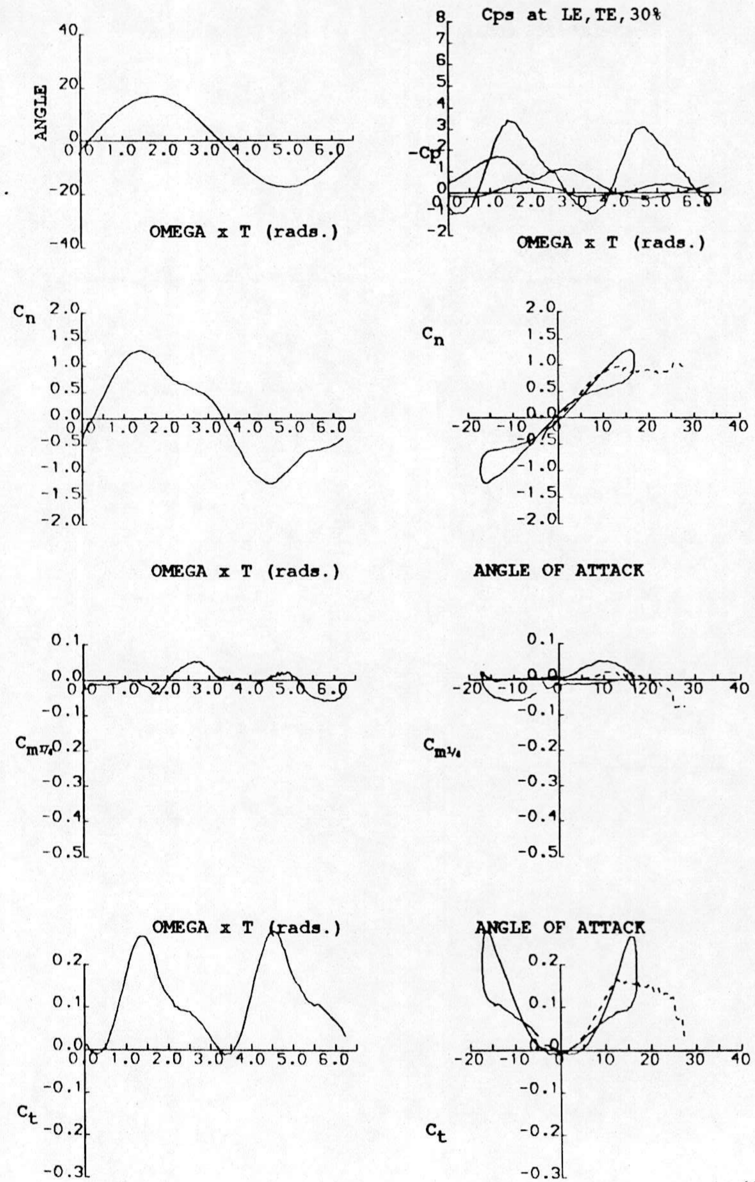




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14341	DATE OF TEST: 11/11/91
REYNOLDS NUMBER = 1594737.	MACH NUMBER = 0.129
DYNAMIC PRESSURE = 1167.19 Nm^{-2}	AIR TEMPERATURE = 24.2°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 155.91 Hz.
MOTION TYPE: SINUSOIDAL	REDUCED FREQUENCY = 0.047
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 1.218 Hz.	
AVERAGED DATA OF 10 CYCLES	

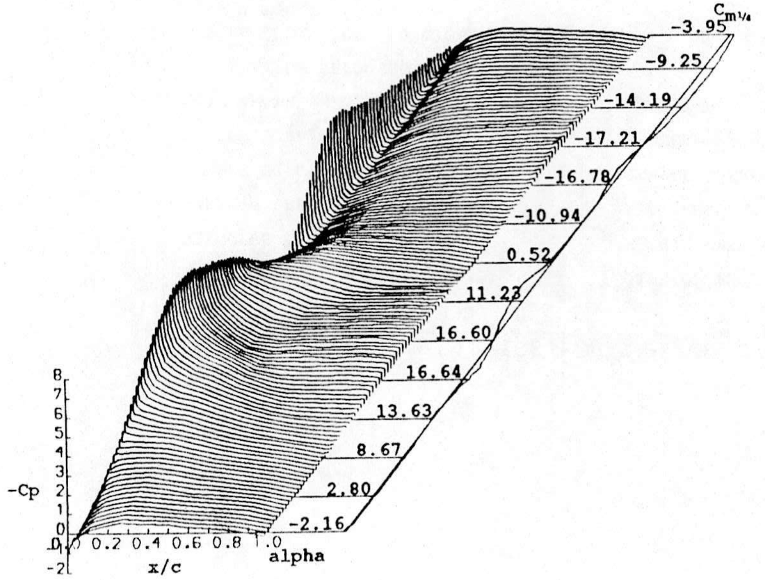


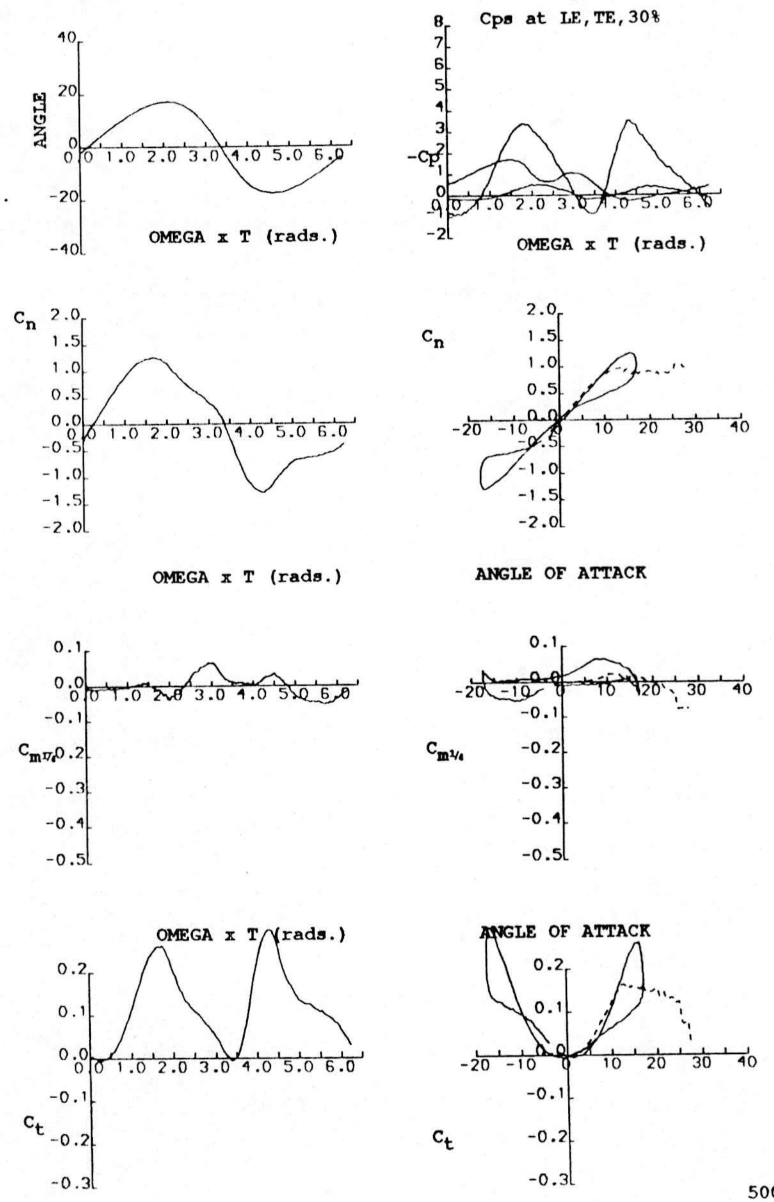


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55001
REYNOLDS NUMBER = 1588453.
DYNAMIC PRESSURE = 1195.20 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.132
AIR TEMPERATURE = 25.6°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14351

REYNOLDS NUMBER = 1594049.

DYNAMIC PRESSURE = 1167.19 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91

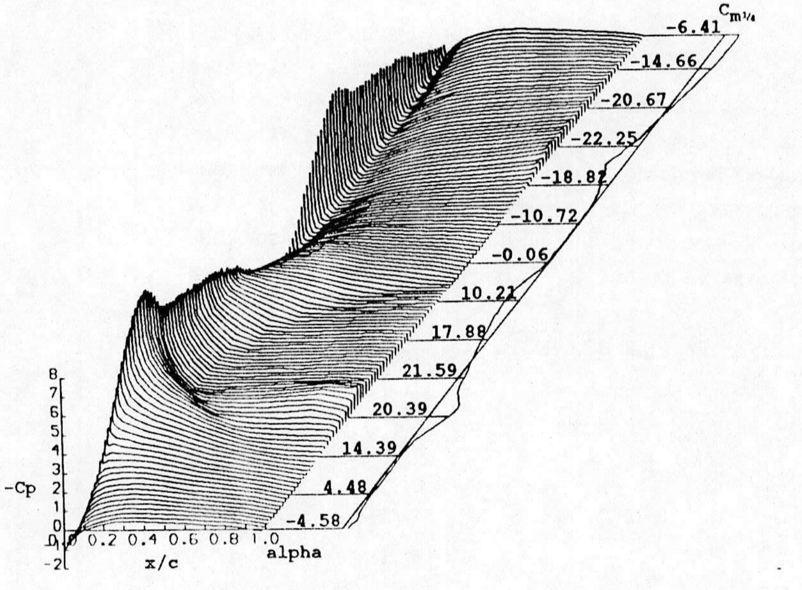
MACH NUMBER = 0.129

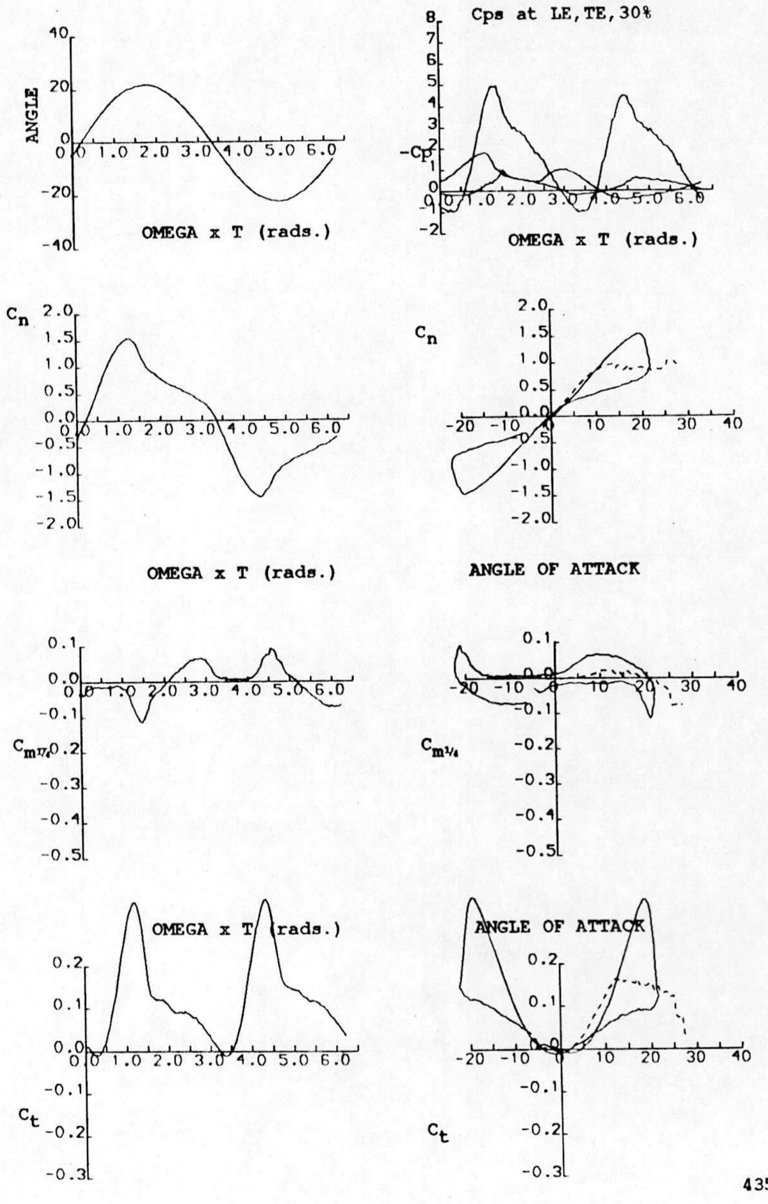
AIR TEMPERATURE = 24.3°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55011

REYNOLDS NUMBER = 1585053.

DYNAMIC PRESSURE = 1195.20 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

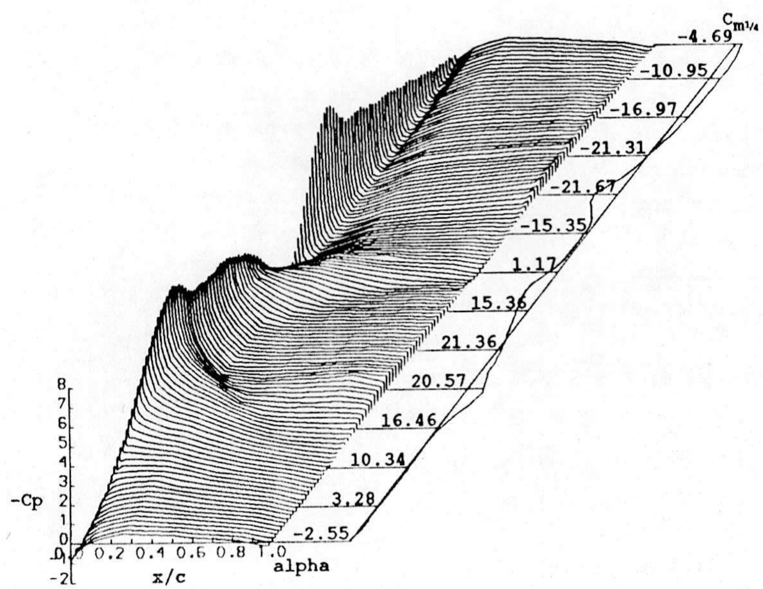
MACH NUMBER = 0.132

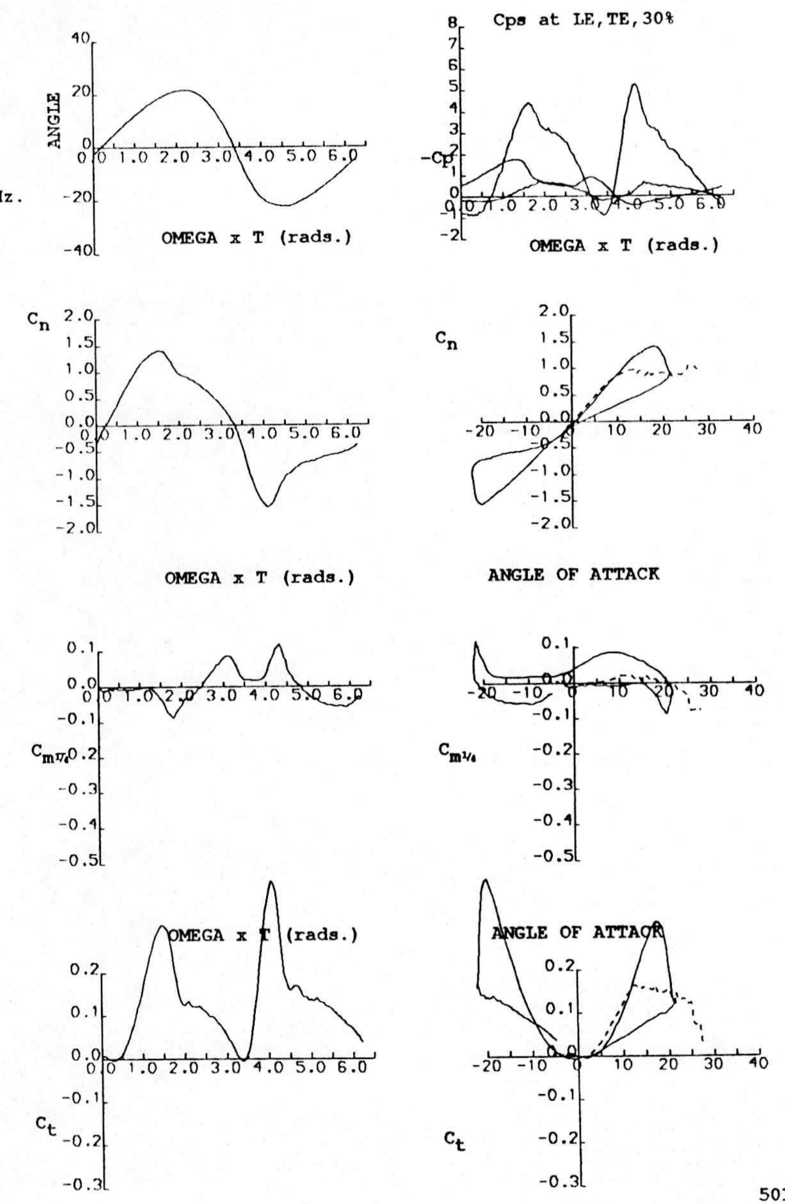
AIR TEMPERATURE = 26.1°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 22.60°

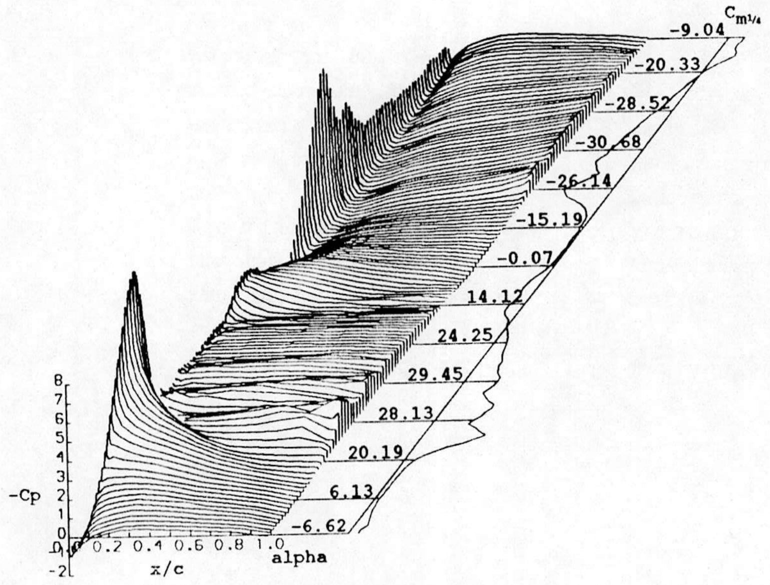


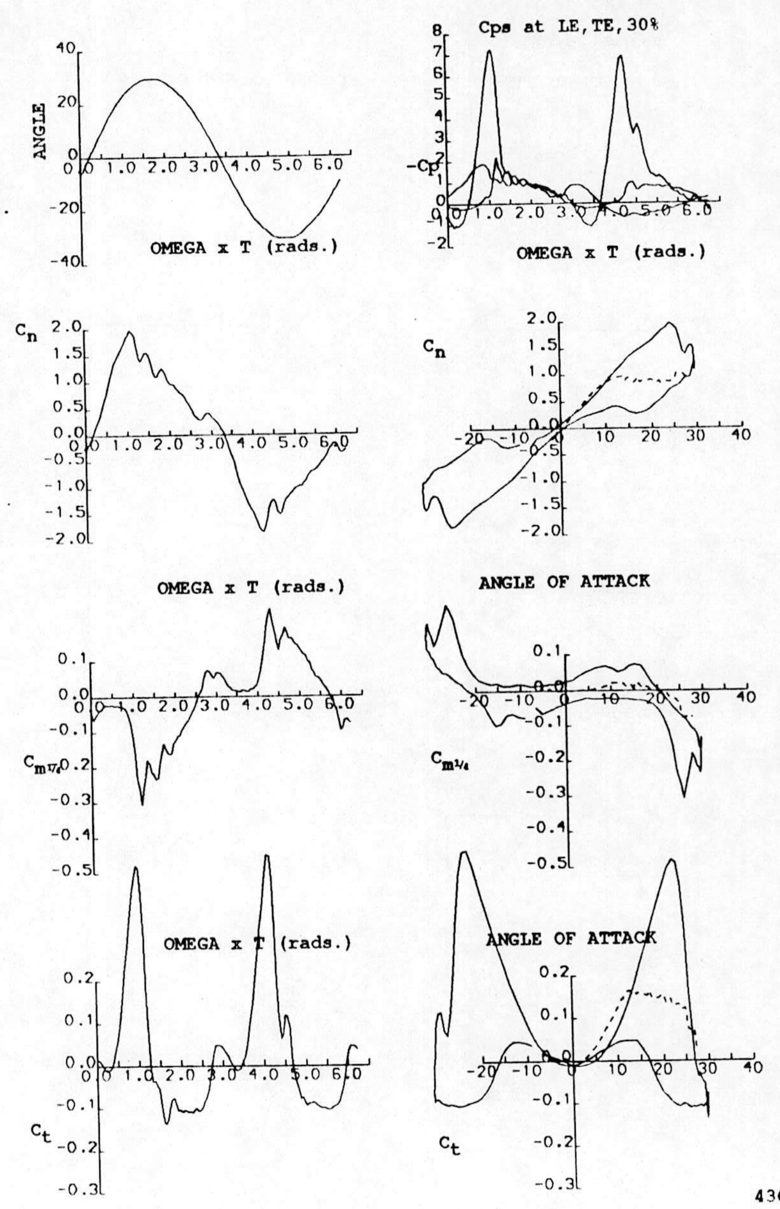


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14361
REYNOLDS NUMBER = 1591990.
DYNAMIC PRESSURE = 1167.19 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 11/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 24.6°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 32.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55021

REYNOLDS NUMBER = 1583021.

DYNAMIC PRESSURE = 1195.20 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

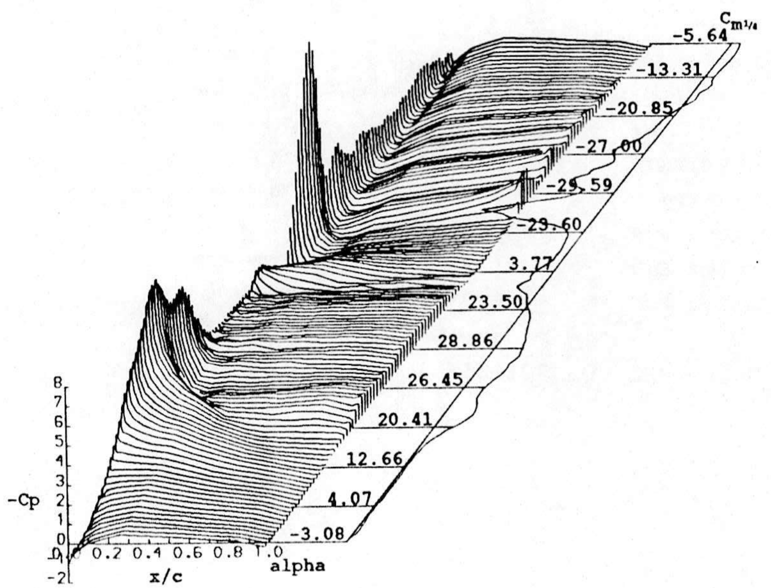
MACH NUMBER = 0.132

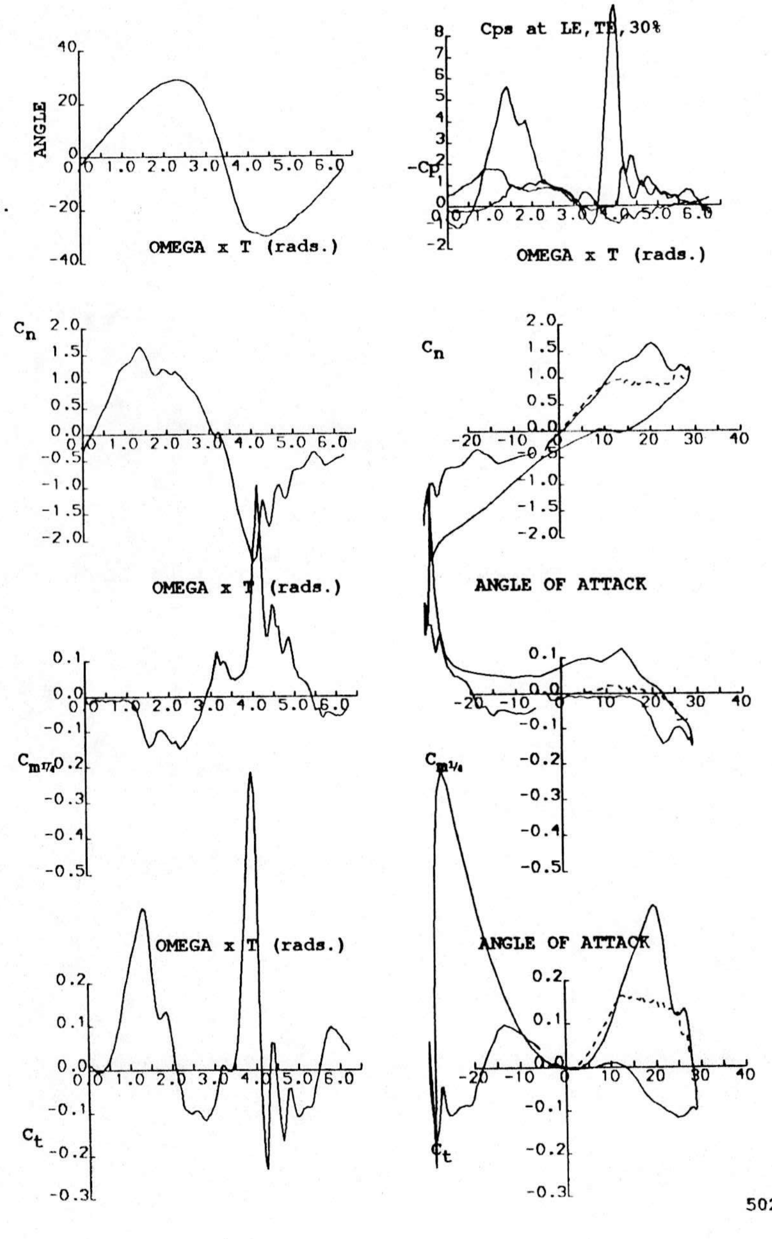
AIR TEMPERATURE = 26.4°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 32.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14381

REYNOLDS NUMBER = 2067046.

DYNAMIC PRESSURE = 1925.38 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

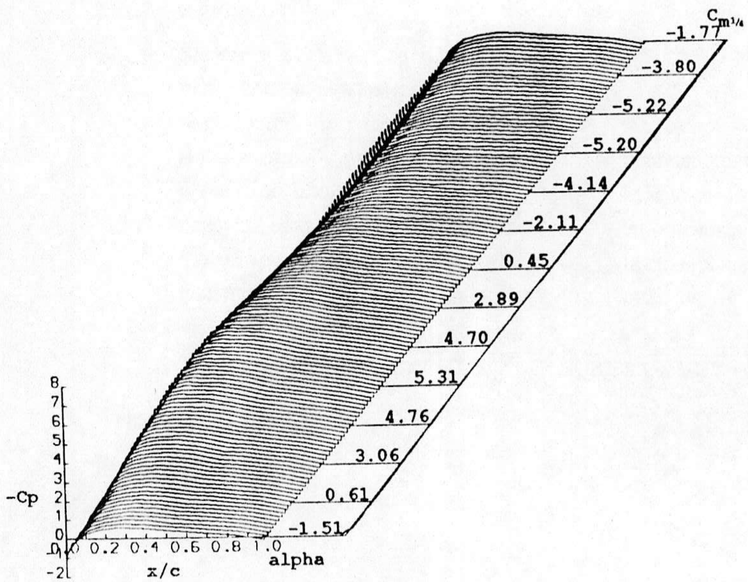
MACH NUMBER = 0.167

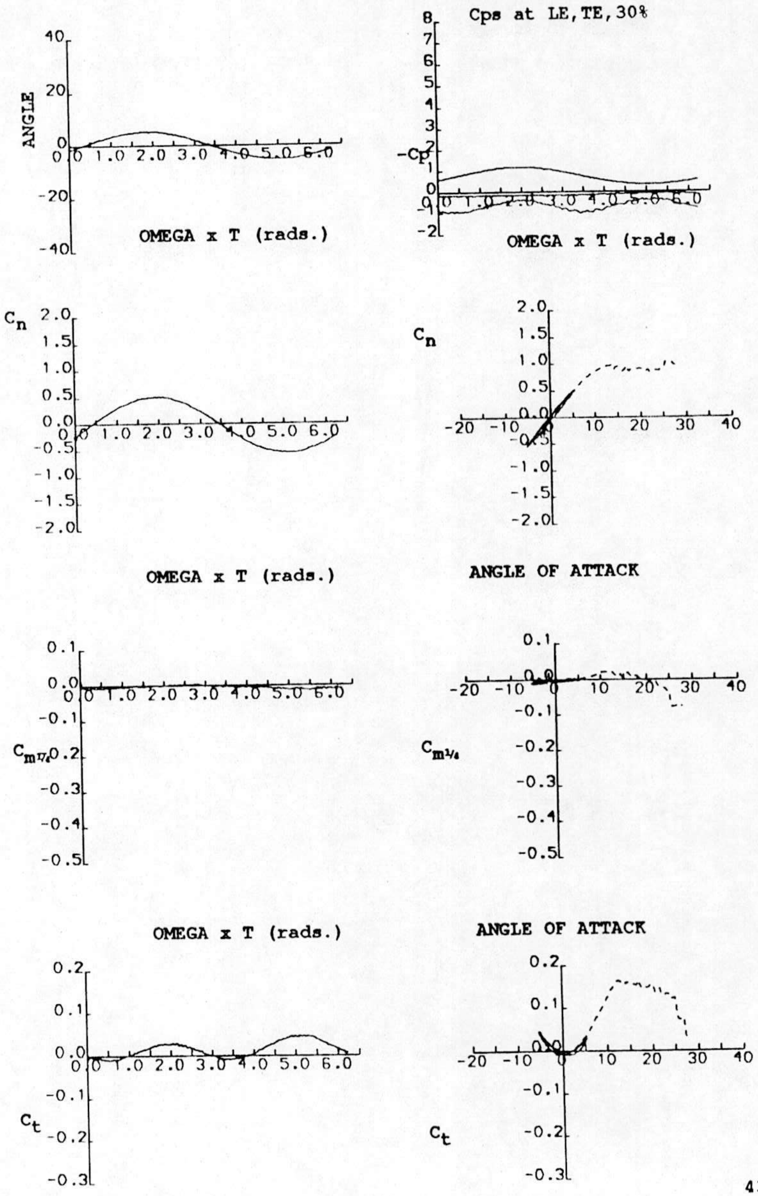
AIR TEMPERATURE = 20.7°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.049

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55041

REYNOLDS NUMBER = 2073131.

DYNAMIC PRESSURE = 2123.51 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

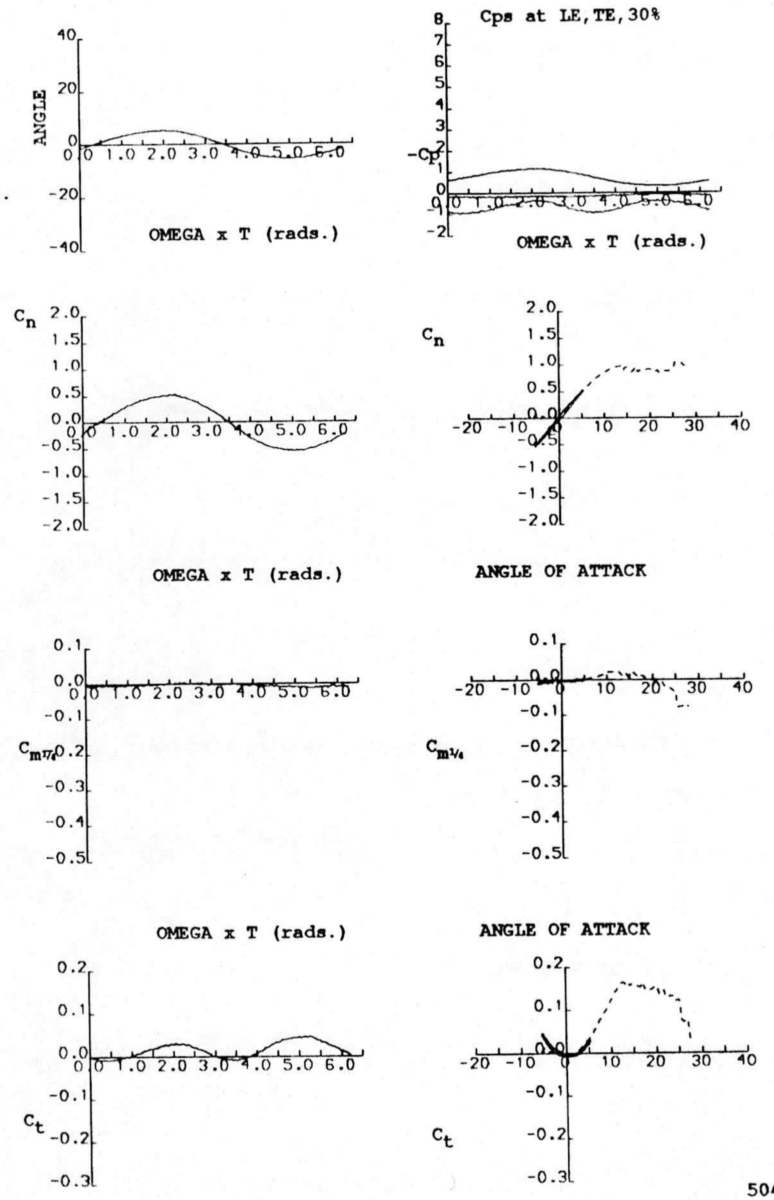
MACH NUMBER = 0.176

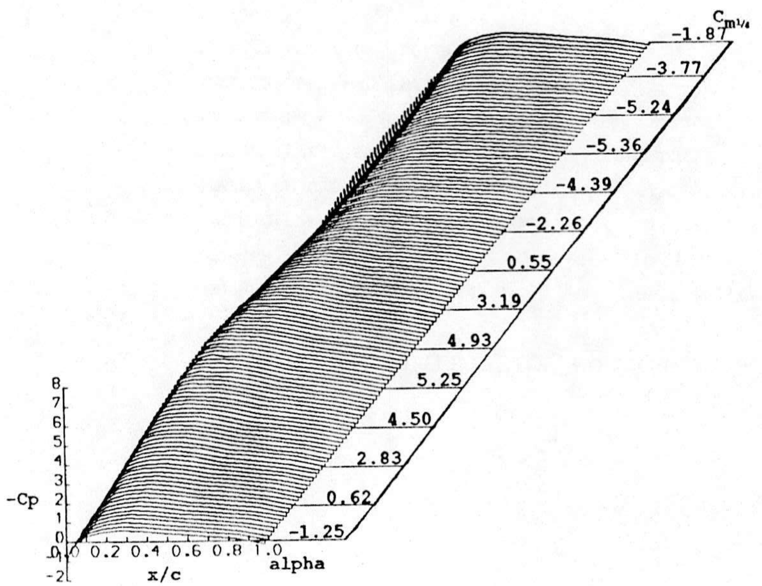
AIR TEMPERATURE = 30.4°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14391

REYNOLDS NUMBER = 2058046.

DYNAMIC PRESSURE = 1925.38 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

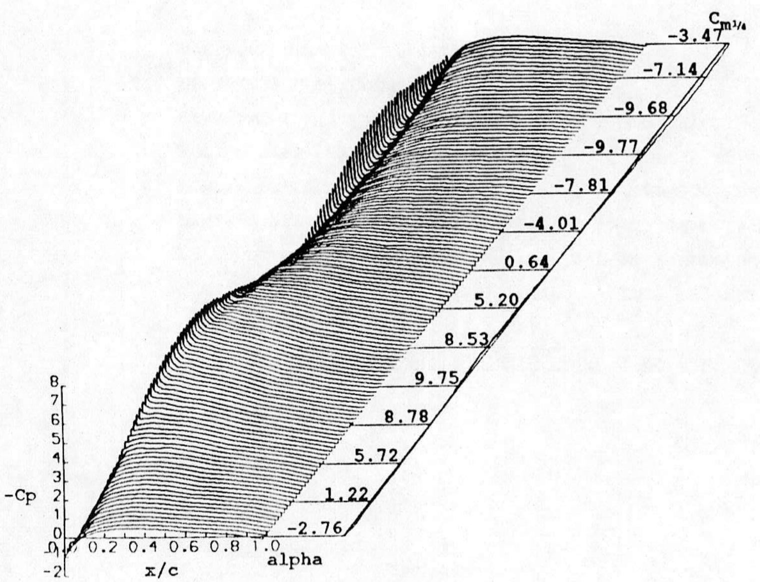
MACH NUMBER = 0.167

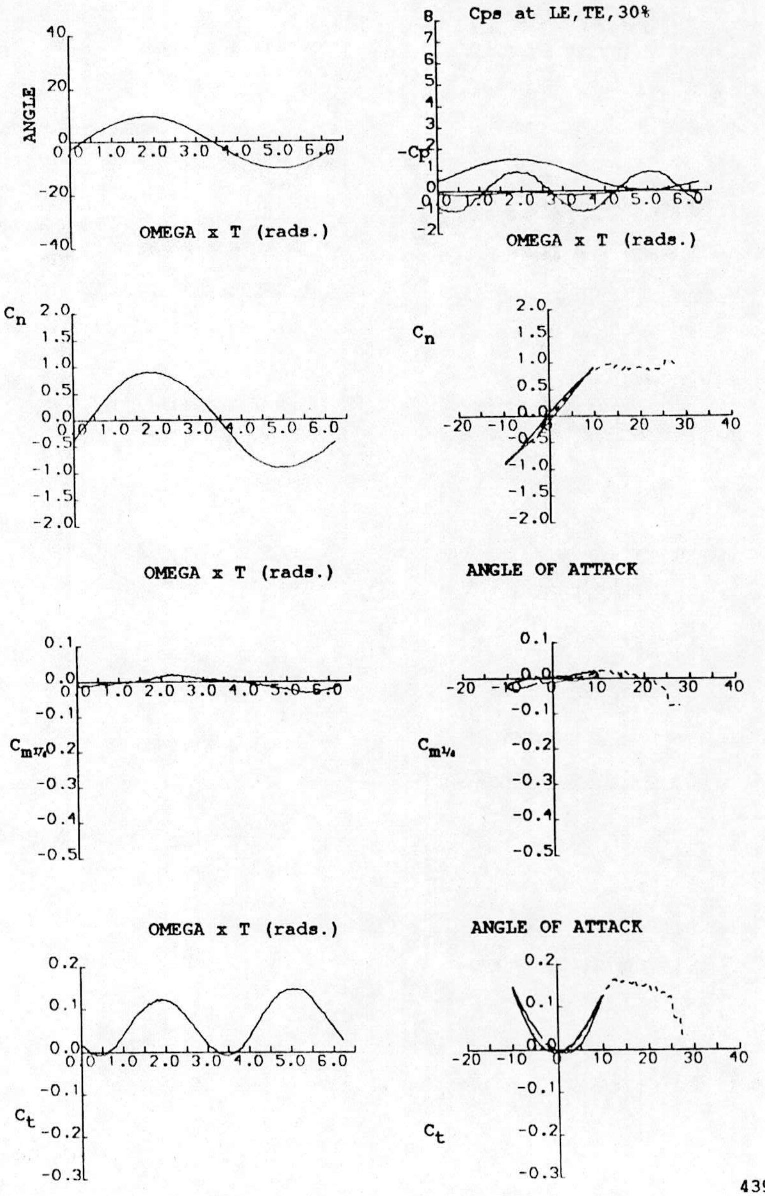
AIR TEMPERATURE = 21.7°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.049

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55051

REYNOLDS NUMBER = 2066170.

DYNAMIC PRESSURE = 2123.51 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

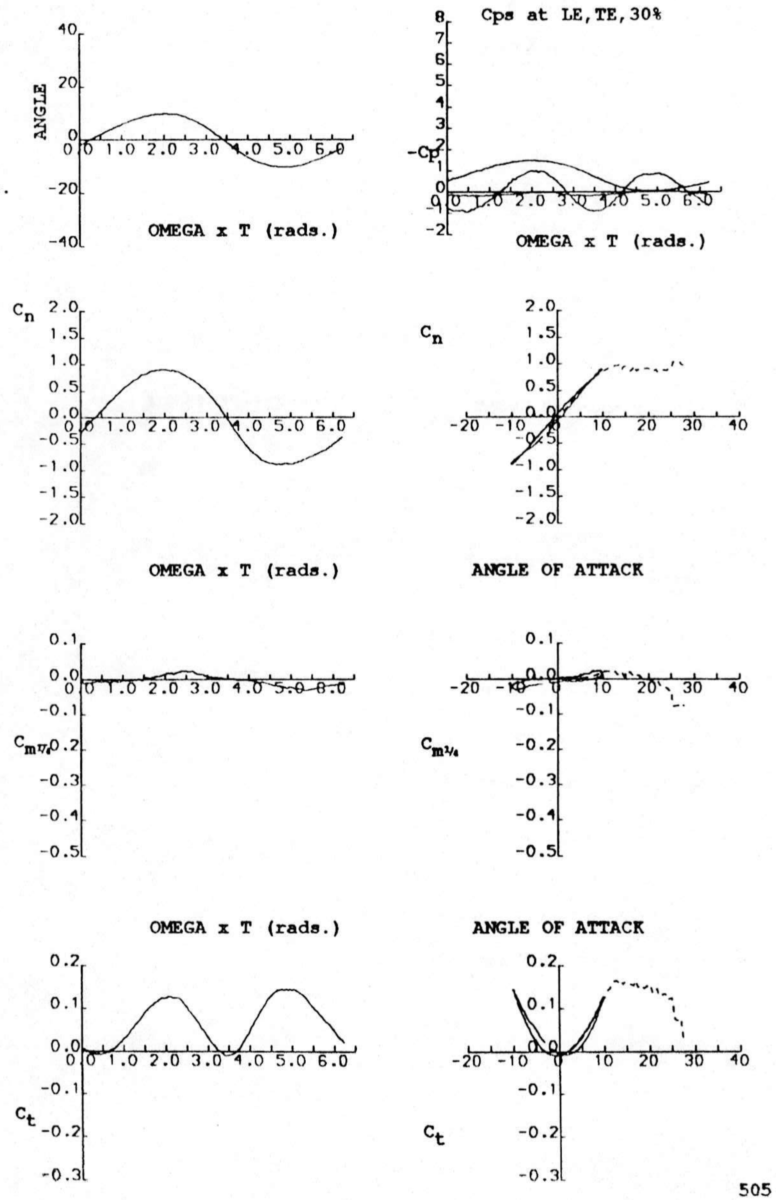
MACH NUMBER = 0.176

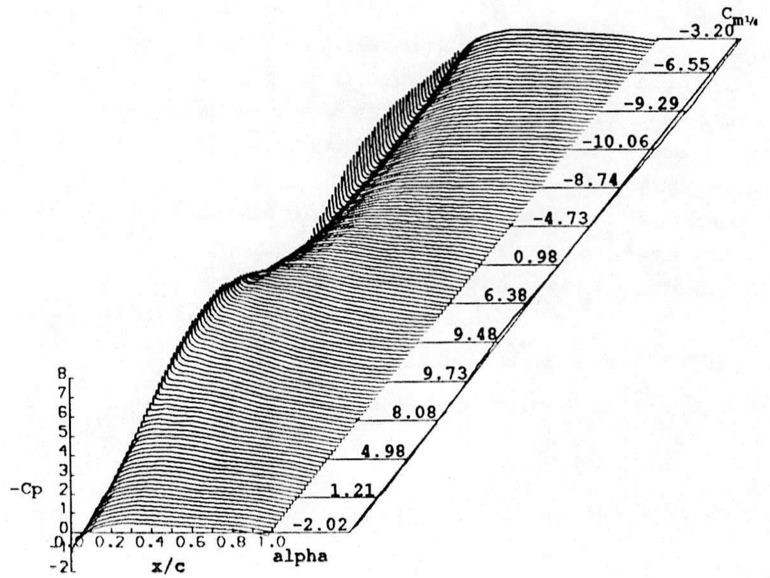
AIR TEMPERATURE = 31.2°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14401

REYNOLDS NUMBER = 2052682.

DYNAMIC PRESSURE = 1925.38 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

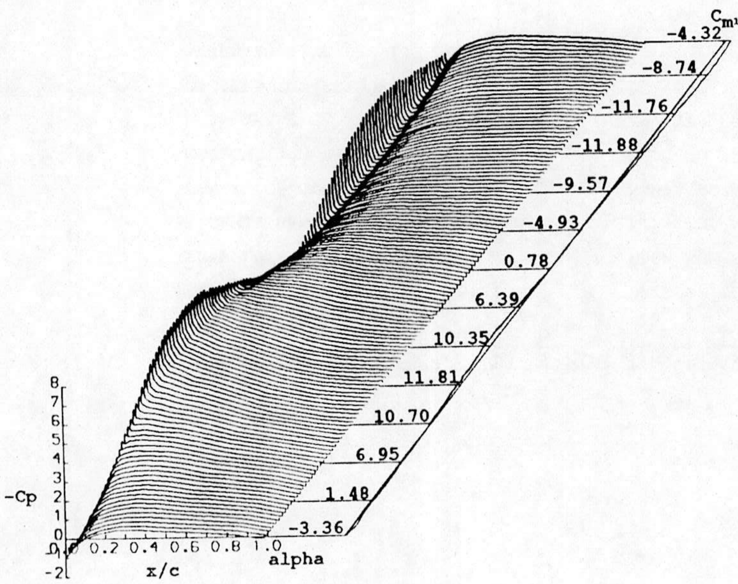
MACH NUMBER = 0.167

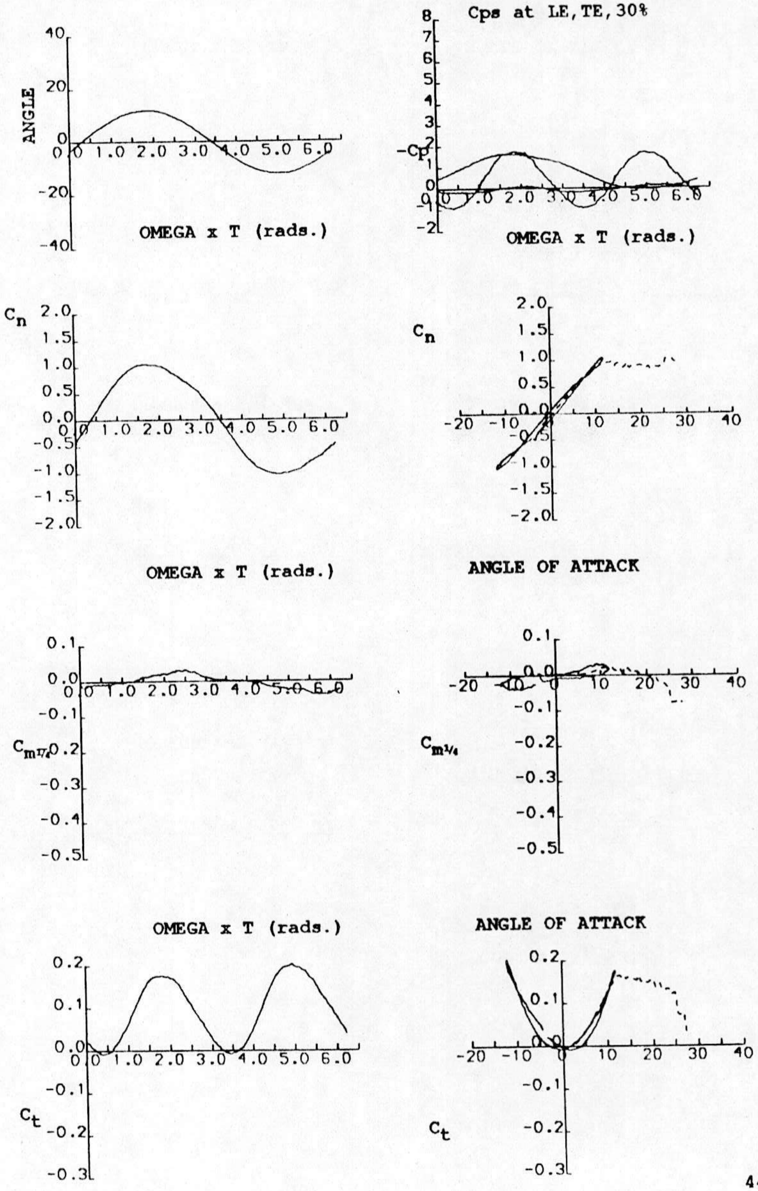
AIR TEMPERATURE = 22.3°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.049

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55061

REYNOLDS NUMBER = 2060115.

DYNAMIC PRESSURE = 2123.51 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

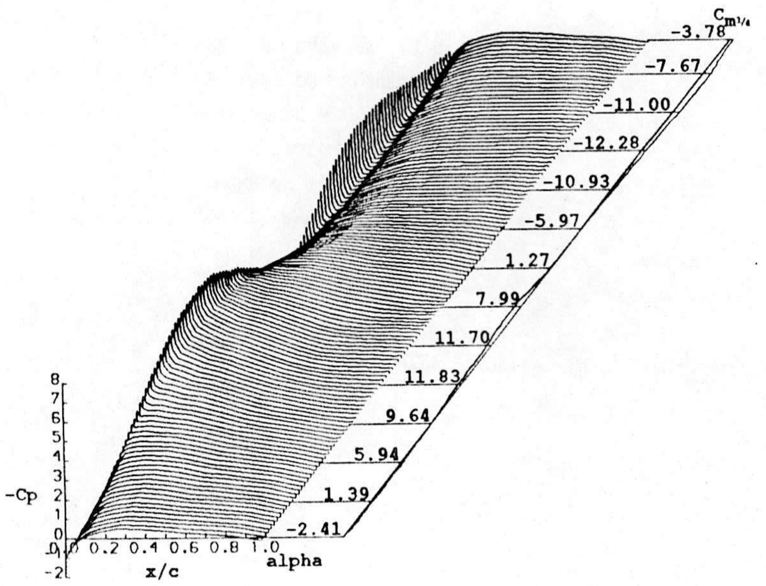
MACH NUMBER = 0.176

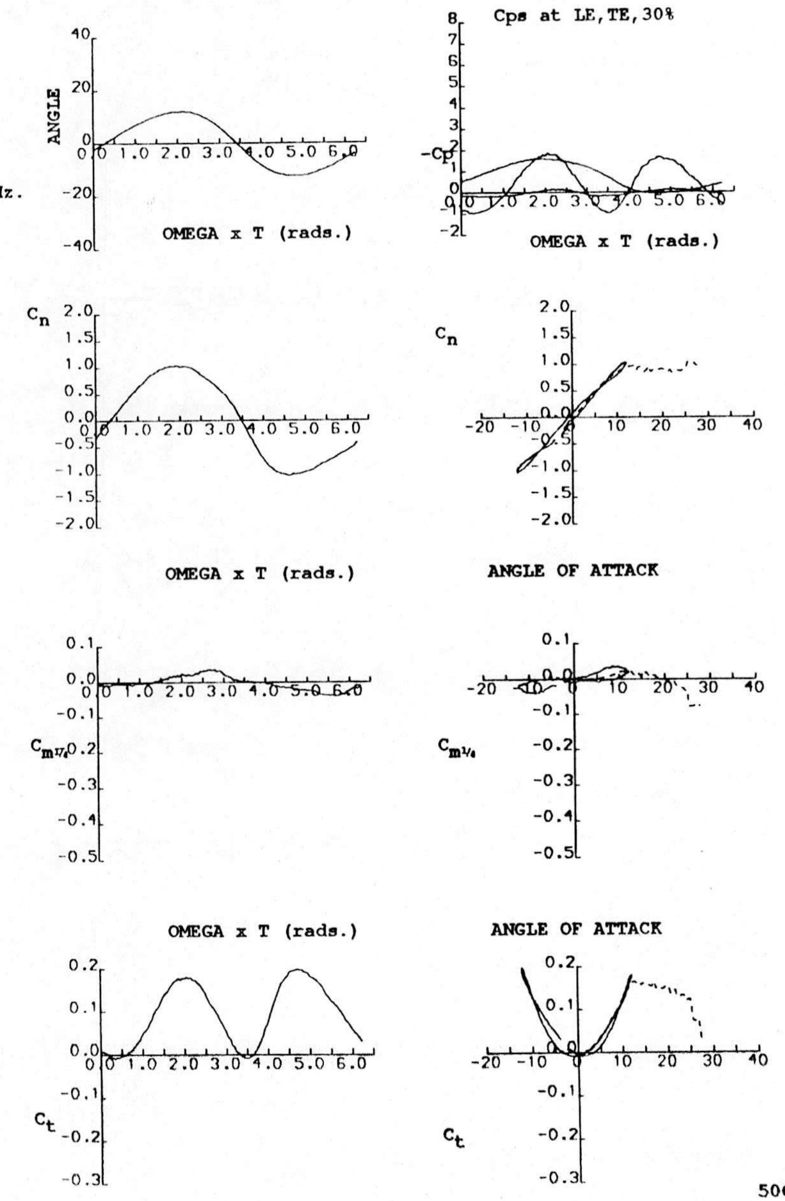
AIR TEMPERATURE = 31.9°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14411

REYNOLDS NUMBER = 2048232.

DYNAMIC PRESSURE = 1925.38 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

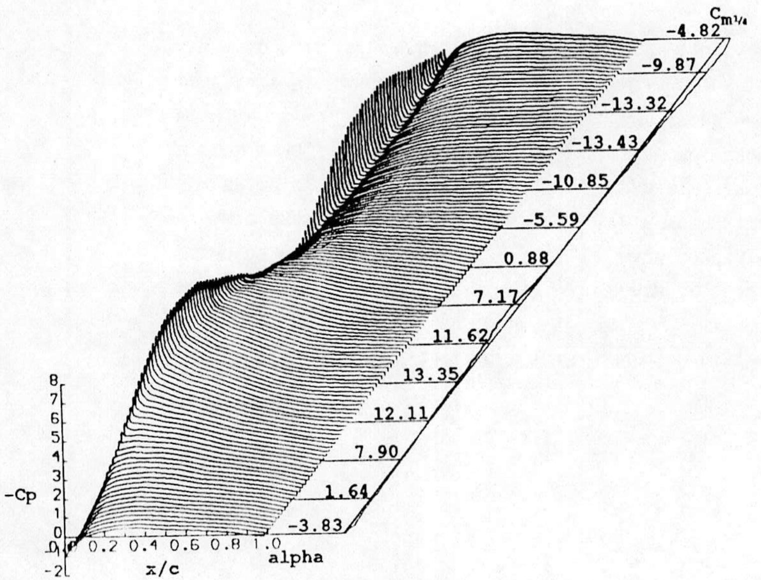
MACH NUMBER = 0.167

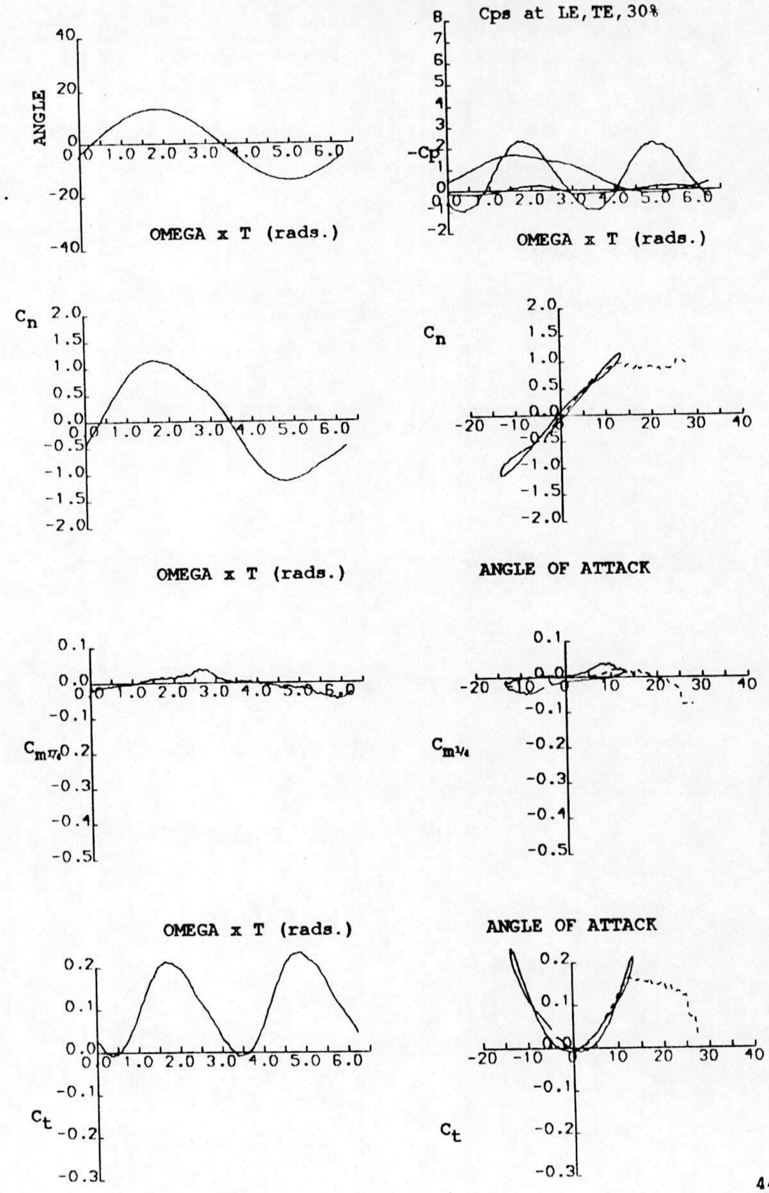
AIR TEMPERATURE = 22.8°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.049

AMPLITUDE = 13.80°

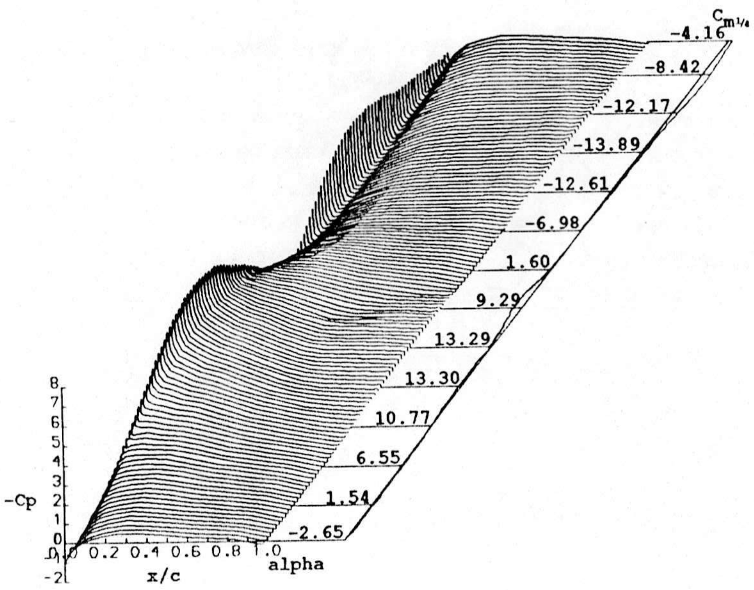


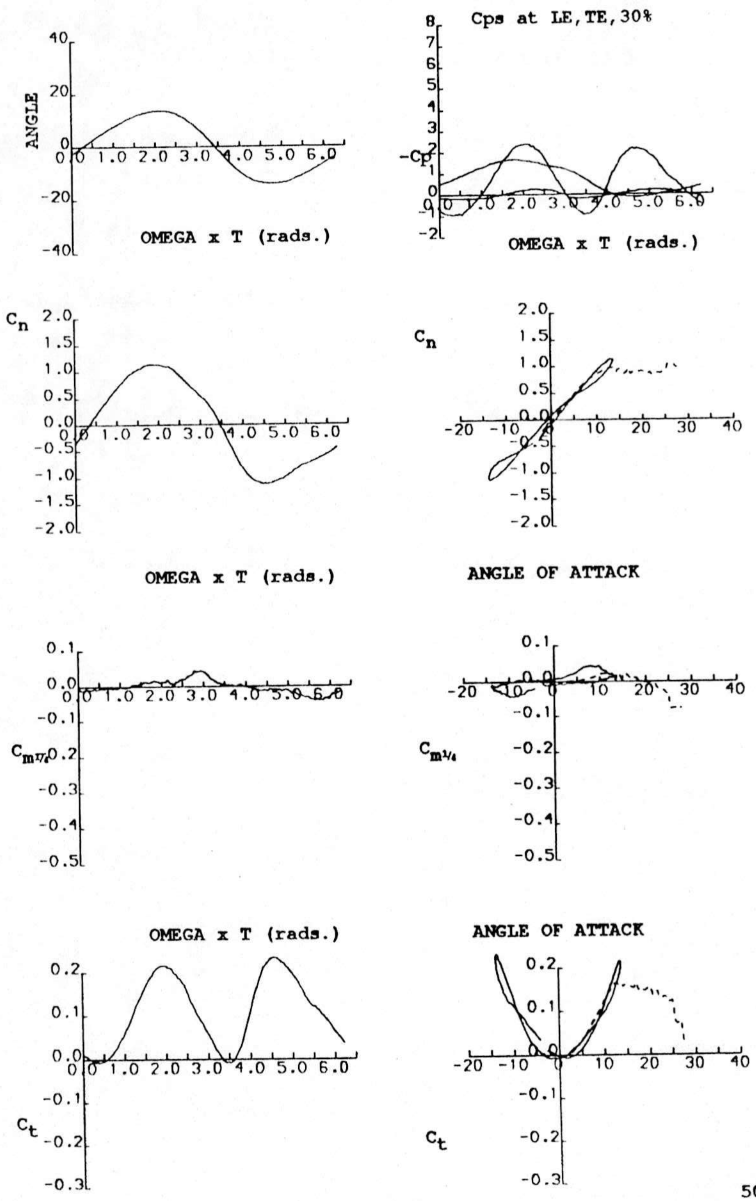


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55071
REYNOLDS NUMBER = 2054094.
DYNAMIC PRESSURE = 2123.51 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.626 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.176
AIR TEMPERATURE = 32.6°C
SAMPLING FREQUENCY = 208.12 Hz.
REDUCED FREQUENCY = 0.045
AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14421

REYNOLDS NUMBER = 2044685.

DYNAMIC PRESSURE = 1925.38 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

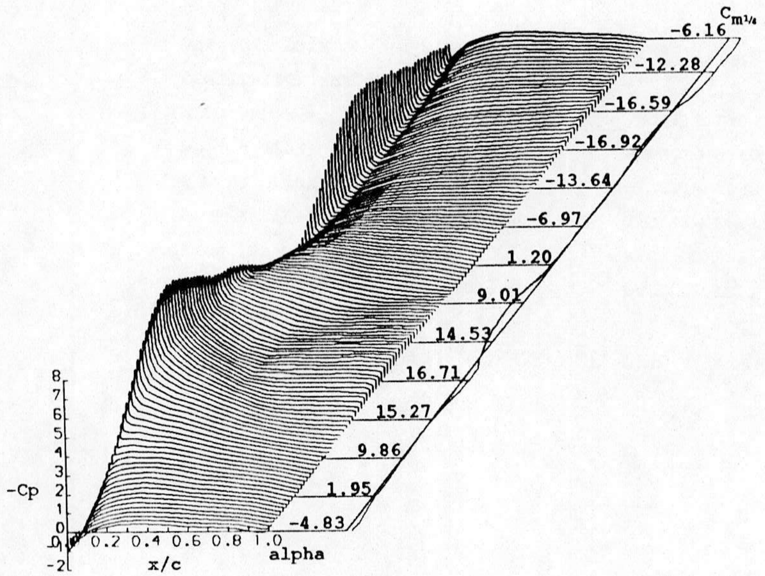
MACH NUMBER = 0.167

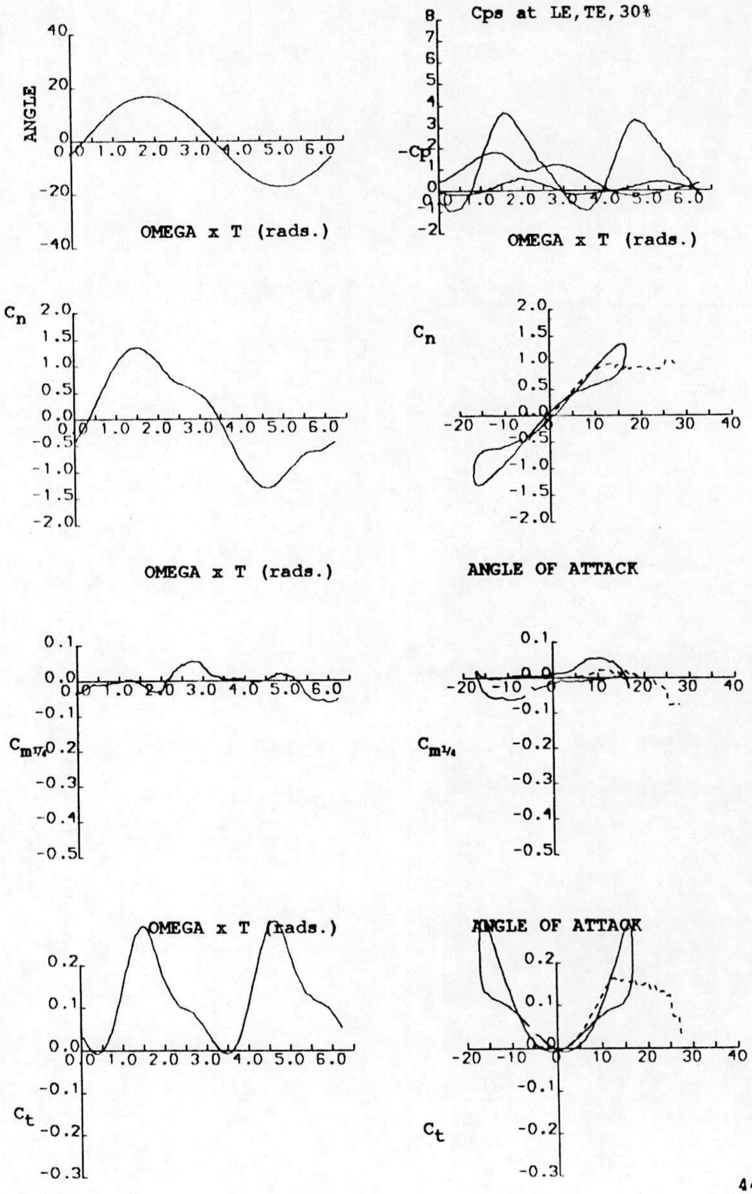
AIR TEMPERATURE = 23.2°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.049

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55081

REYNOLDS NUMBER = 2049814.

DYNAMIC PRESSURE = 2123.51 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

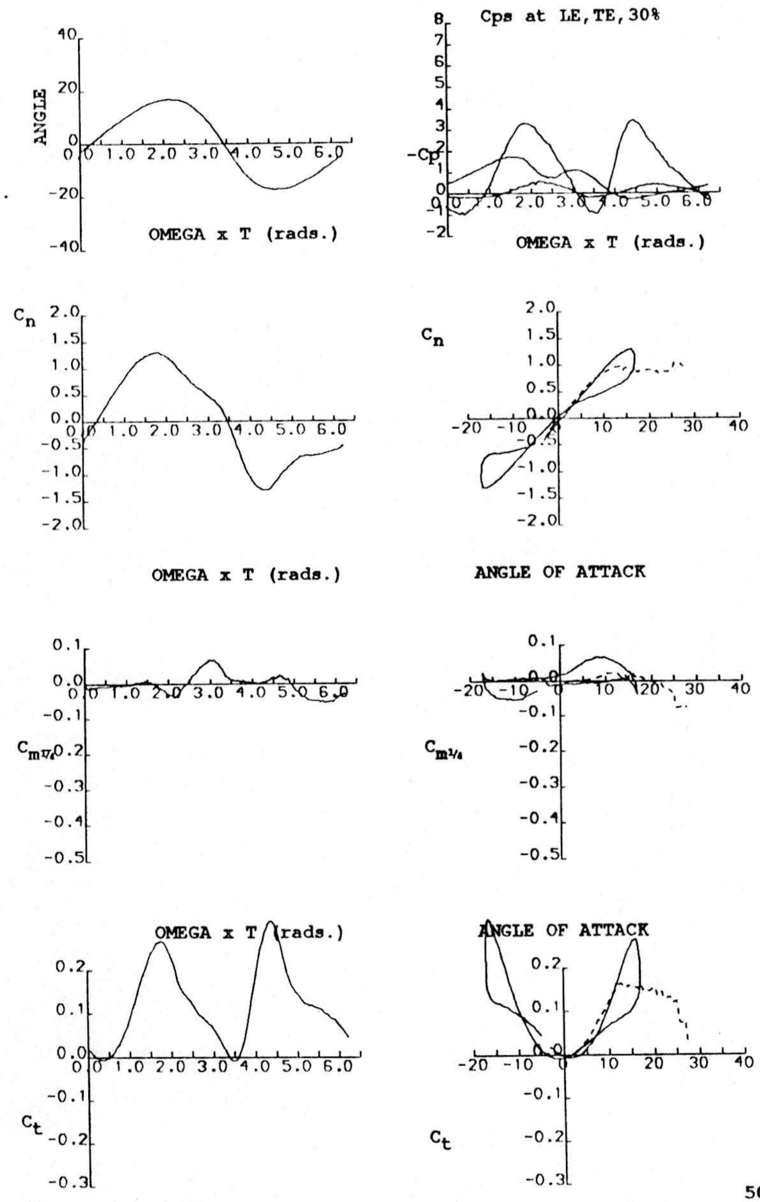
MACH NUMBER = 0.176

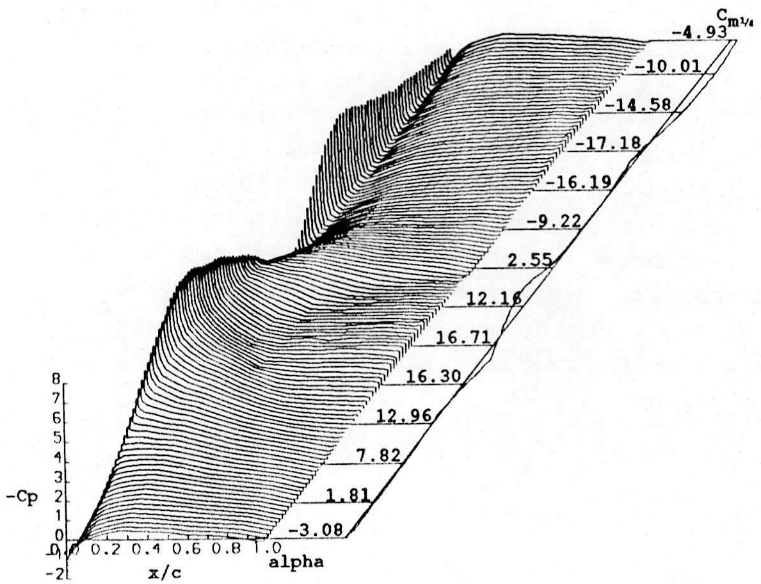
AIR TEMPERATURE = 33.1°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.045

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14431

REYNOLDS NUMBER = 2040268.

DYNAMIC PRESSURE = 1925.38 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

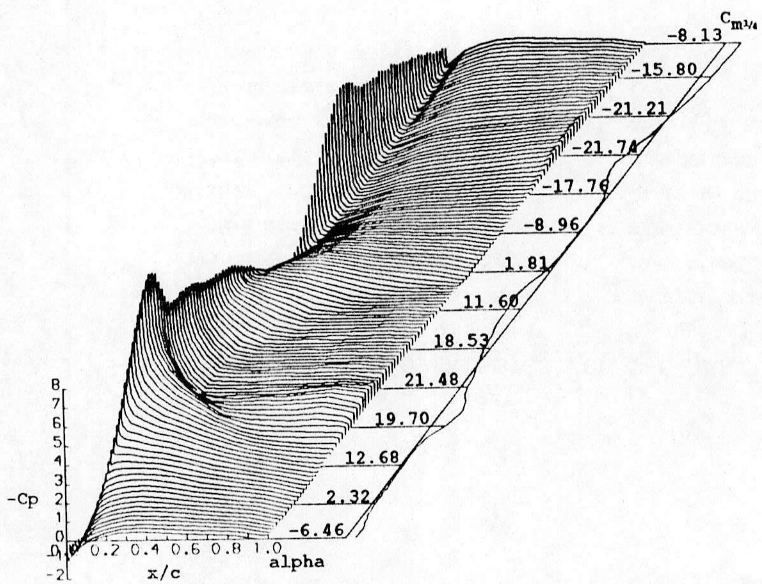
MACH NUMBER = 0.167

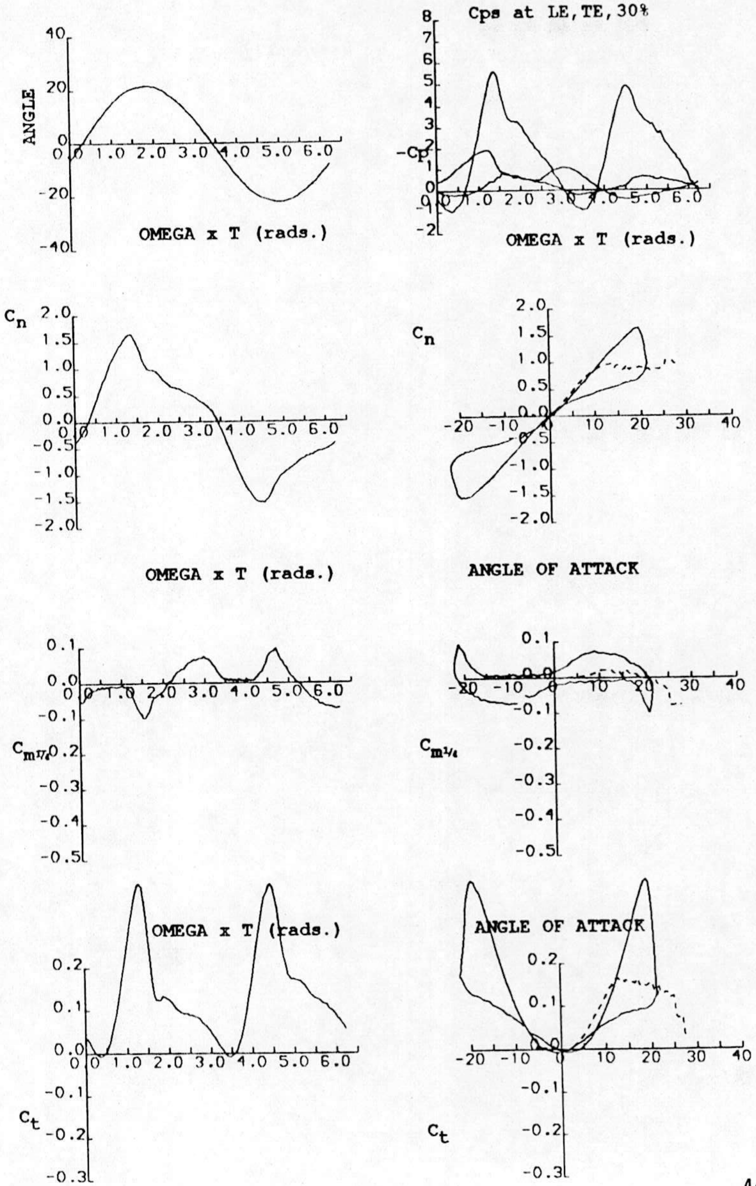
AIR TEMPERATURE = 23.7°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.049

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55091

REYNOLDS NUMBER = 2041304.

DYNAMIC PRESSURE = 2123.51 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.626 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

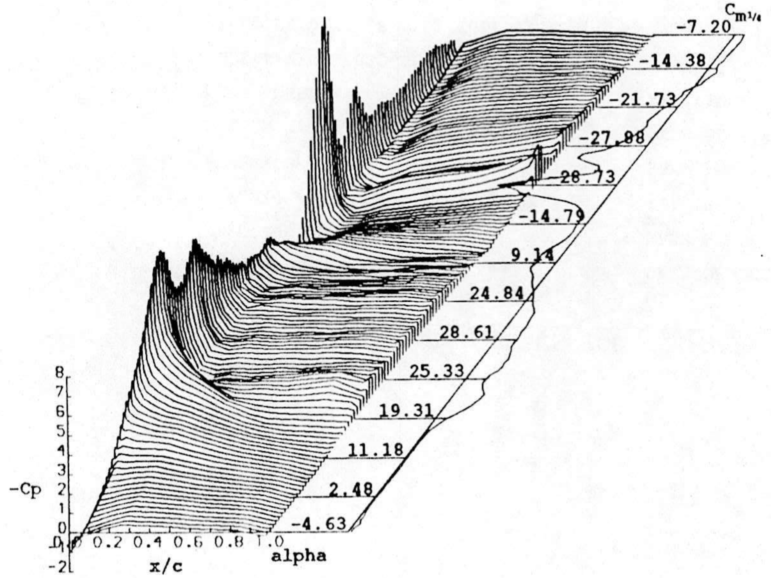
MACH NUMBER = 0.176

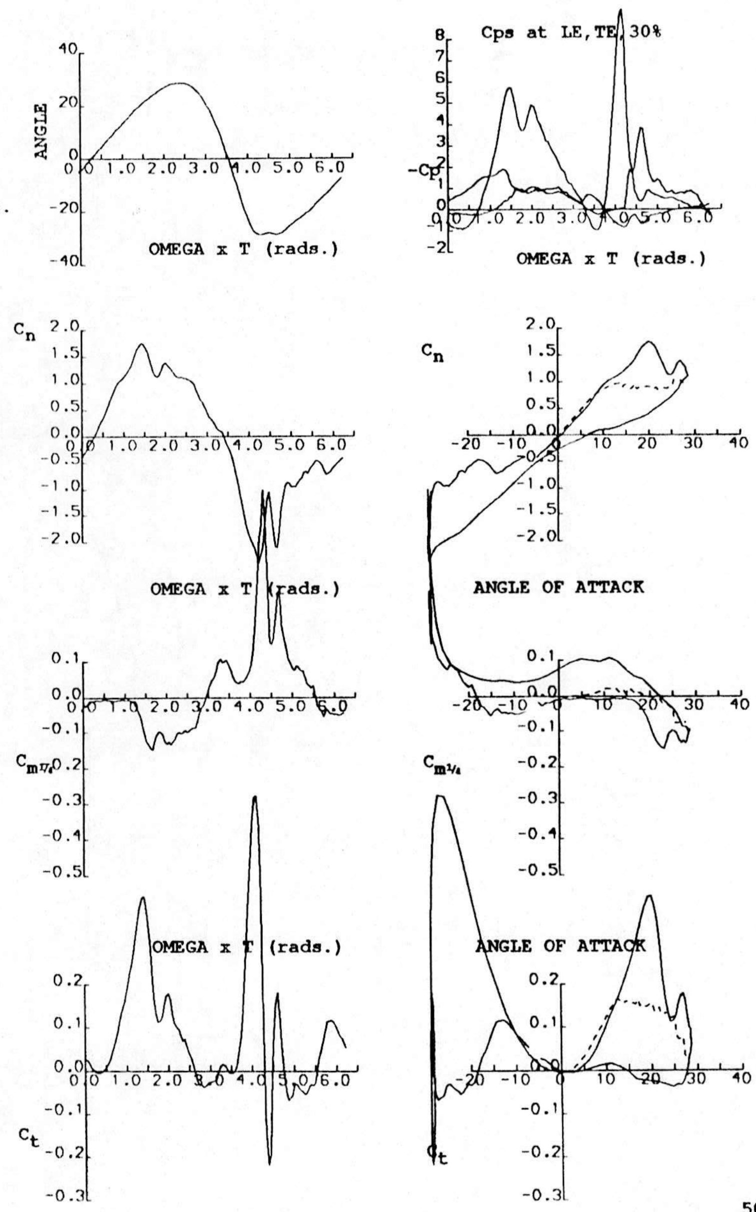
AIR TEMPERATURE = 34.1°C

SAMPLING FREQUENCY = 208.12 Hz.

REDUCED FREQUENCY = 0.045

AMPLITUDE = 32.80°

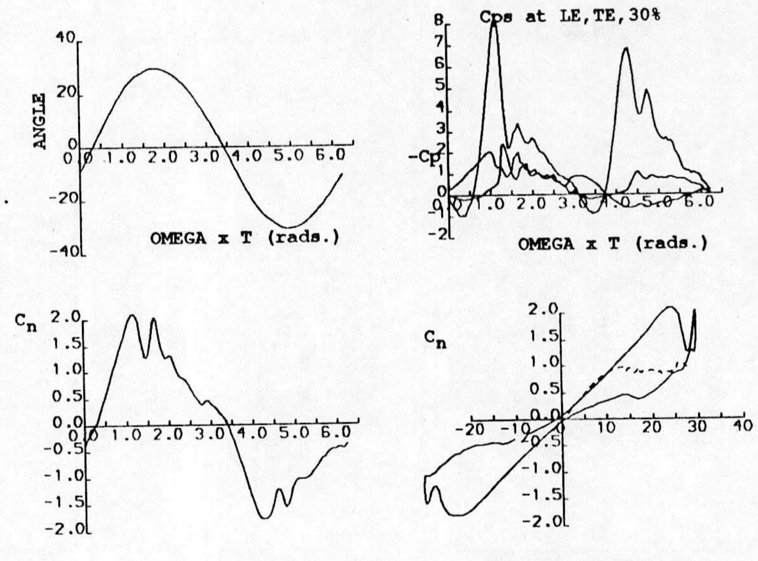


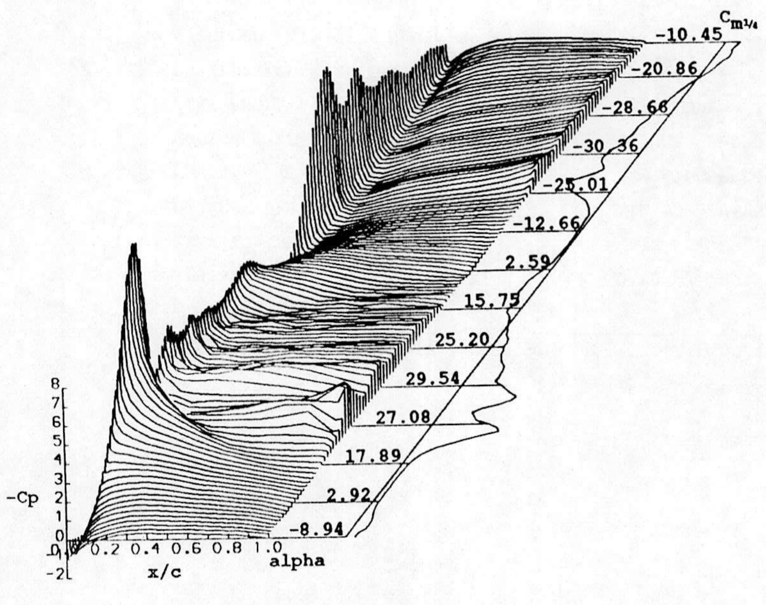


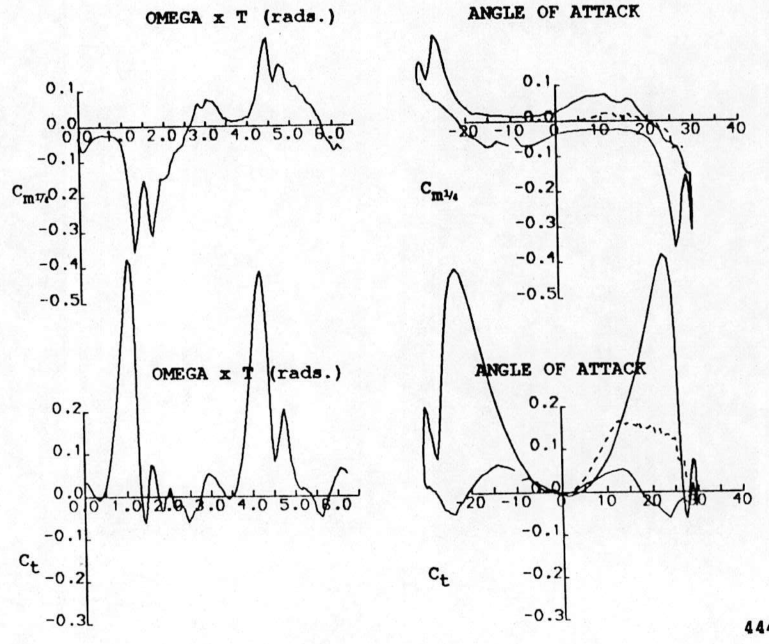
DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14442
REYNOLDS NUMBER = 1978656.
DYNAMIC PRESSURE = 1871.52 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.626 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.165
AIR TEMPERATURE = 27.7°C
SAMPLING FREQUENCY = 208.12 Hz.
REDUCED FREQUENCY = 0.049
AMPLITUDE = 32.00°

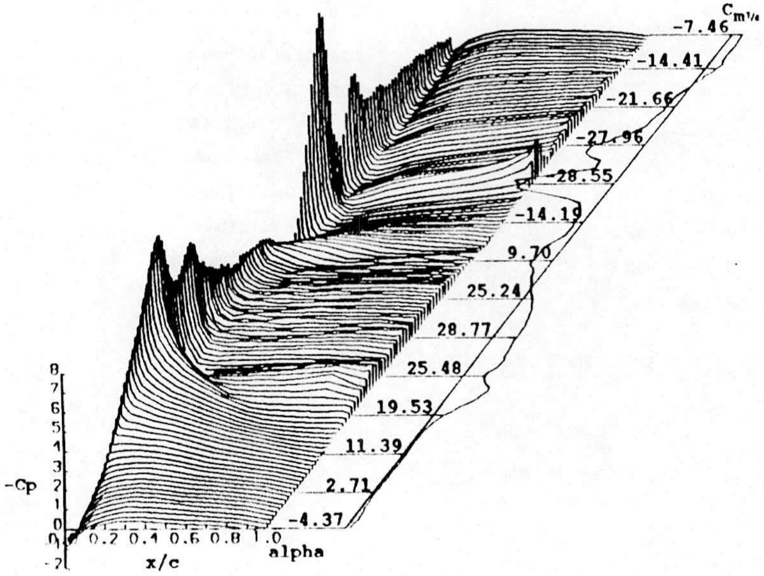


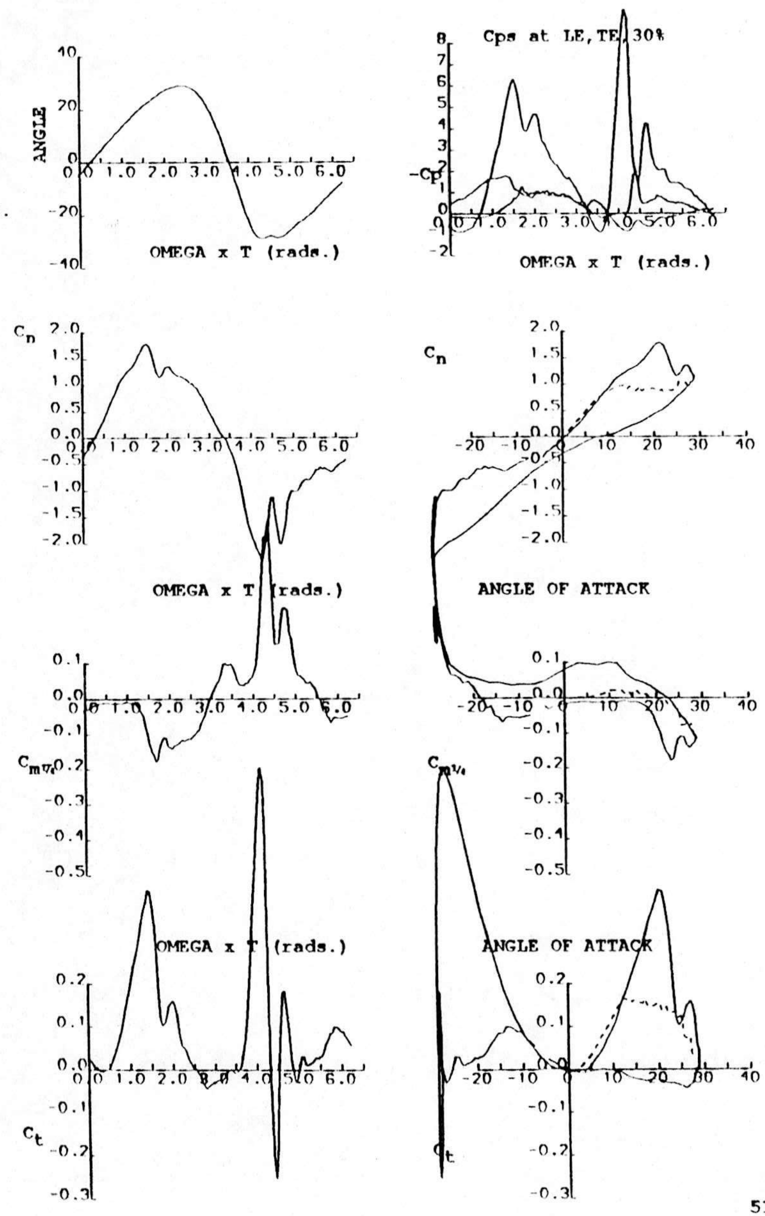




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55102	DATE OF TEST: 14/11/91
REYNOLDS NUMBER = 1971107.	MACH NUMBER = 0.165
DYNAMIC PRESSURE = 1871.52 Nm^{-2}	AIR TEMPERATURE = 28.6°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 208.12 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.049
MEAN ANGLE = 0.00°	AMPLITUDE = 32.00°
OSCILLATION FREQUENCY = 1.626 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14451

REYNOLDS NUMBER = 1578970.

DYNAMIC PRESSURE = 1146.97 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

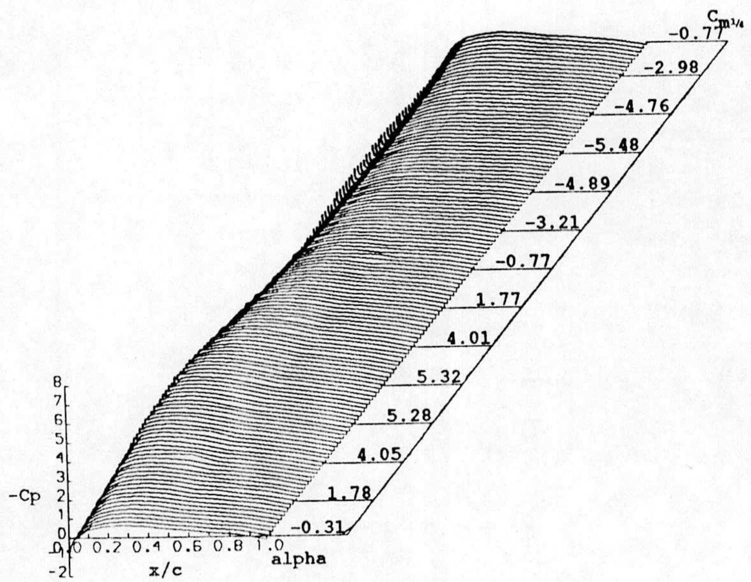
MACH NUMBER = 0.129

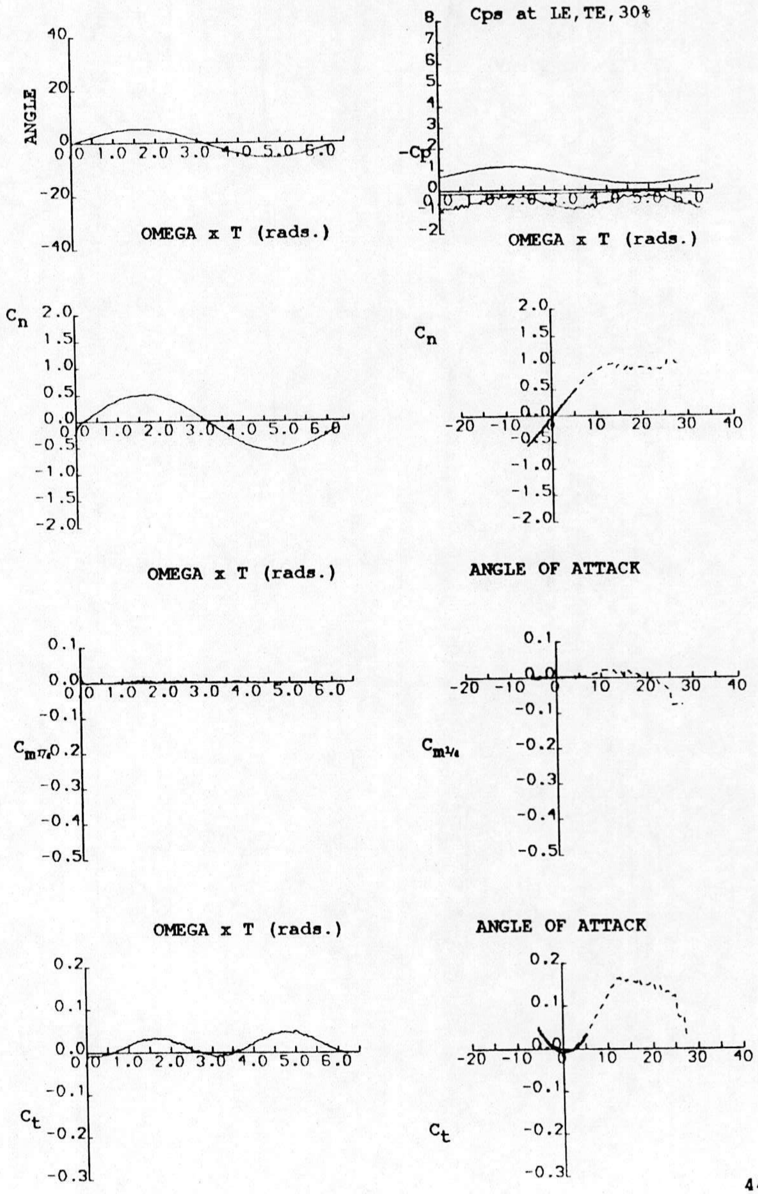
AIR TEMPERATURE = 23.0°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.019

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55111

REYNOLDS NUMBER = 1566814.

DYNAMIC PRESSURE = 1212.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

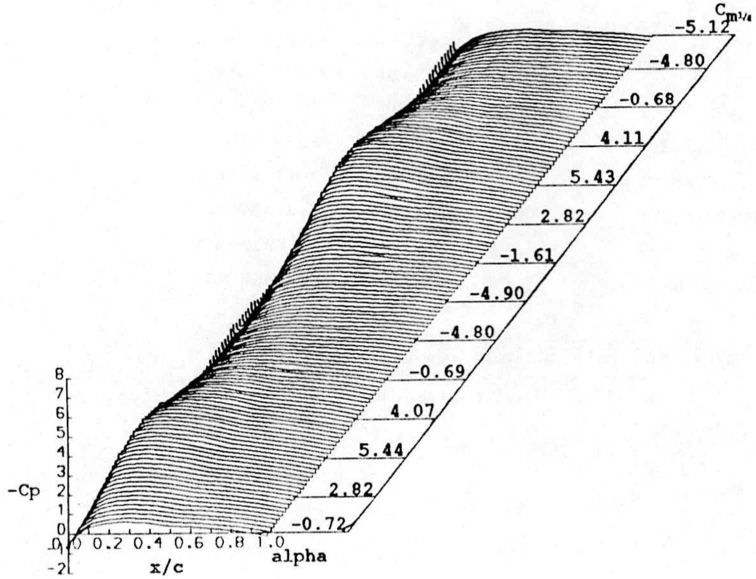
MACH NUMBER = 0.133

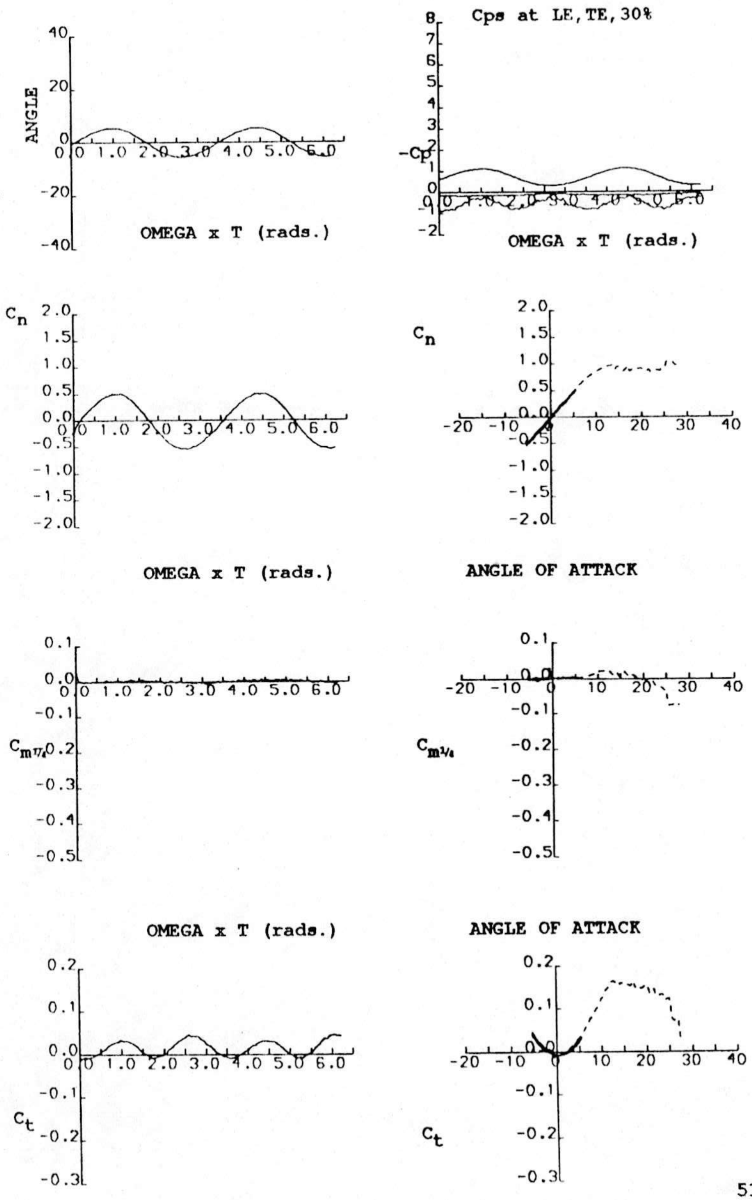
AIR TEMPERATURE = 30.4°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.018

AMPLITUDE = 5.40°

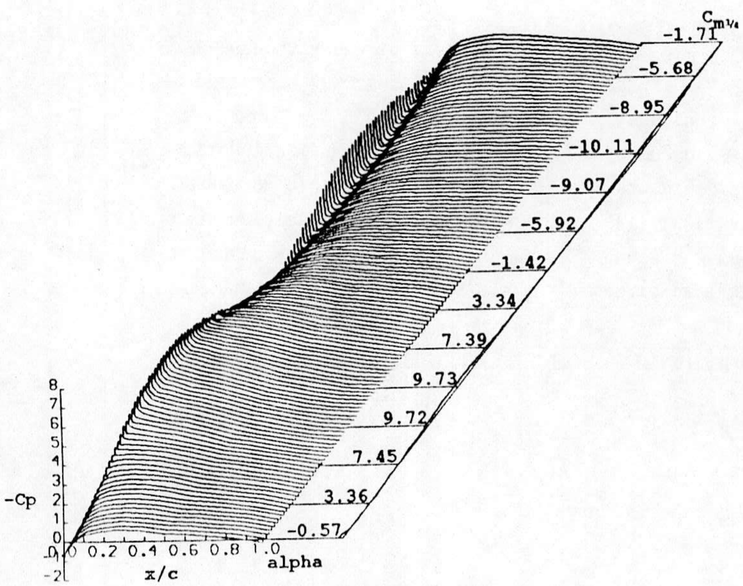


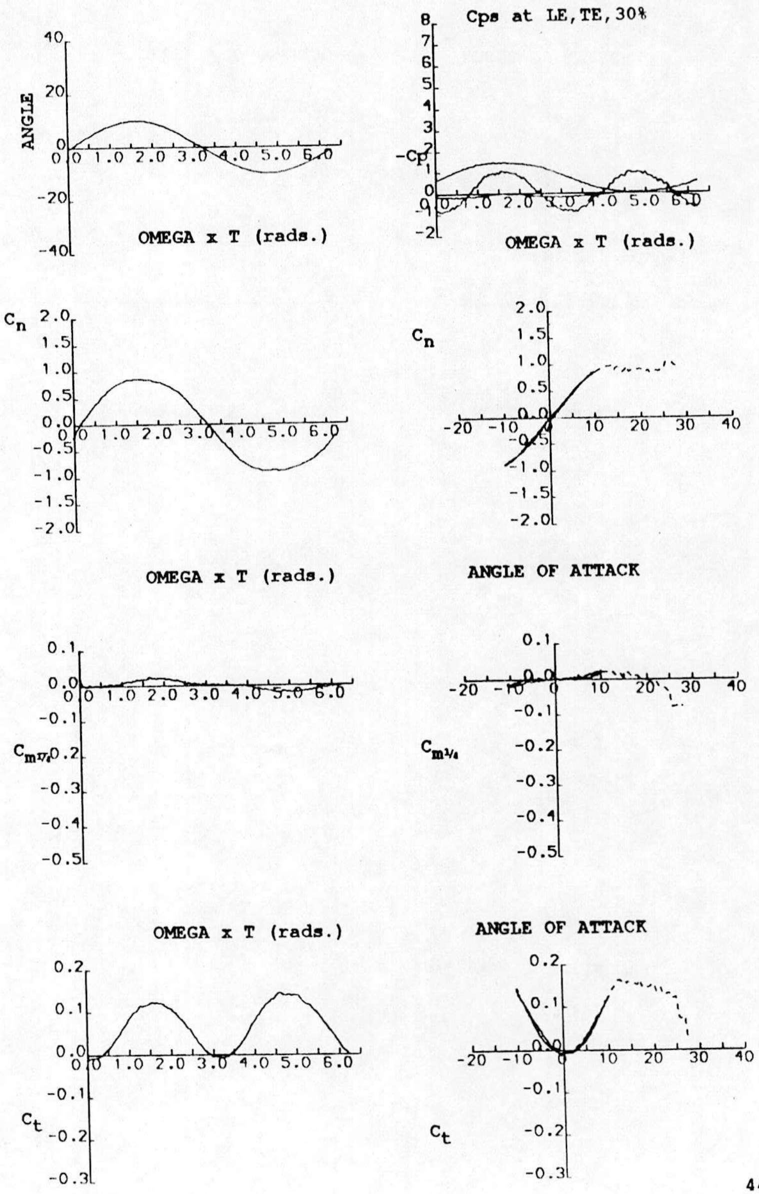


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14461
REYNOLDS NUMBER = 1575556.
DYNAMIC PRESSURE = 1146.97 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.487 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 23.5°C
SAMPLING FREQUENCY = 62.34 Hz.
REDUCED FREQUENCY = 0.019
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55121

REYNOLDS NUMBER = 1565495.

DYNAMIC PRESSURE = 1212.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

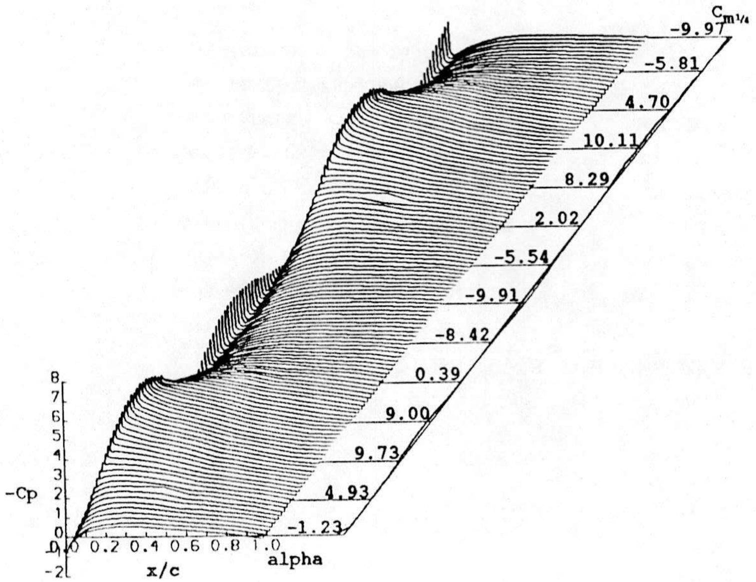
MACH NUMBER = 0.133

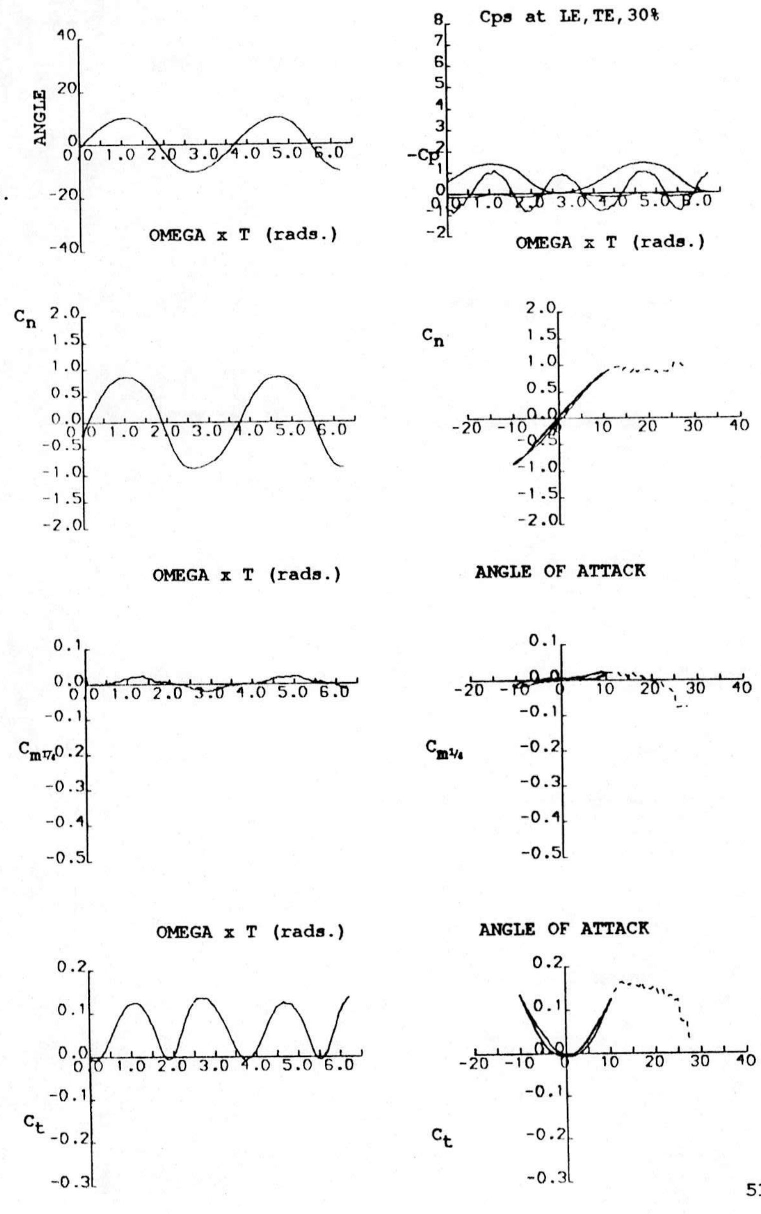
AIR TEMPERATURE = 30.6°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.018

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14471

REYNOLDS NUMBER = 1572836.

DYNAMIC PRESSURE = 1146.97 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

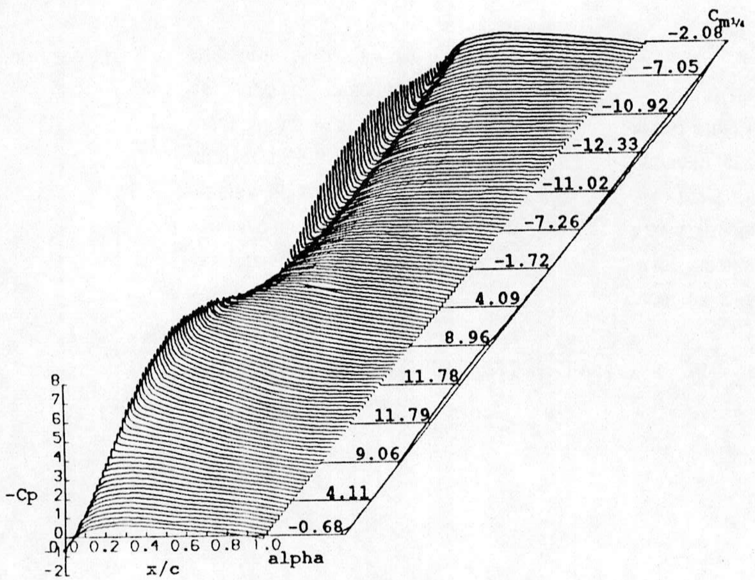
MACH NUMBER = 0.129

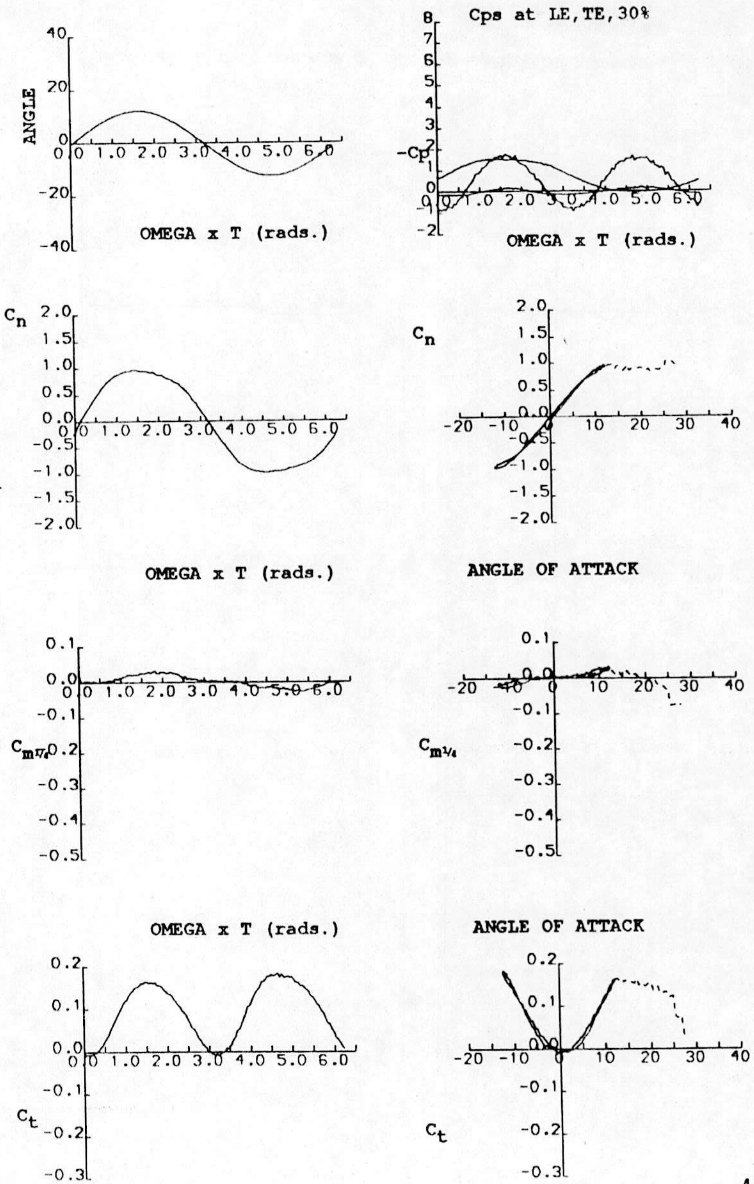
AIR TEMPERATURE = 23.9°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.019

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55131

REYNOLDS NUMBER = 1564179.

DYNAMIC PRESSURE = 1212.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

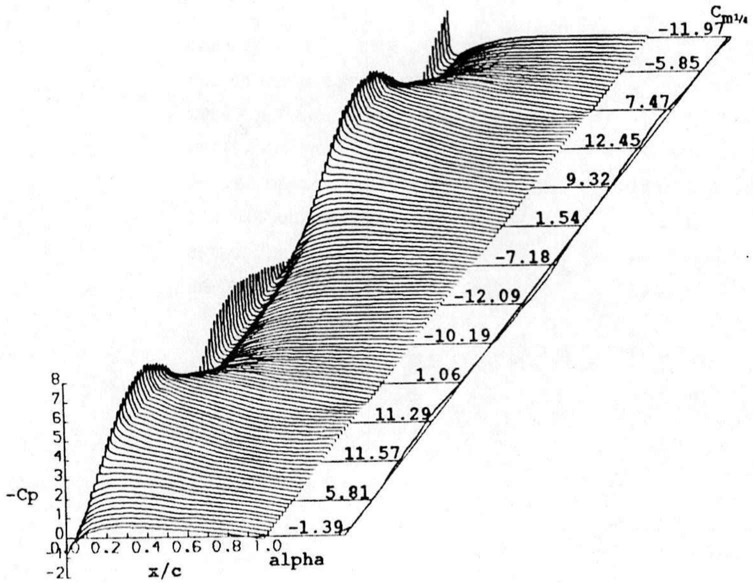
MACH NUMBER = 0.133

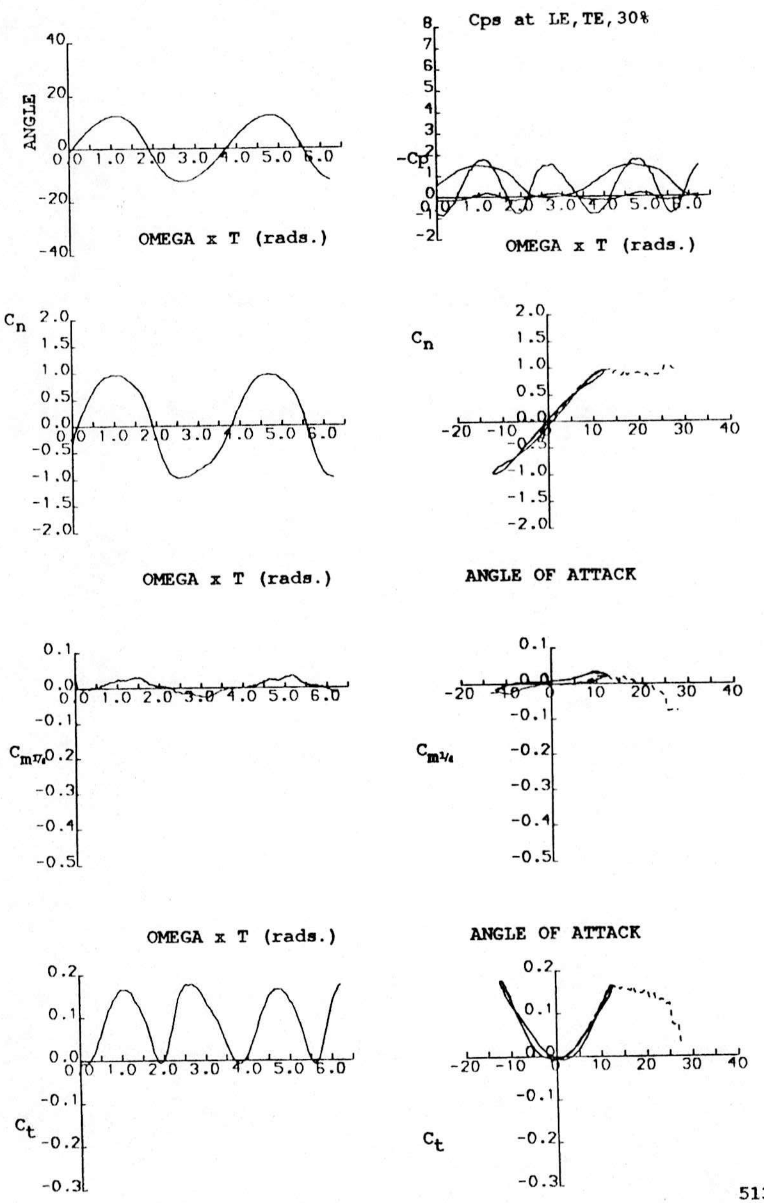
AIR TEMPERATURE = 30.8°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.018

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14481

REYNOLDS NUMBER = 1570801.

DYNAMIC PRESSURE = 1146.97 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

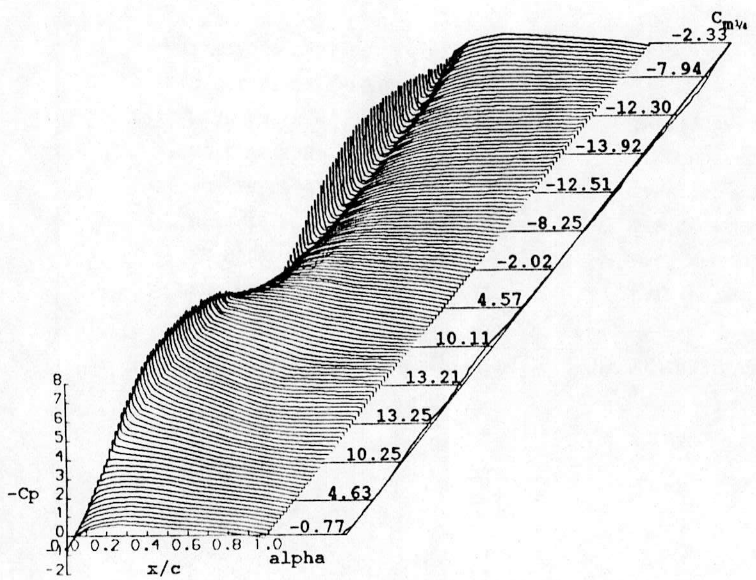
MACH NUMBER = 0.129

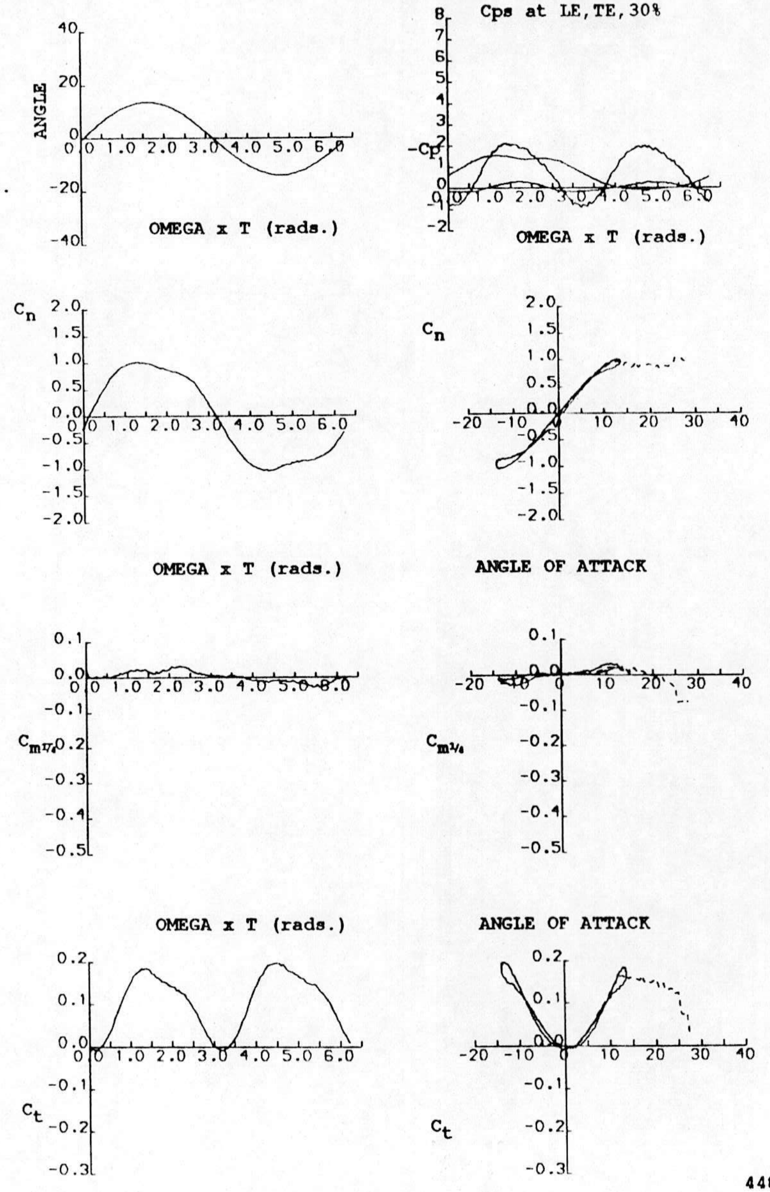
AIR TEMPERATURE = 24.2°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.019

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55141

REYNOLDS NUMBER = 1563522.

DYNAMIC PRESSURE = 1212.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

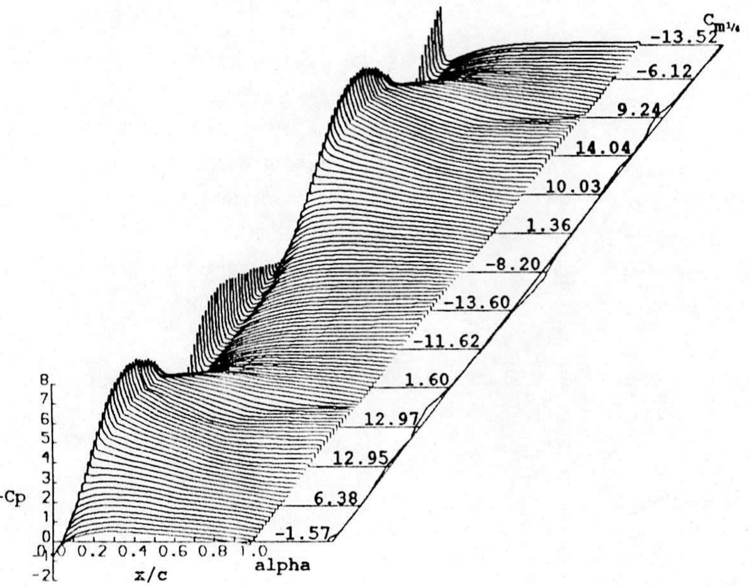
MACH NUMBER = 0.133

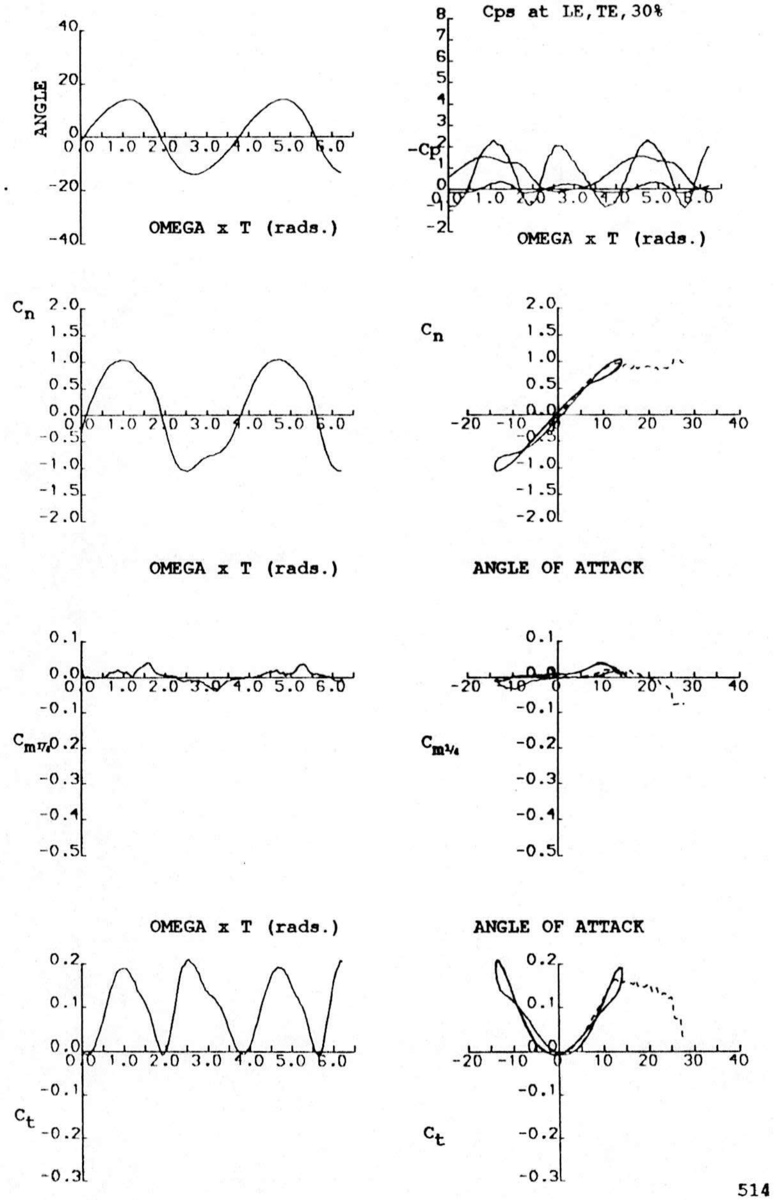
AIR TEMPERATURE = 30.9°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.018

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14491

REYNOLDS NUMBER = 1568095.

DYNAMIC PRESSURE = 1146.97 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

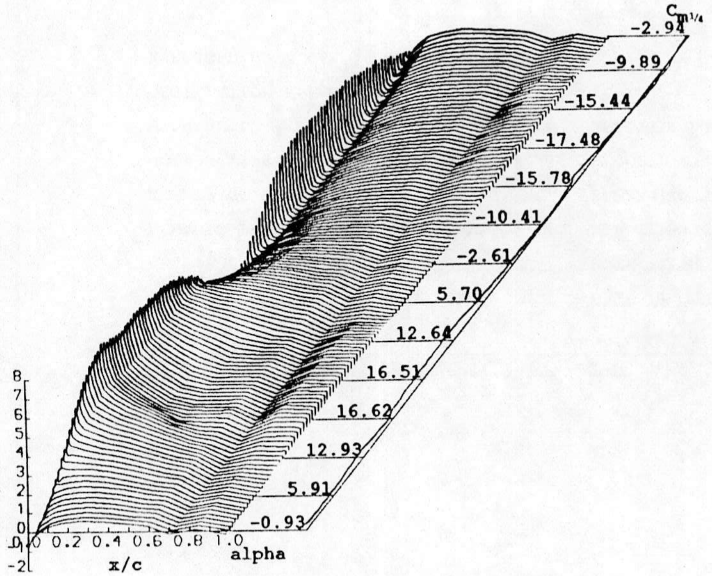
MACH NUMBER = 0.129

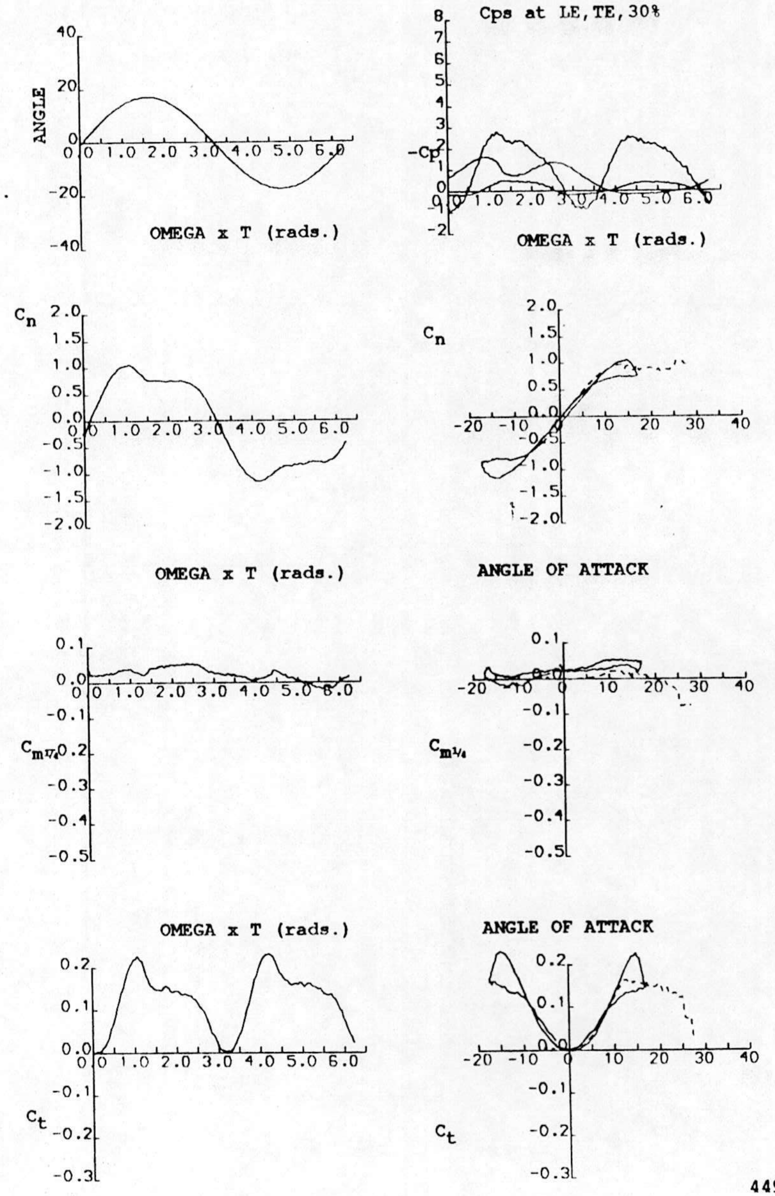
AIR TEMPERATURE = 24.6°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.019

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55151

REYNOLDS NUMBER = 1562208.

DYNAMIC PRESSURE = 1212.93 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91

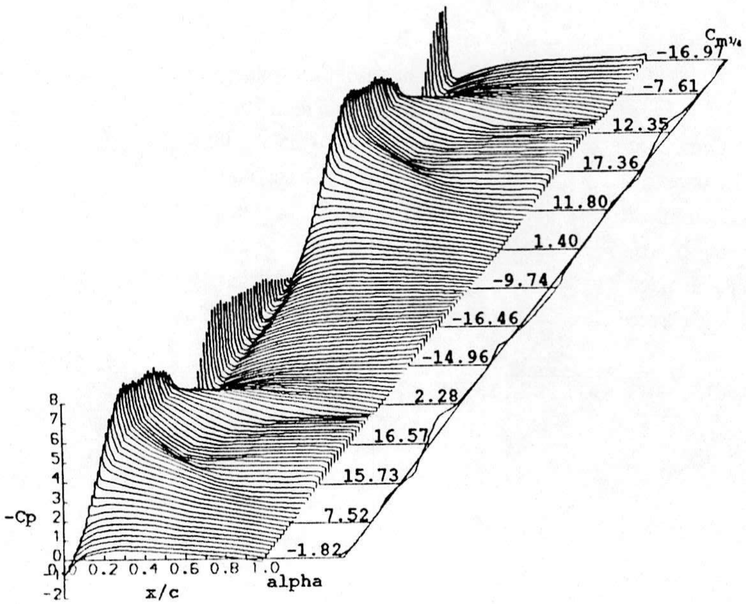
MACH NUMBER = 0.133

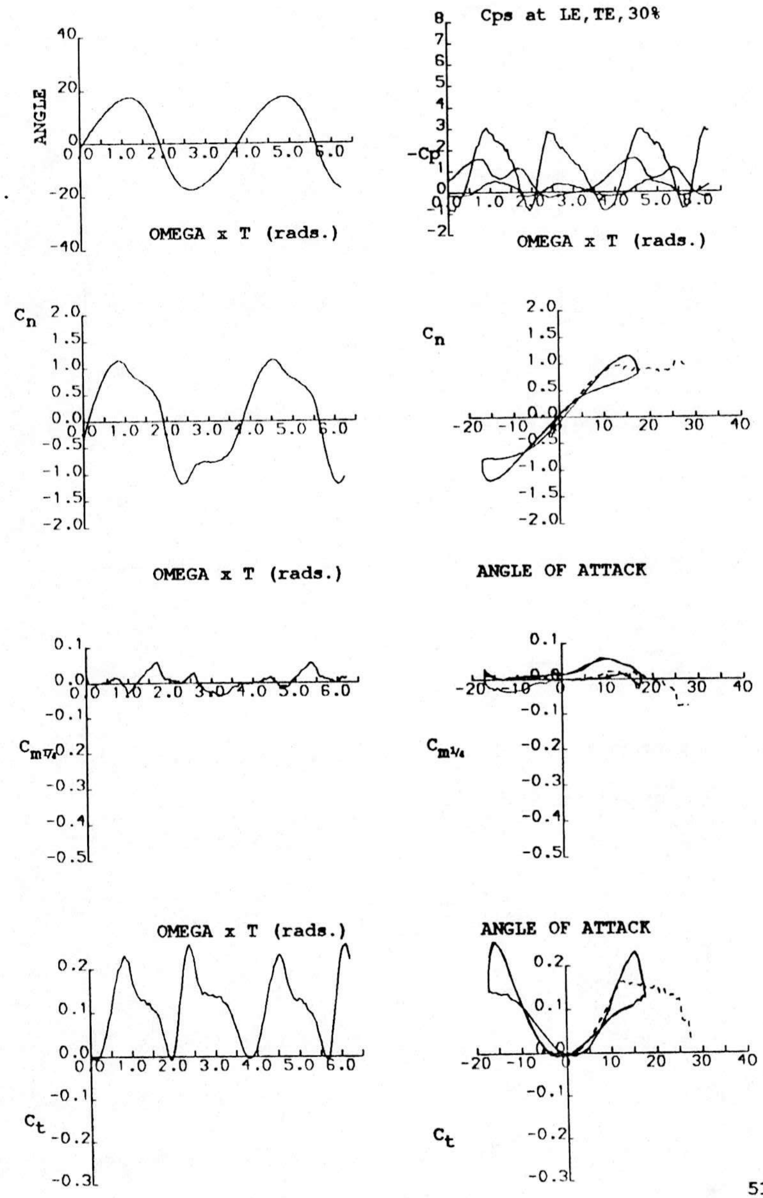
AIR TEMPERATURE = 31.1°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.018

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14501

REYNOLDS NUMBER = 1566746.

DYNAMIC PRESSURE = 1146.97 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

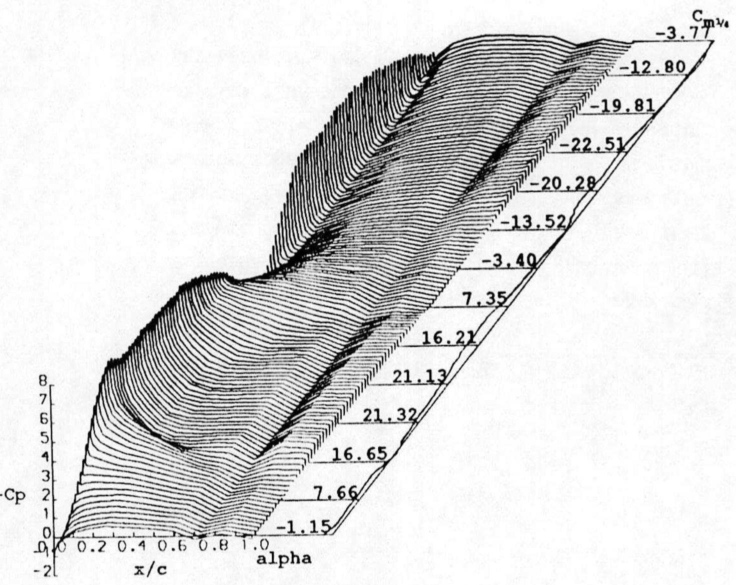
MACH NUMBER = 0.129

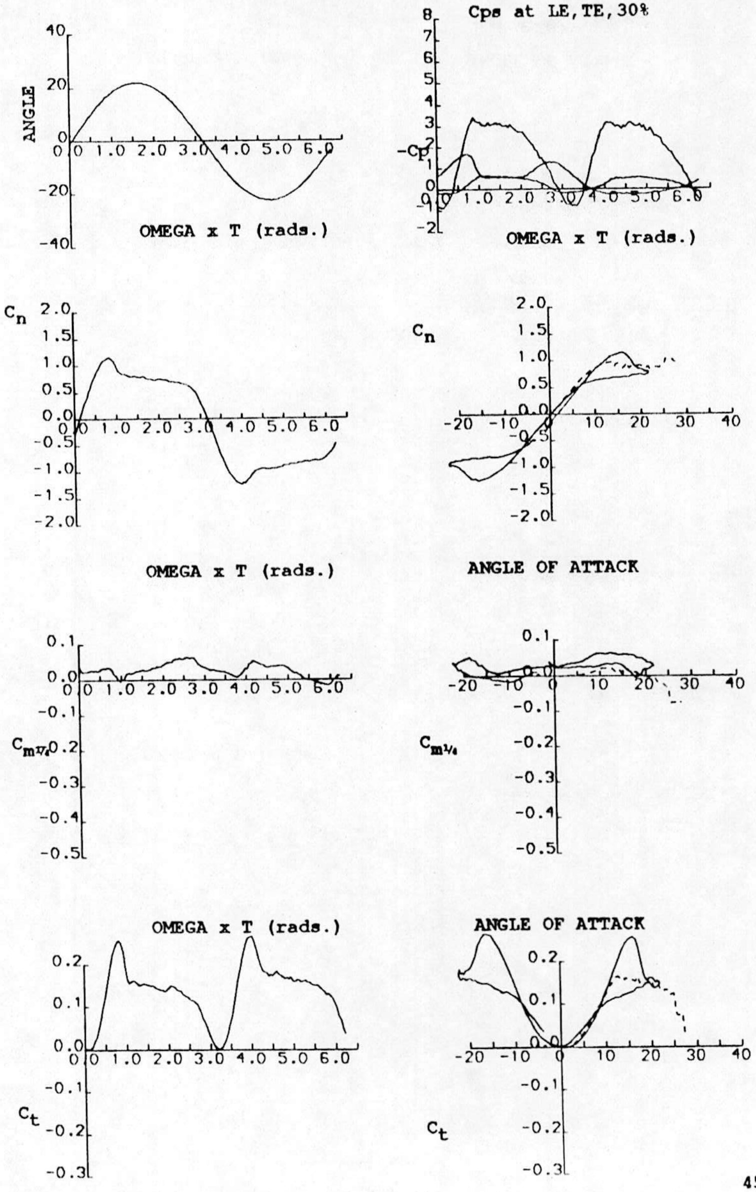
AIR TEMPERATURE = 24.8°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.019

AMPLITUDE = 22.60°

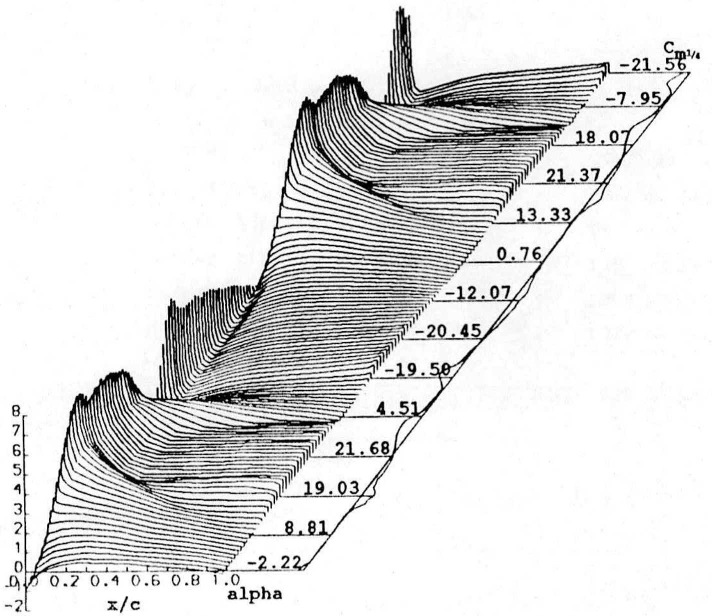


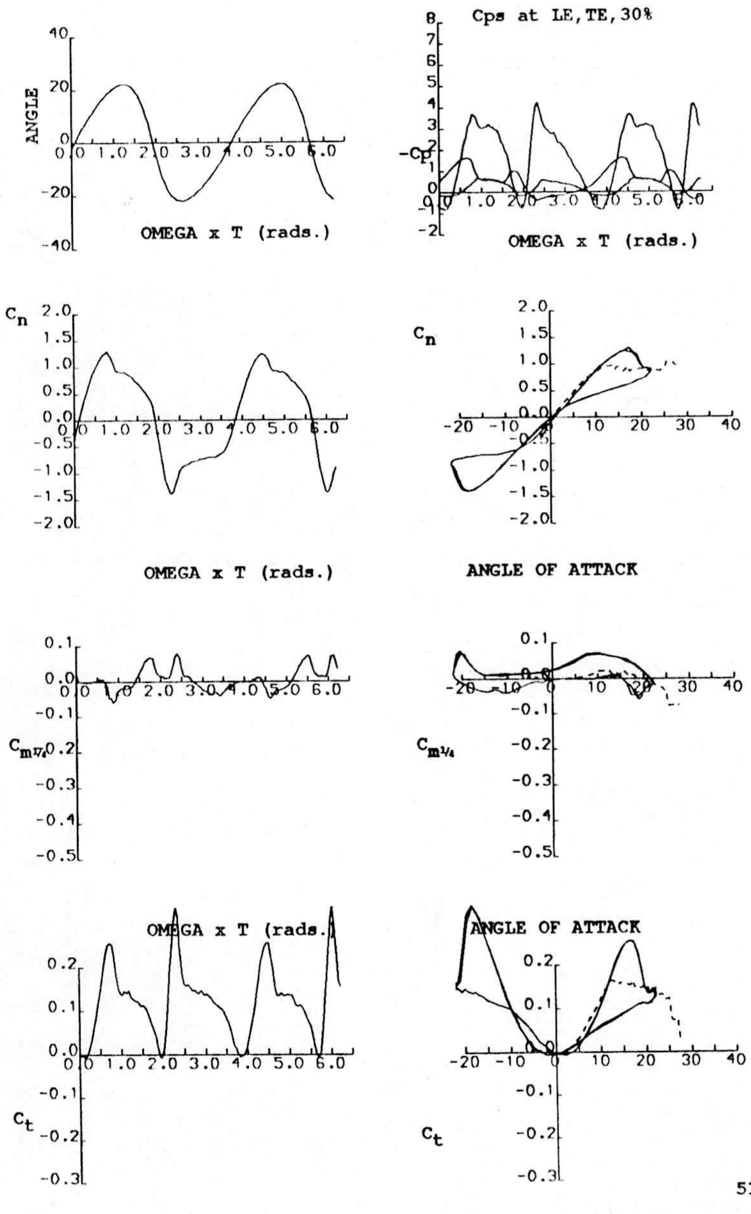


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55161
REYNOLDS NUMBER = 1560898.
DYNAMIC PRESSURE = 1212.93 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.487 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.133
AIR TEMPERATURE = 31.3°C
SAMPLING FREQUENCY = 62.34 Hz.
REDUCED FREQUENCY = 0.018
AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14511

REYNOLDS NUMBER = 1564726.

DYNAMIC PRESSURE = 1146.97 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 9.00°

OSCILLATION FREQUENCY = 0.487 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

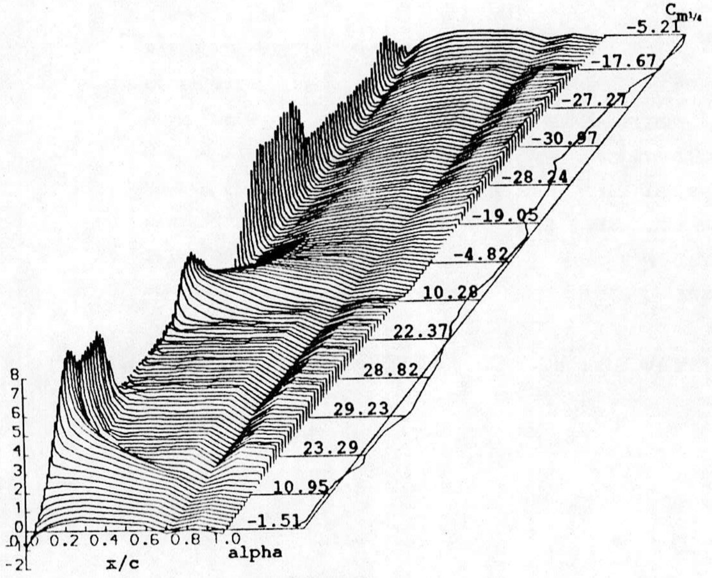
MACH NUMBER = 0.129

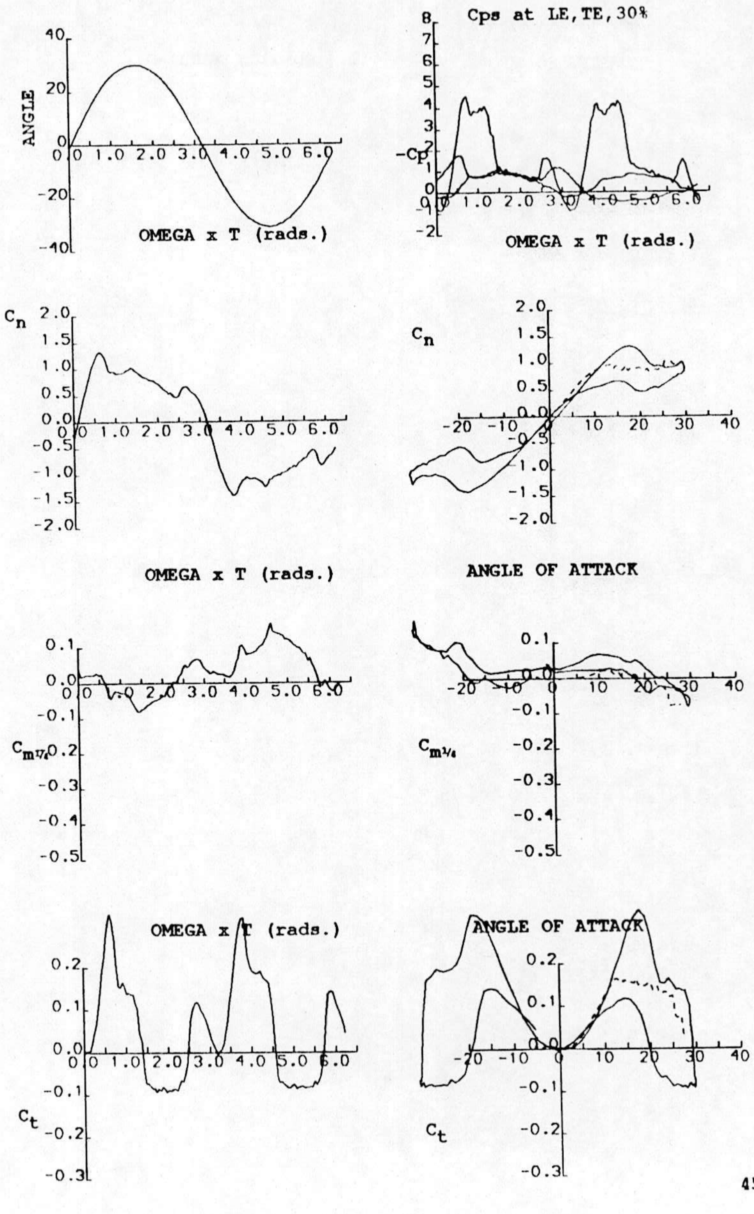
AIR TEMPERATURE = 25.1°C

SAMPLING FREQUENCY = 62.34 Hz.

REDUCED FREQUENCY = 0.019

AMPLITUDE = 32.00°

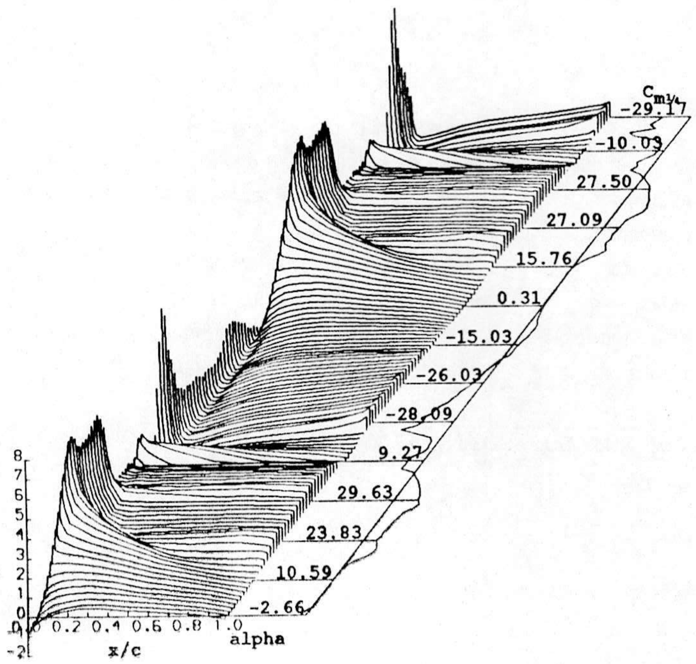


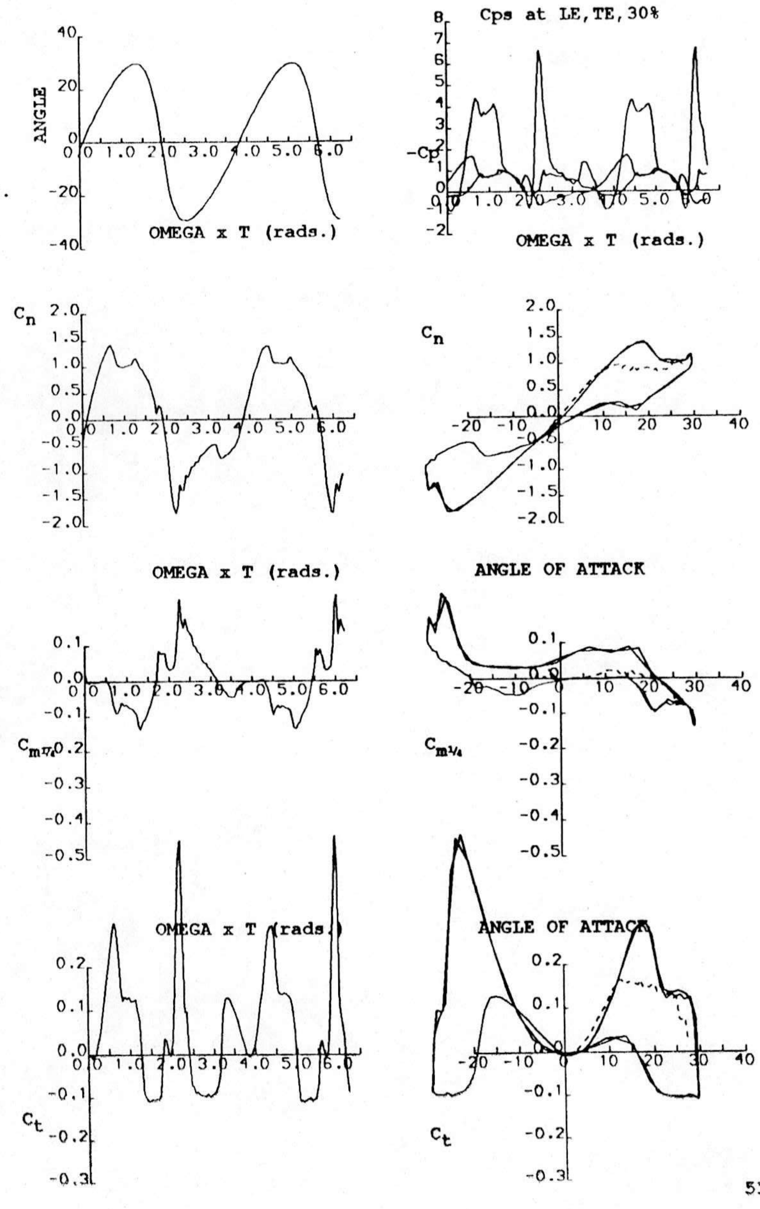


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55171
REYNOLDS NUMBER = 1559588.
DYNAMIC PRESSURE = 1212.93 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.487 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 13/11/91
MACH NUMBER = 0.133
AIR TEMPERATURE = 31.5°C
SAMPLING FREQUENCY = 62.34 Hz.
REDUCED FREQUENCY = 0.018
AMPLITUDE = 32.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14521

REYNOLDS NUMBER = 1563269.

DYNAMIC PRESSURE = 1138.94 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

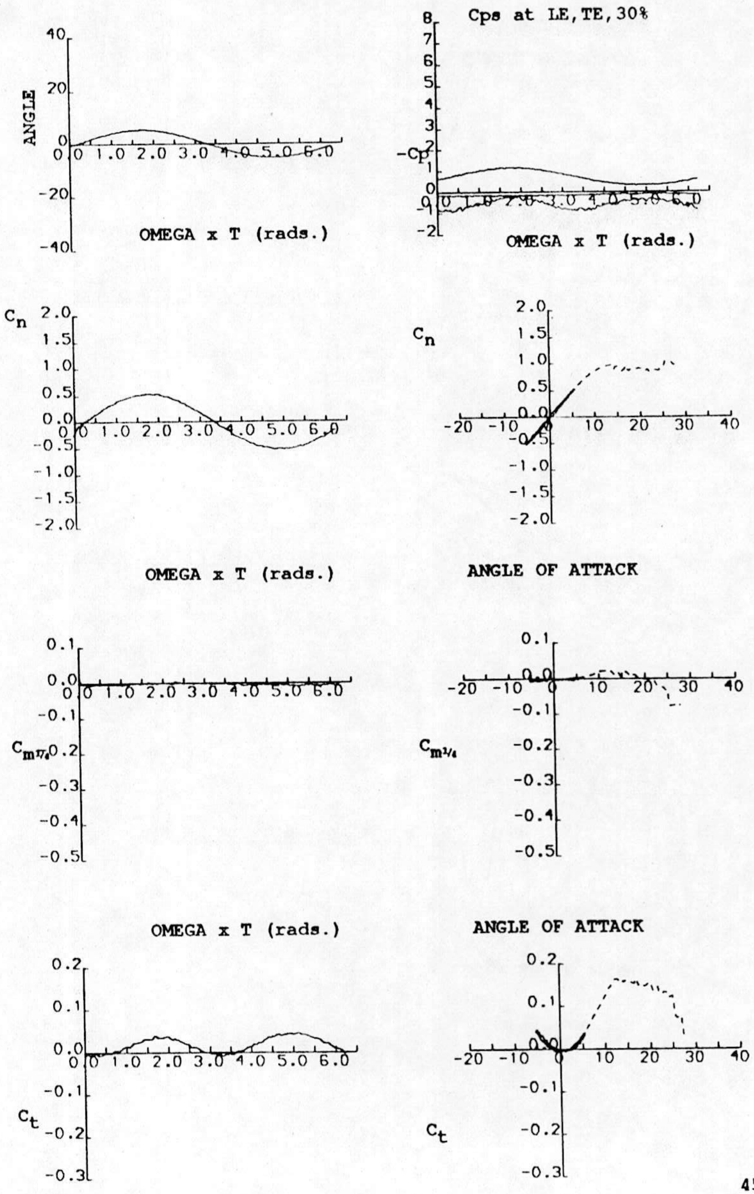
MACH NUMBER = 0.129

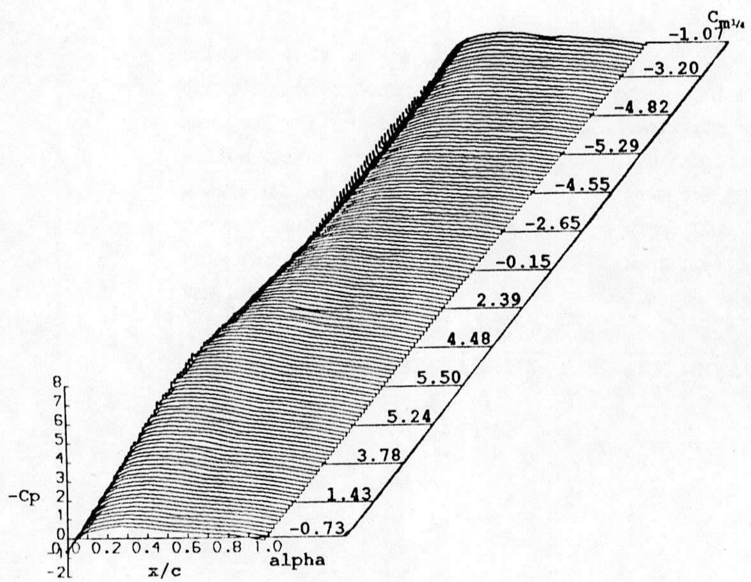
AIR TEMPERATURE = 24.5°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.038

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55191

REYNOLDS NUMBER = 1644553.

DYNAMIC PRESSURE = 1217.37 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

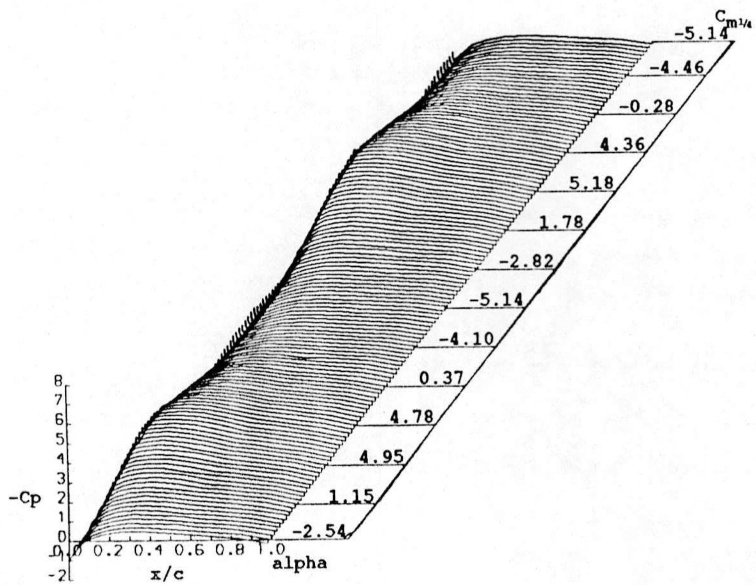
MACH NUMBER = 0.133

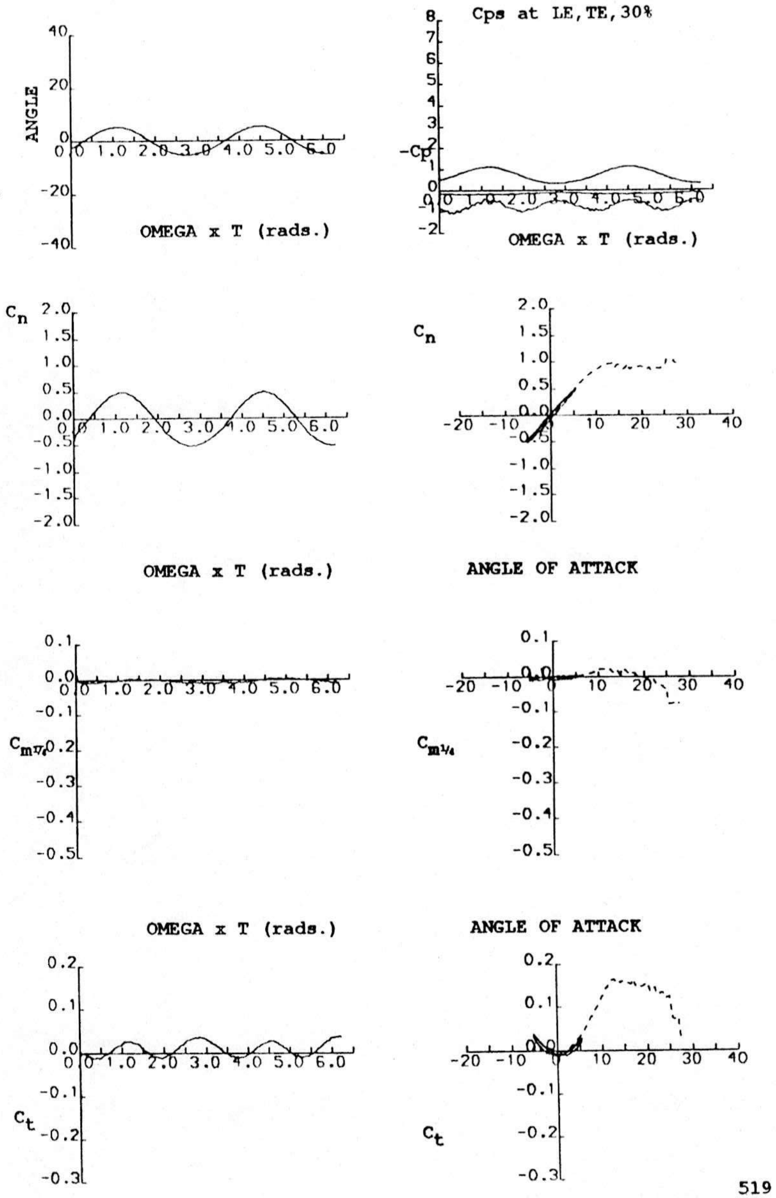
AIR TEMPERATURE = 20.3°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.037

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14531

REYNOLDS NUMBER = 1558569.

DYNAMIC PRESSURE = 1138.94 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

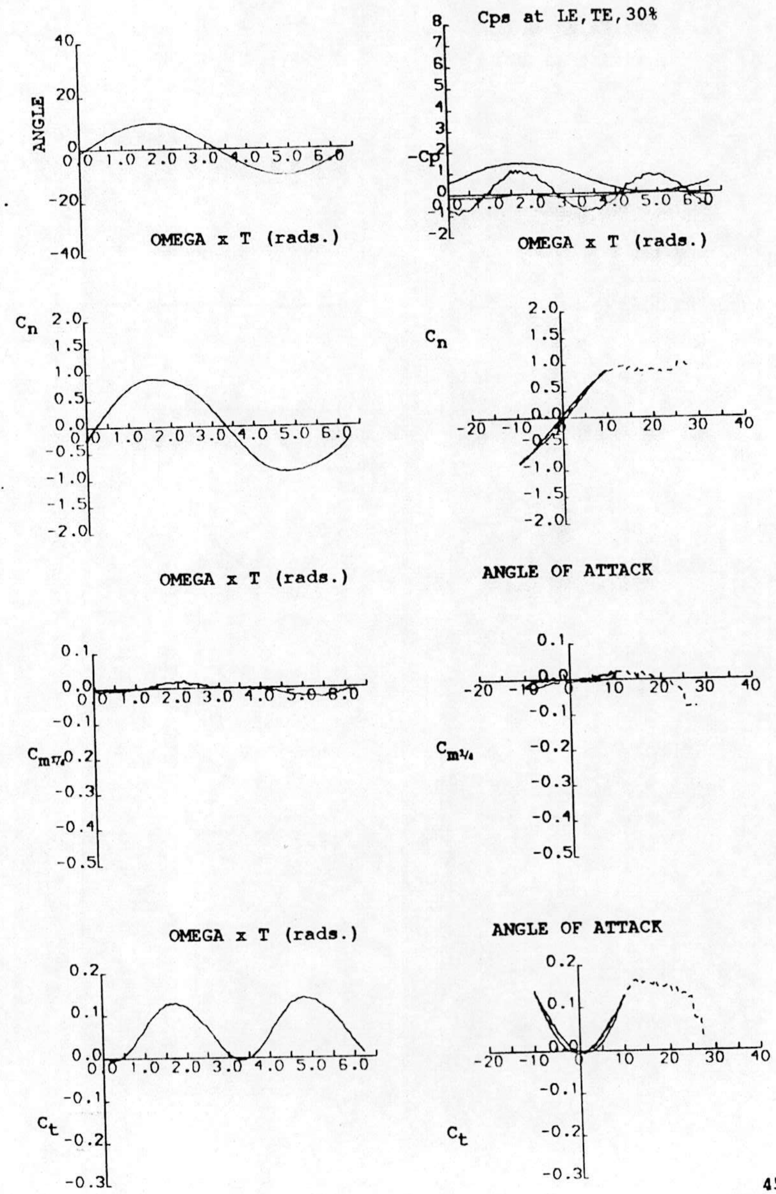
MACH NUMBER = 0.129

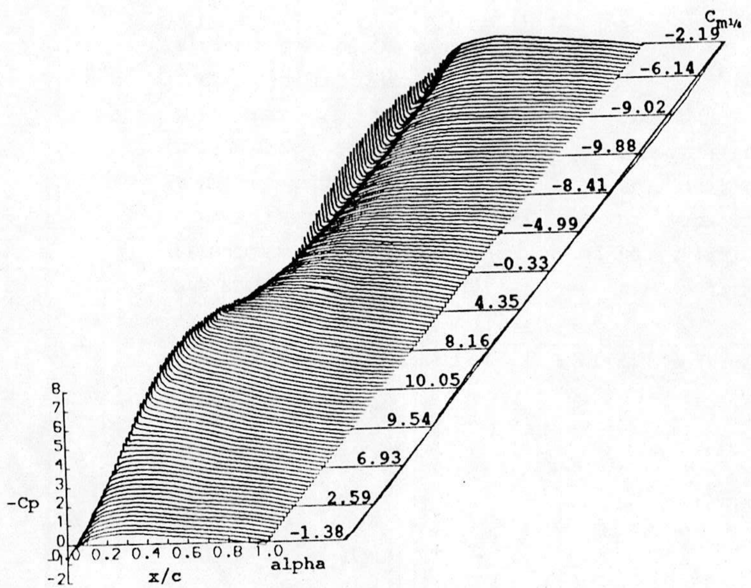
AIR TEMPERATURE = 25.2°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.038

AMPLITUDE = 10.00°

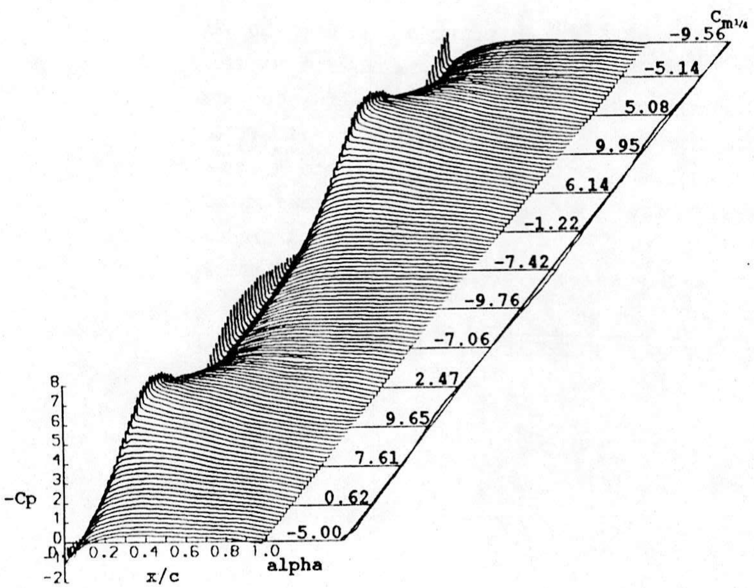


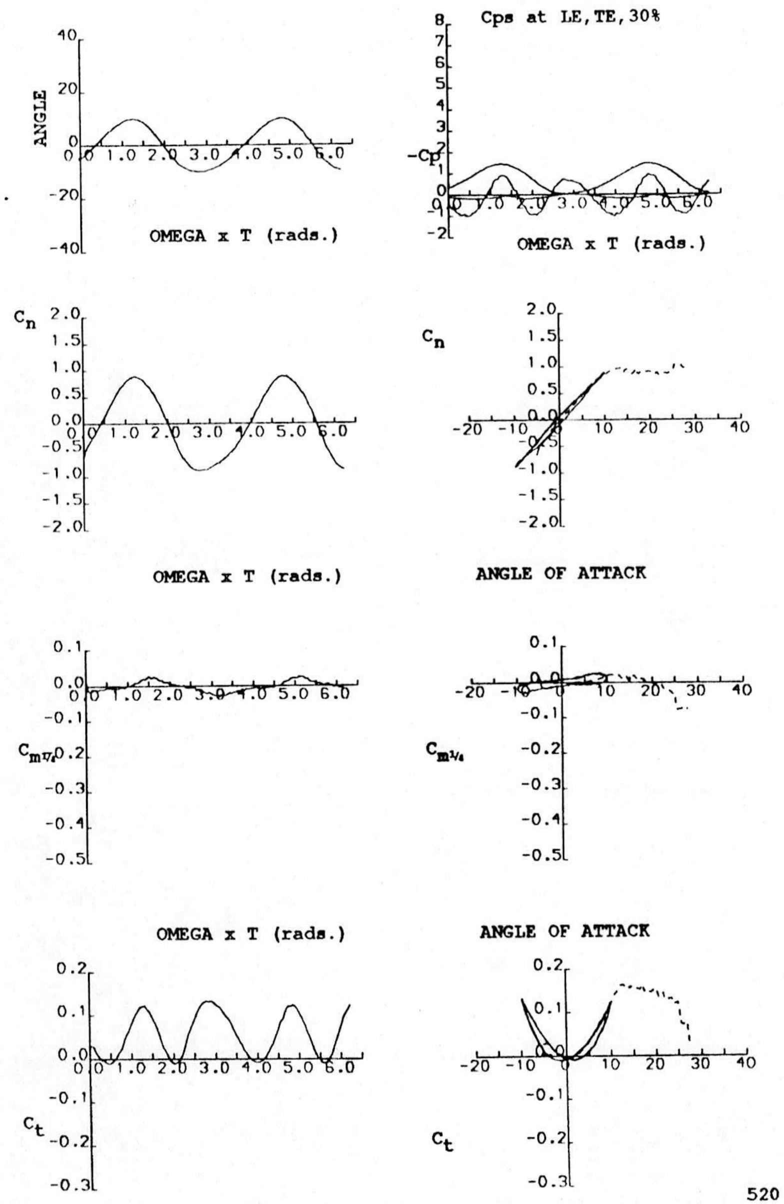


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55201
REYNOLDS NUMBER = 1641677.
DYNAMIC PRESSURE = 1217.37 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.133
AIR TEMPERATURE = 20.7°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.037
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14541

REYNOLDS NUMBER = 1557900.

DYNAMIC PRESSURE = 1138.94 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

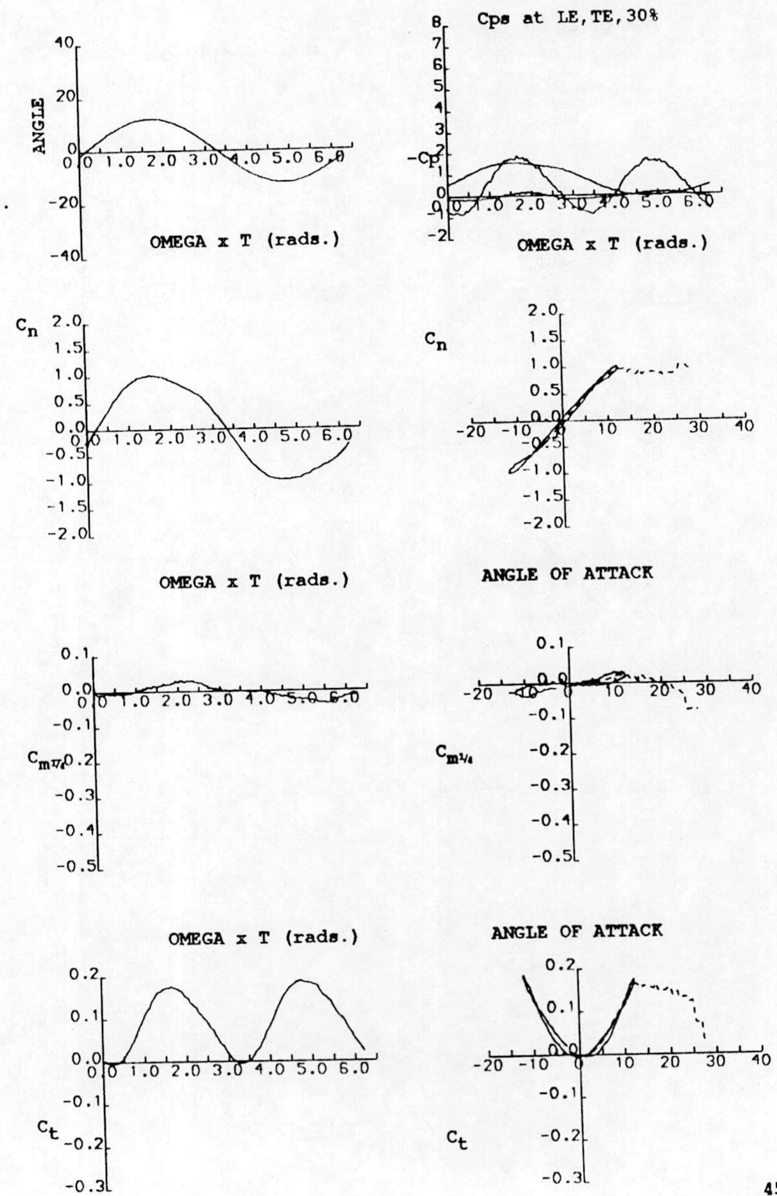
MACH NUMBER = 0.129

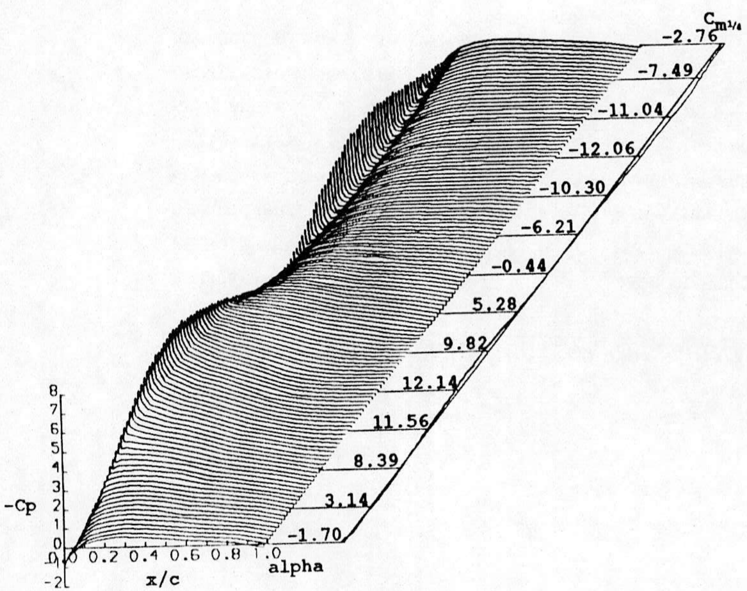
AIR TEMPERATURE = 25.3°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.038

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55211

REYNOLDS NUMBER = 1640242.

DYNAMIC PRESSURE = 1217.37 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

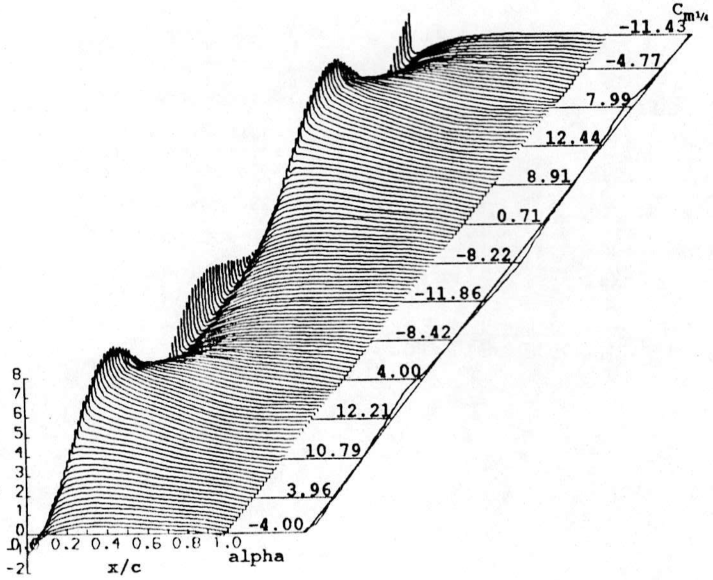
MACH NUMBER = 0.133

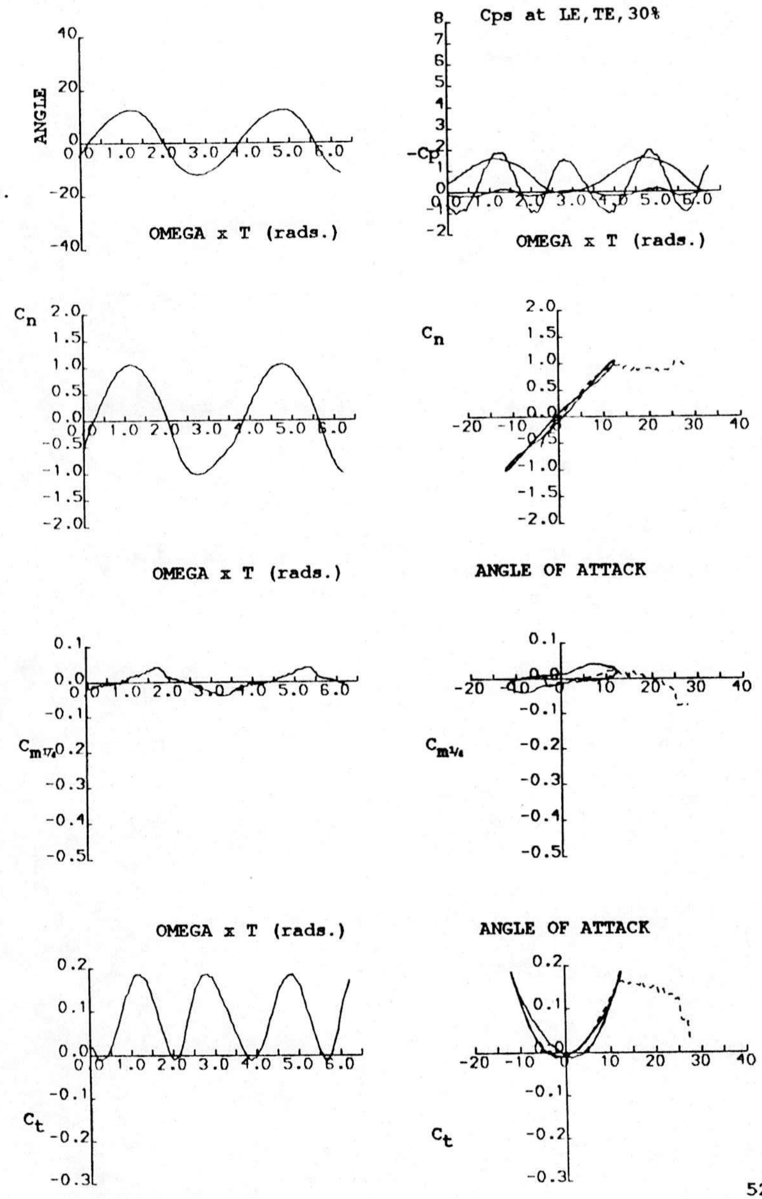
AIR TEMPERATURE = 20.9°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.037

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14551

REYNOLDS NUMBER = 1556563.

DYNAMIC PRESSURE = 1138.94 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

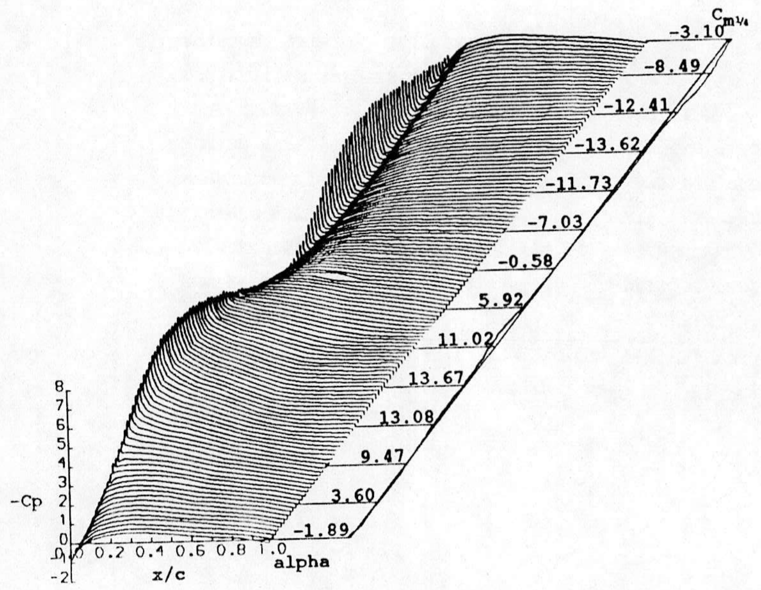
MACH NUMBER = 0.129

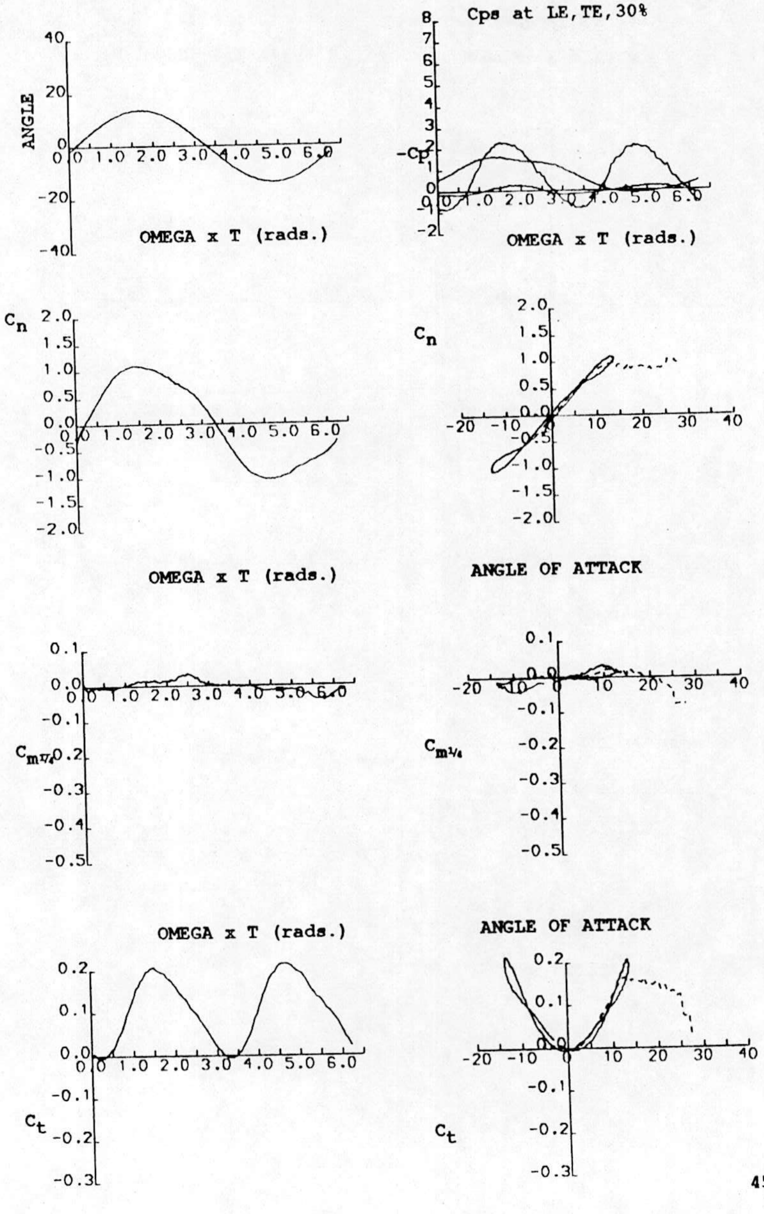
AIR TEMPERATURE = 25.5°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.038

AMPLITUDE = 13.80°

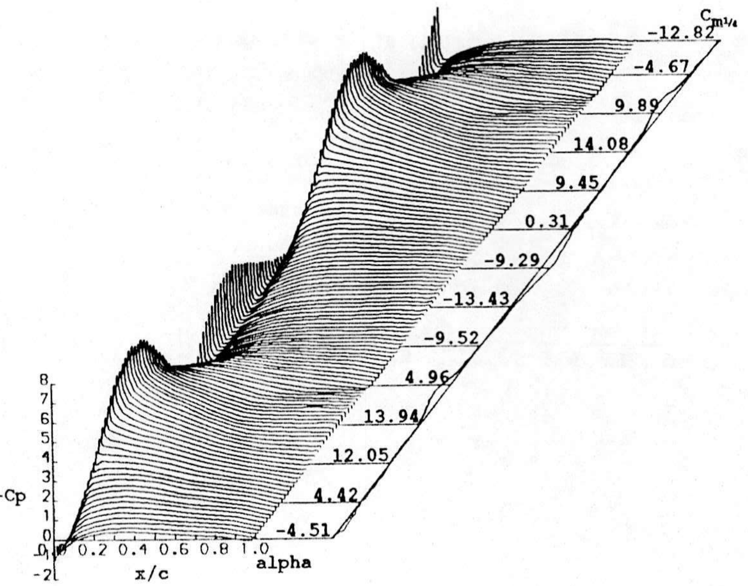


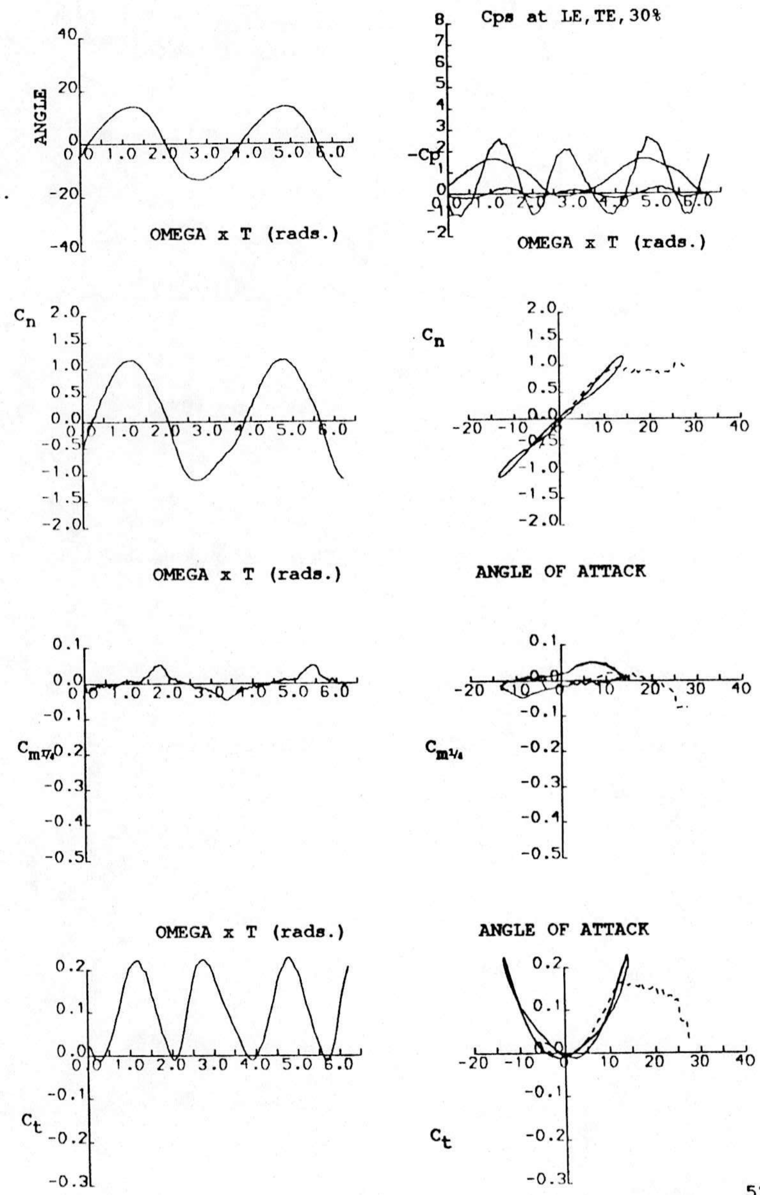


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55221
REYNOLDS NUMBER = 1638095.
DYNAMIC PRESSURE = 1217.37 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.133
AIR TEMPERATURE = 21.2°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.037
AMPLITUDE = 13.80°

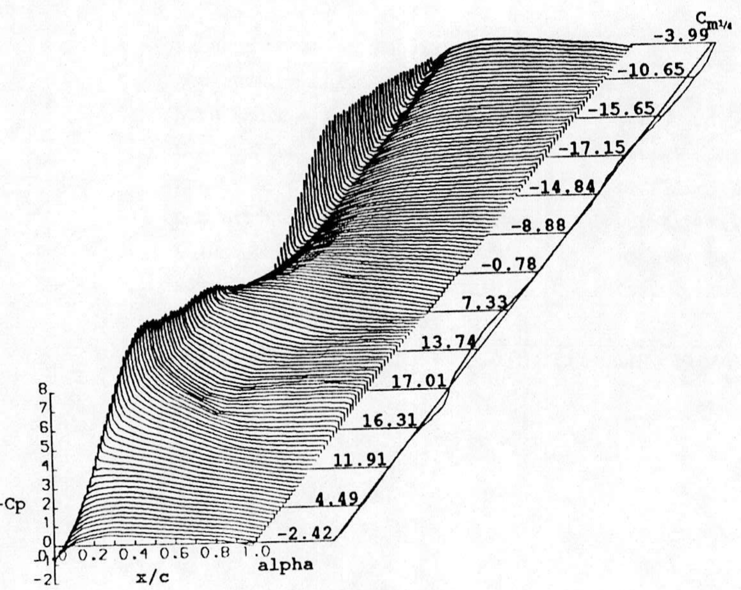


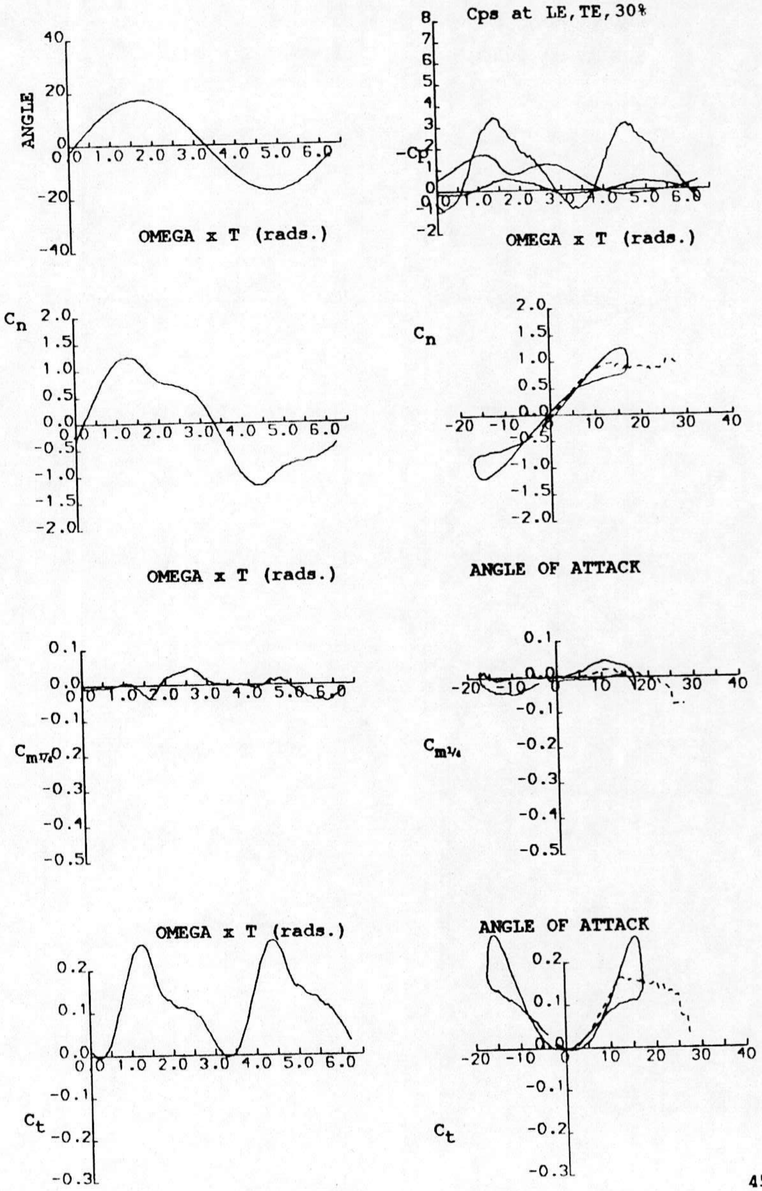


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14561
REYNOLDS NUMBER = 1555228.
DYNAMIC PRESSURE = 1138.94 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 25.7°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.038
AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55231

REYNOLDS NUMBER = 1636667.

DYNAMIC PRESSURE = 1217.37 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

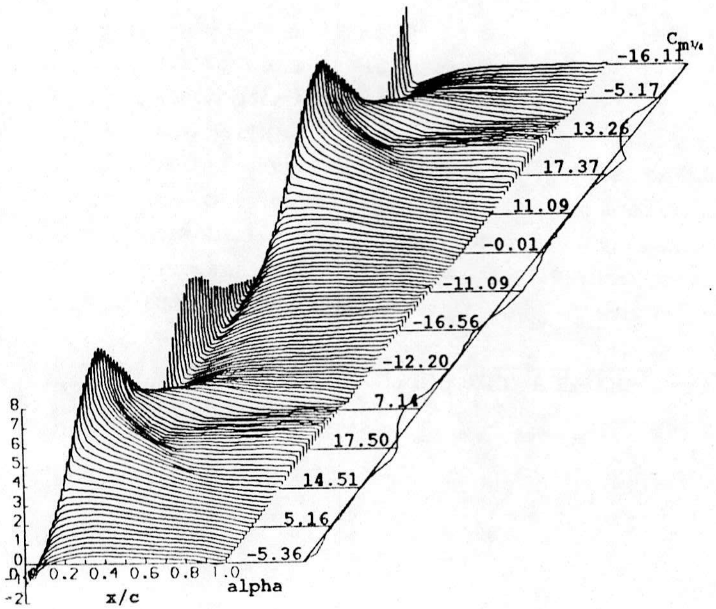
MACH NUMBER = 0.133

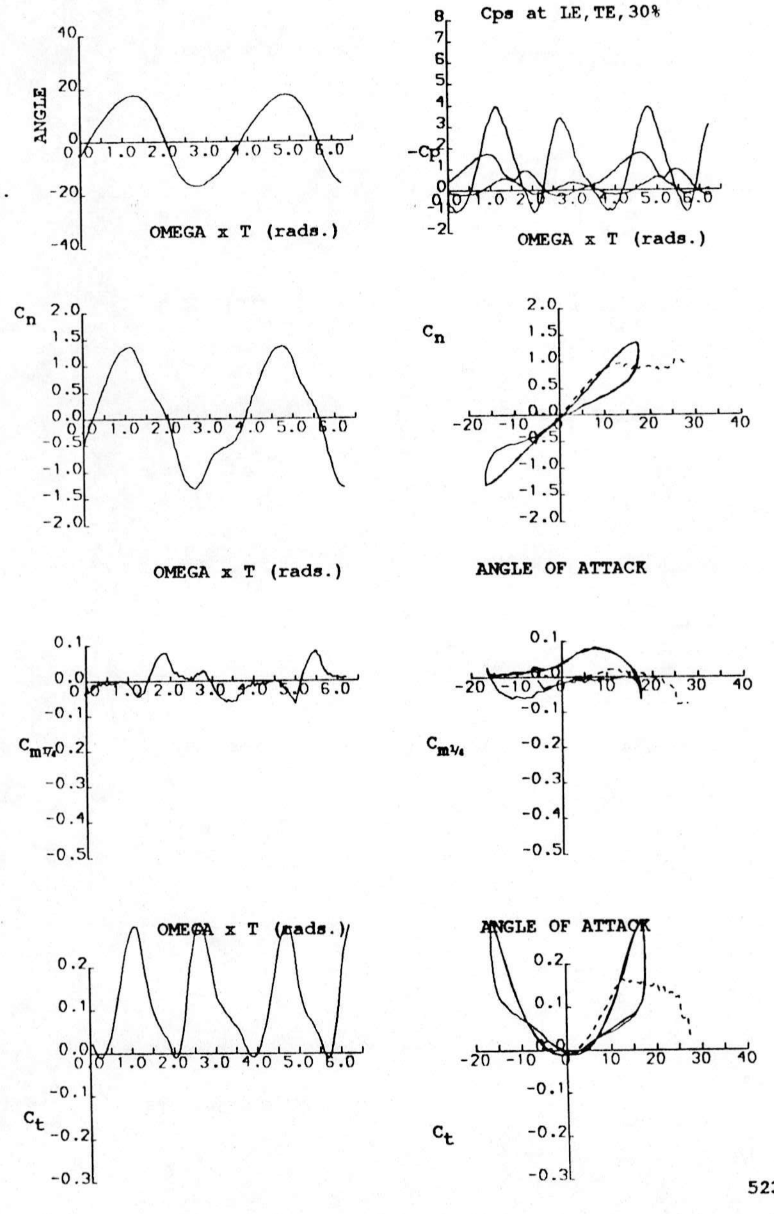
AIR TEMPERATURE = 21.4°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.037

AMPLITUDE = 17.40°

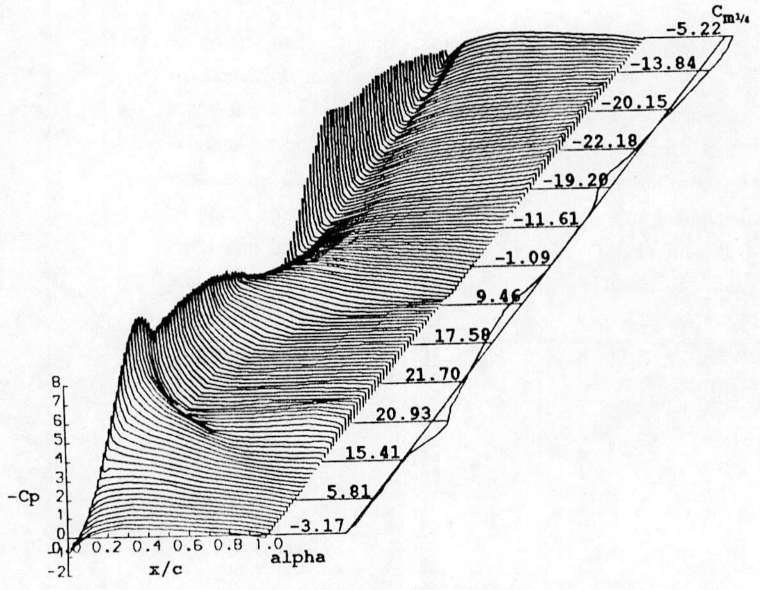


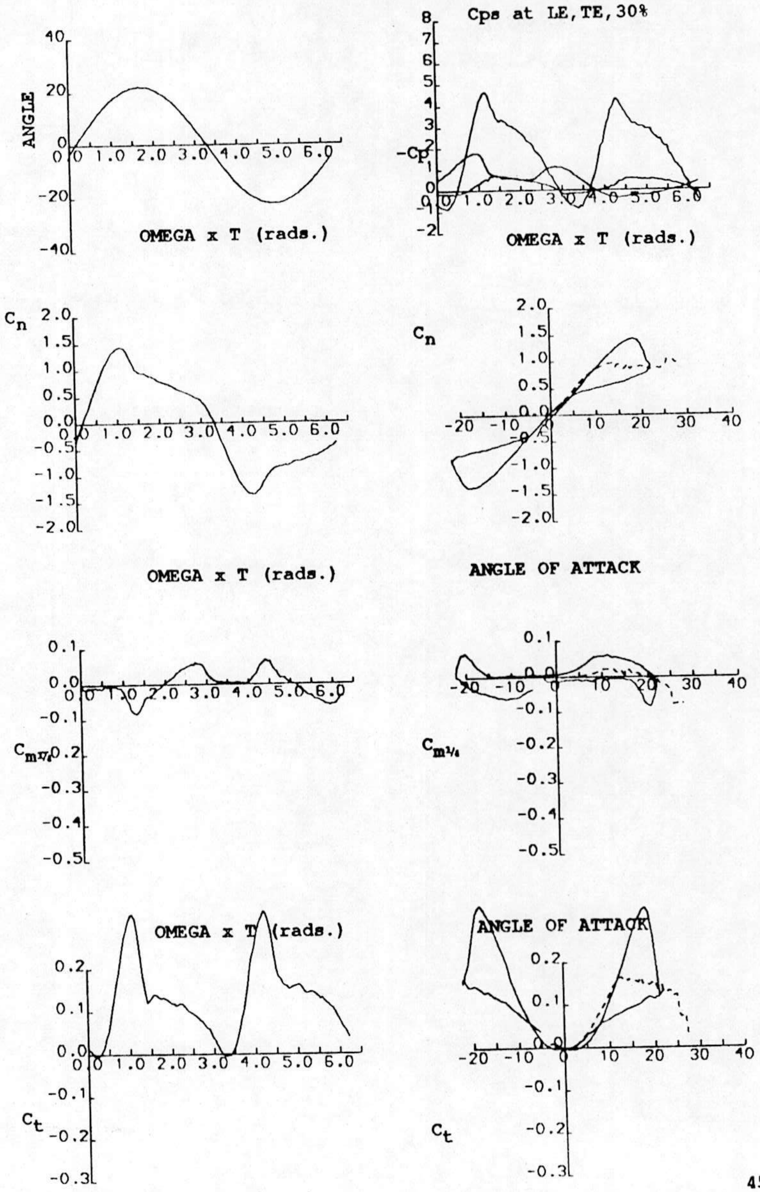


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14571
REYNOLDS NUMBER = 1554562.
DYNAMIC PRESSURE = 1138.94 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 0.975 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 25.8°C
SAMPLING FREQUENCY = 124.80 Hz.
REDUCED FREQUENCY = 0.038
AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55241

REYNOLDS NUMBER = 1634528.

DYNAMIC PRESSURE = 1217.37 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

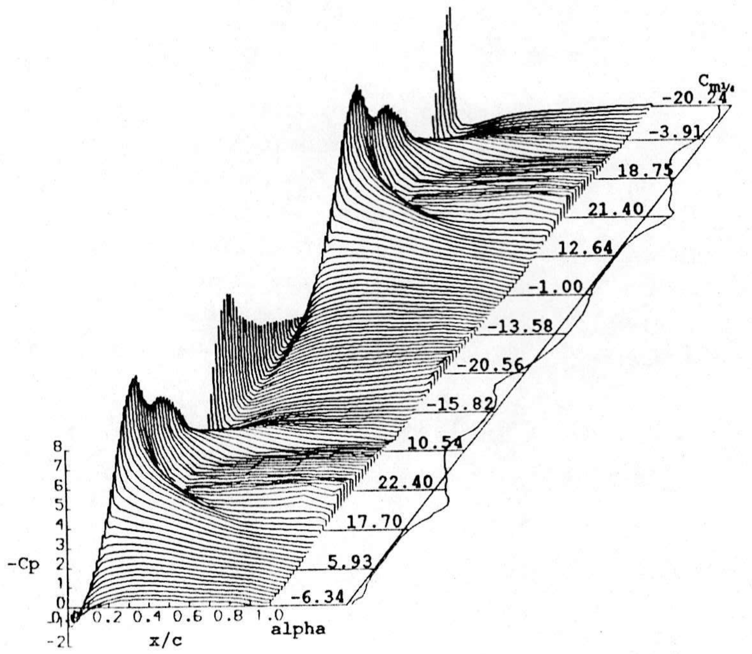
MACH NUMBER = 0.133

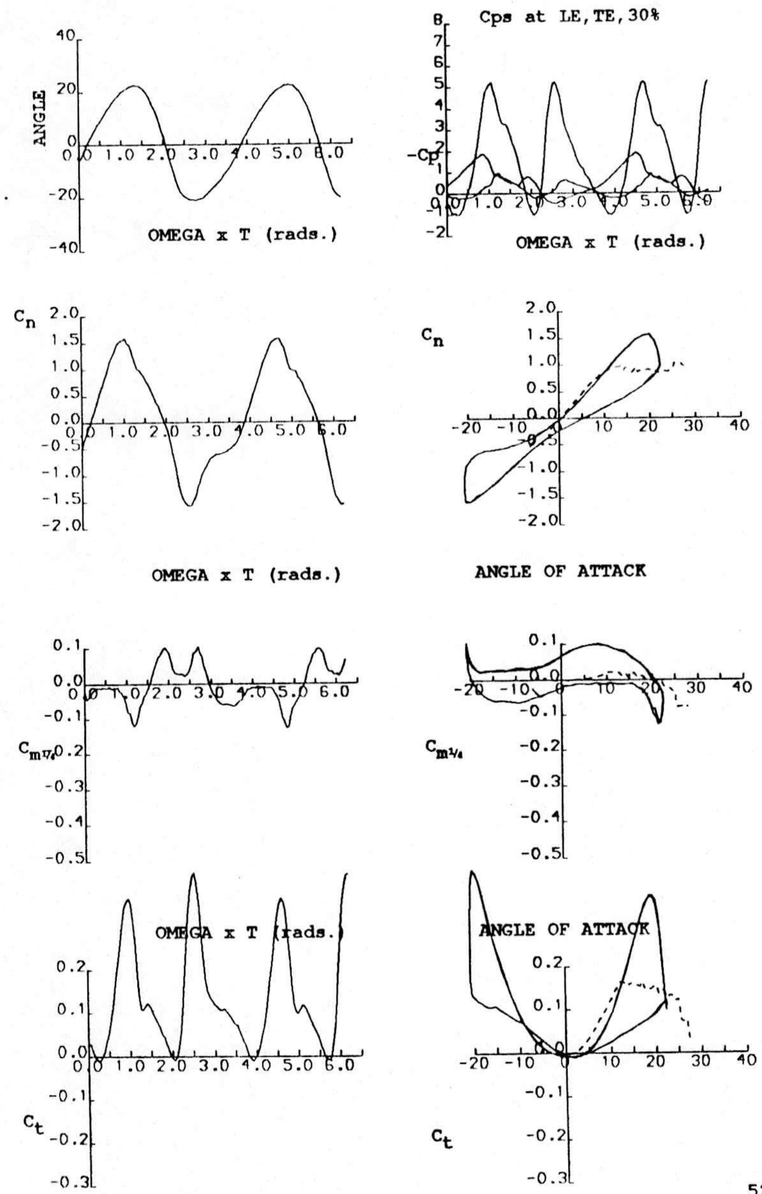
AIR TEMPERATURE = 21.7°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.037

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14581

REYNOLDS NUMBER = 1553230.

DYNAMIC PRESSURE = 1138.94 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 0.975 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

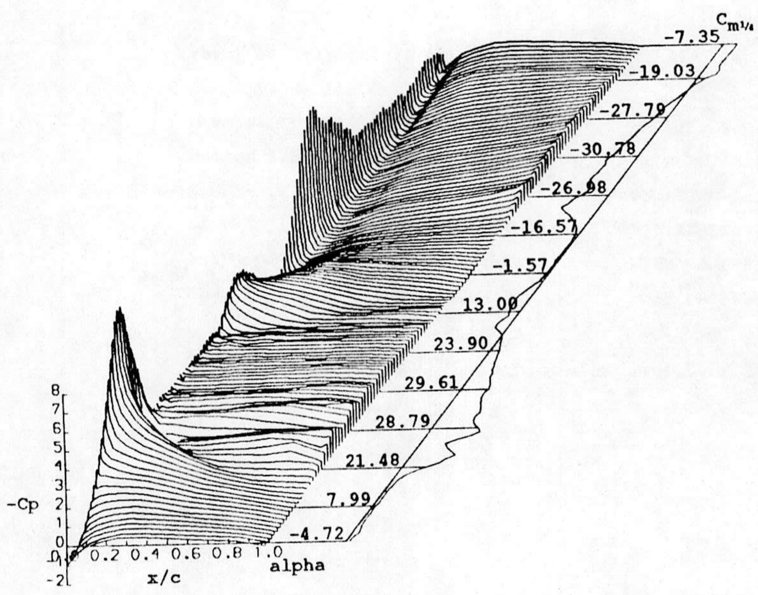
MACH NUMBER = 0.129

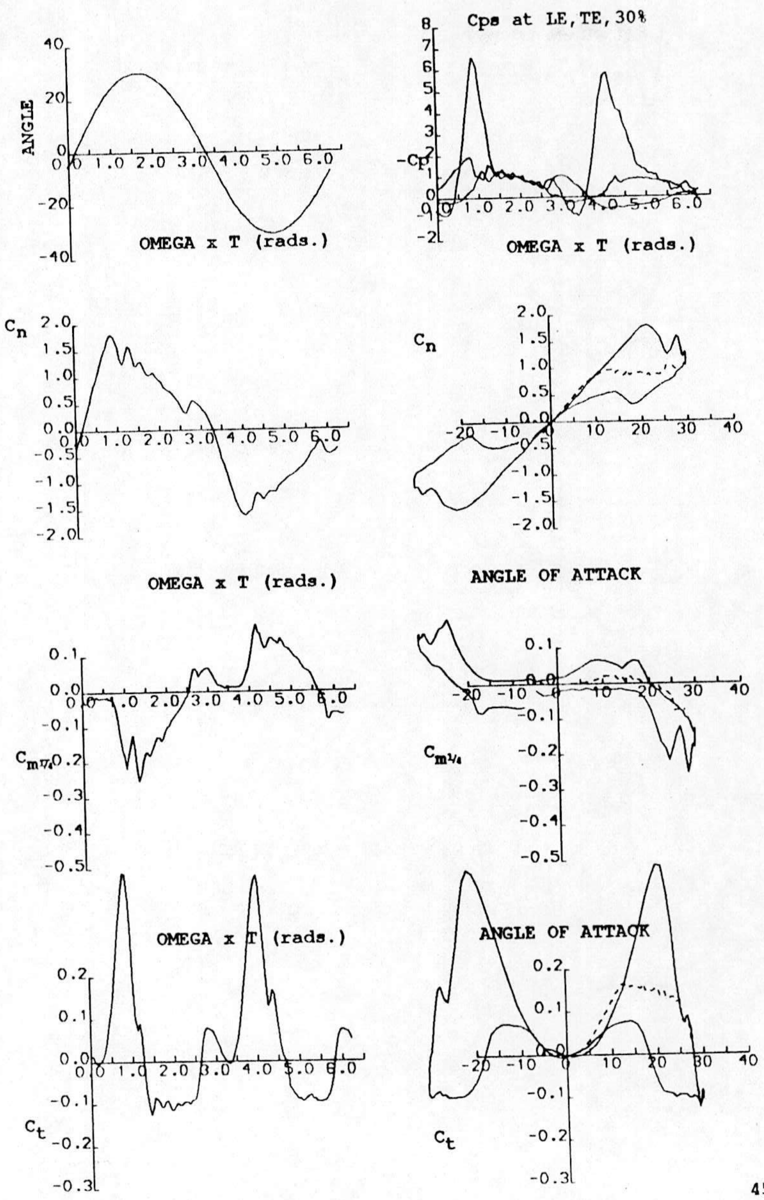
AIR TEMPERATURE = 26.0°C

SAMPLING FREQUENCY = 124.80 Hz.

REDUCED FREQUENCY = 0.038

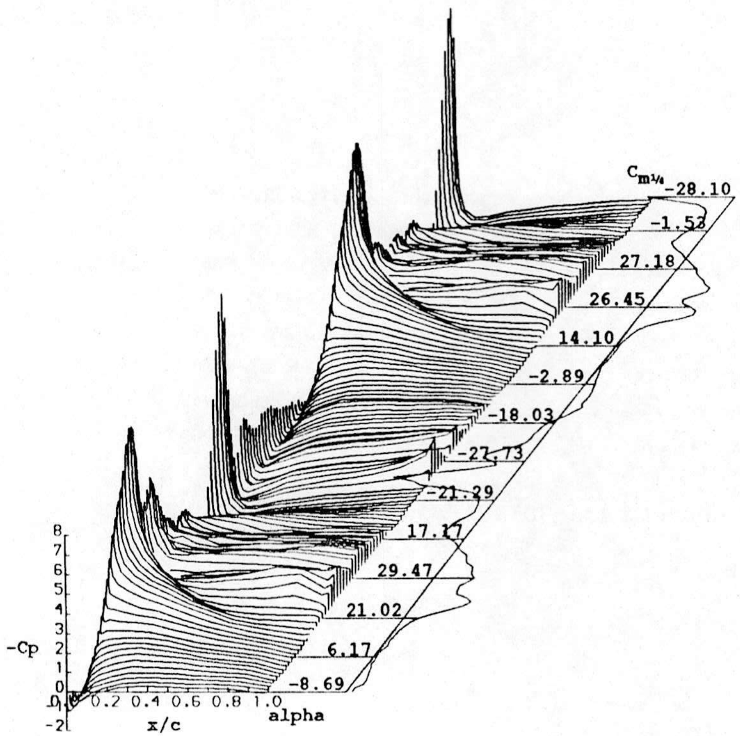
AMPLITUDE = 32.00°

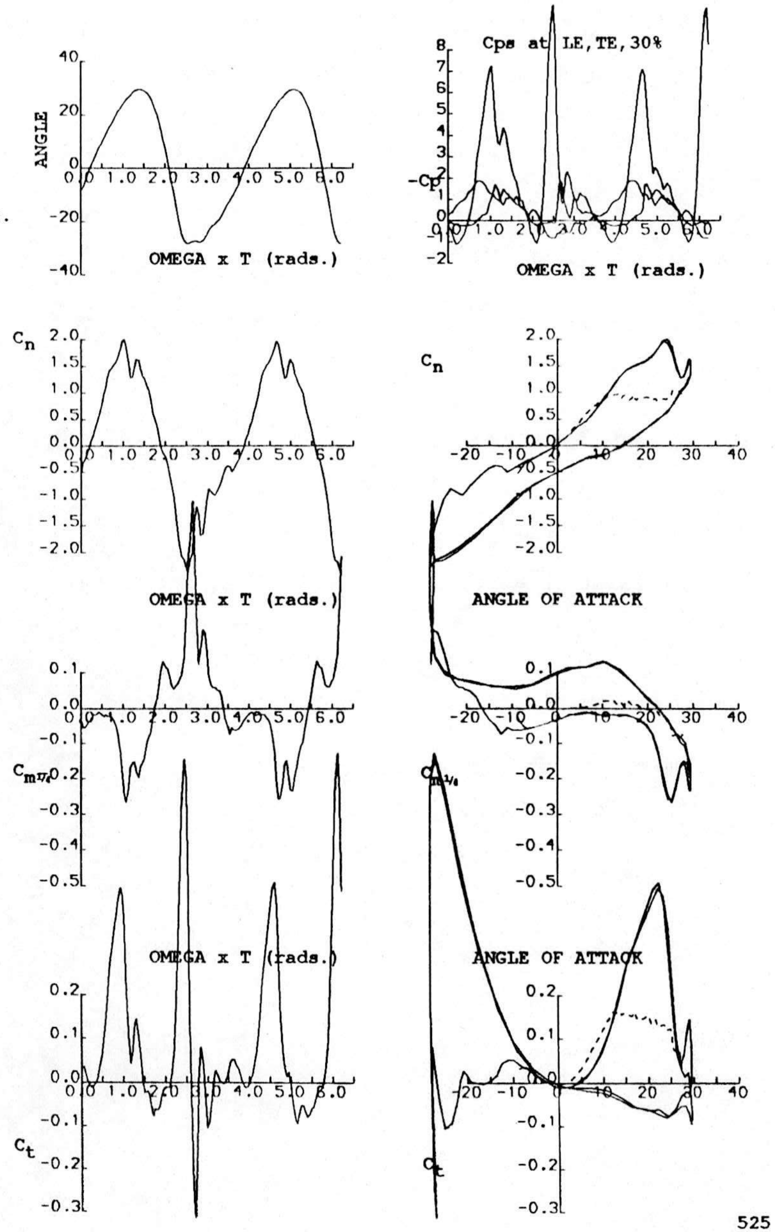




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55251	DATE OF TEST: 14/11/91
REYNOLDS NUMBER = 1631686.	MACH NUMBER = 0.133
DYNAMIC PRESSURE = 1217.37 Nm^{-2}	AIR TEMPERATURE = 22.1°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 124.80 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.037
MEAN ANGLE = 0.00°	AMPLITUDE = 32.00°
OSCILLATION FREQUENCY = 0.975 Hz.	
AVERAGED DATA OF 10 CYCLES	

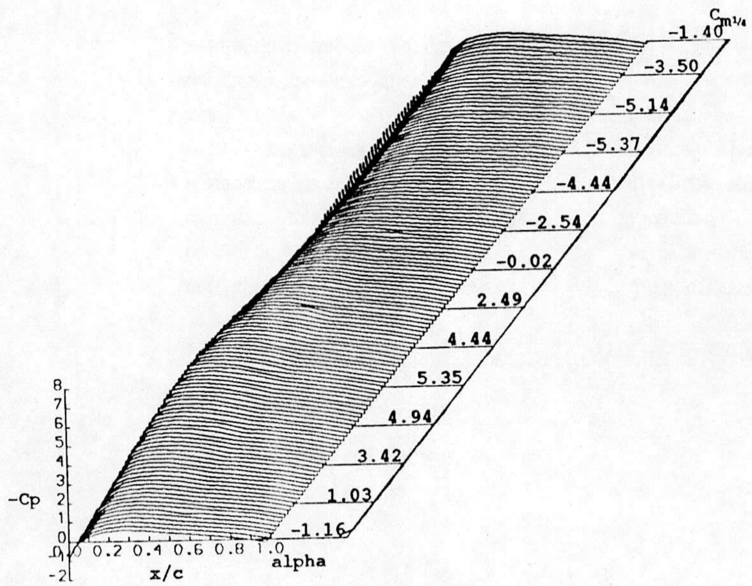


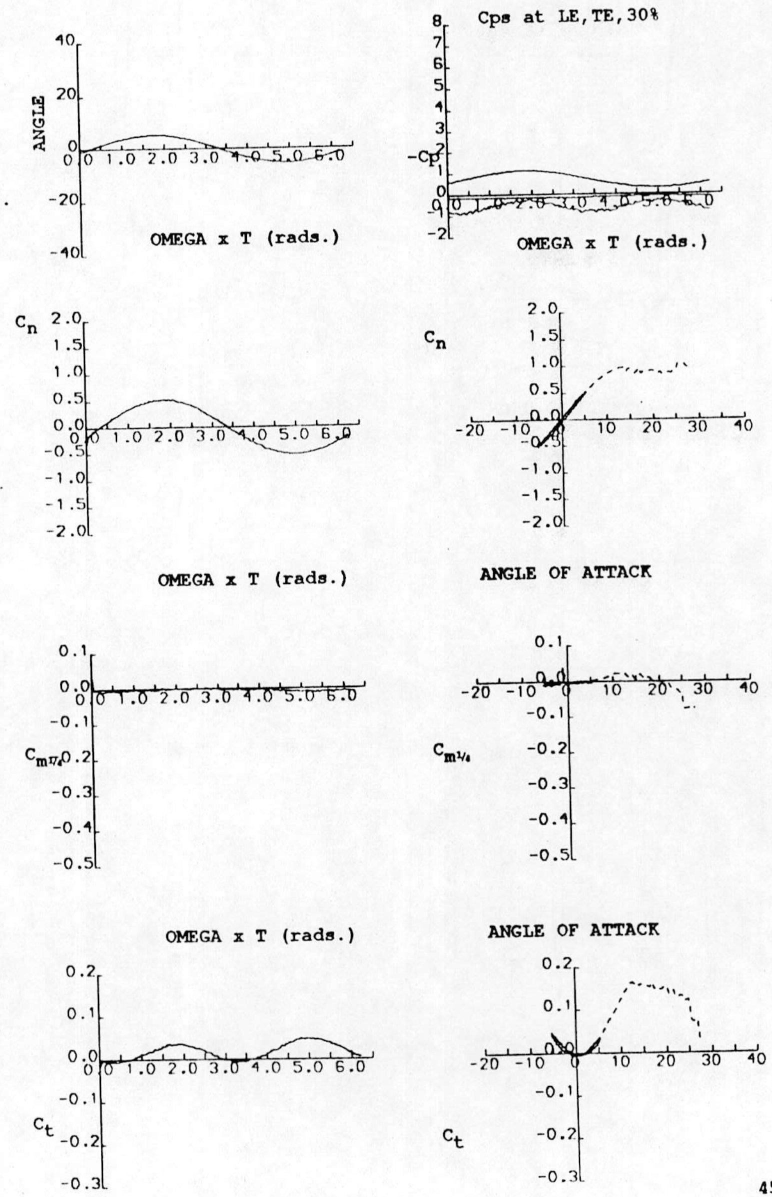


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14591
REYNOLDS NUMBER = 1558828.
DYNAMIC PRESSURE = 1139.29 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 25.0°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55261

REYNOLDS NUMBER = 1639648.

DYNAMIC PRESSURE = 1225.00 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

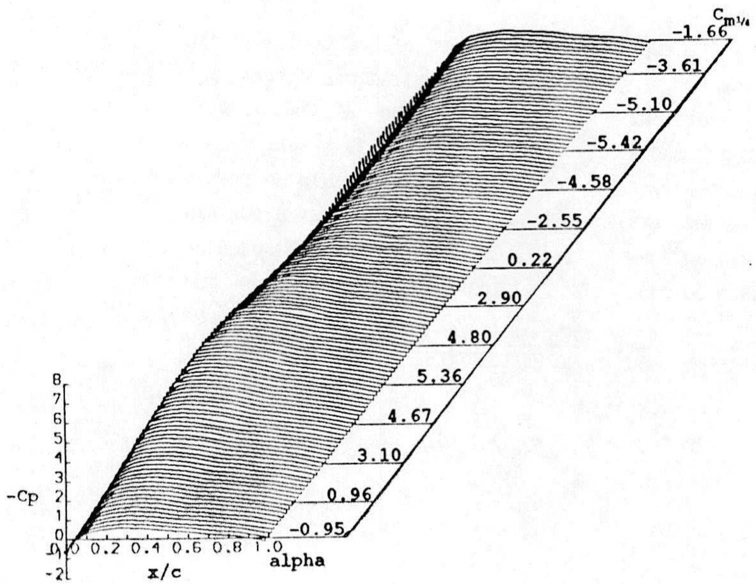
MACH NUMBER = 0.133

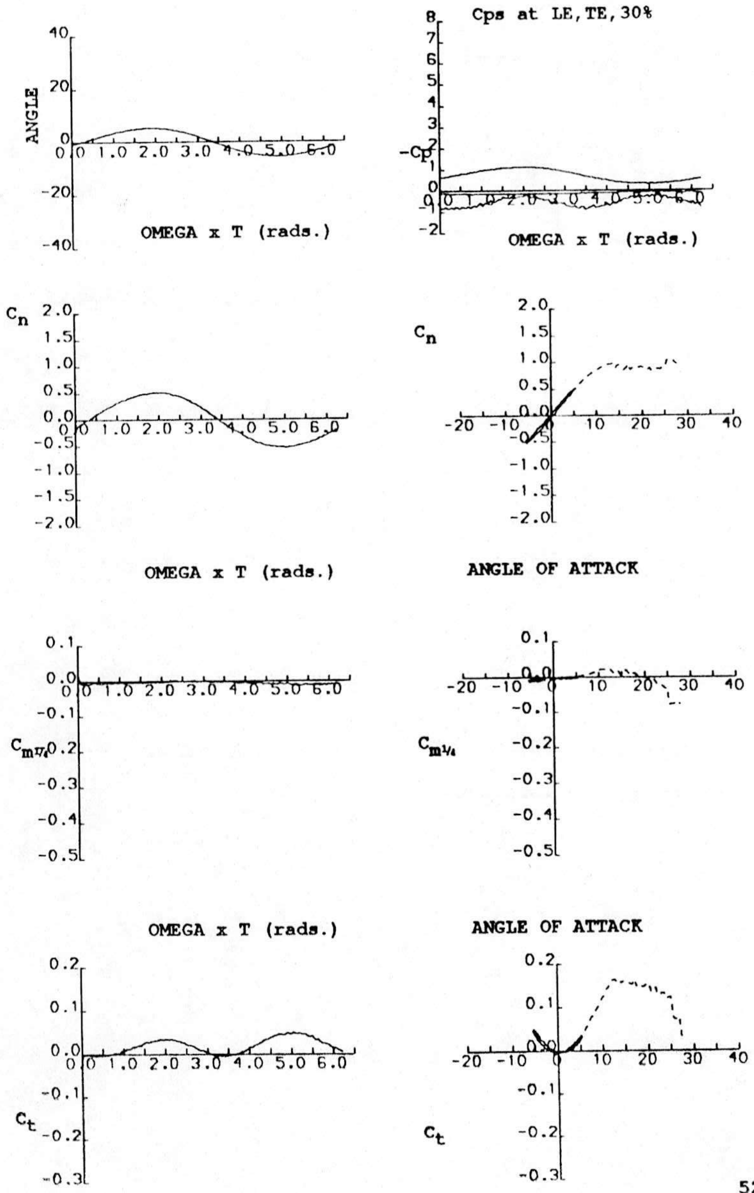
AIR TEMPERATURE = 21.7°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14601

REYNOLDS NUMBER = 1556820.

DYNAMIC PRESSURE = 1139.29 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

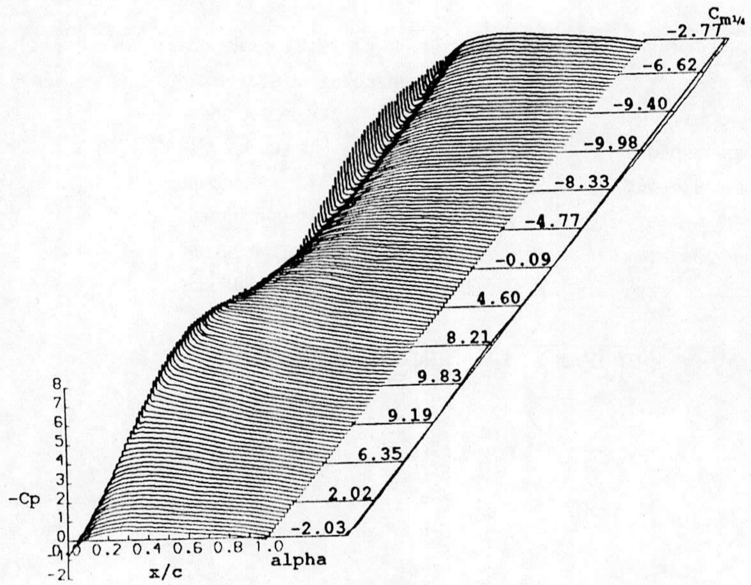
MACH NUMBER = 0.129

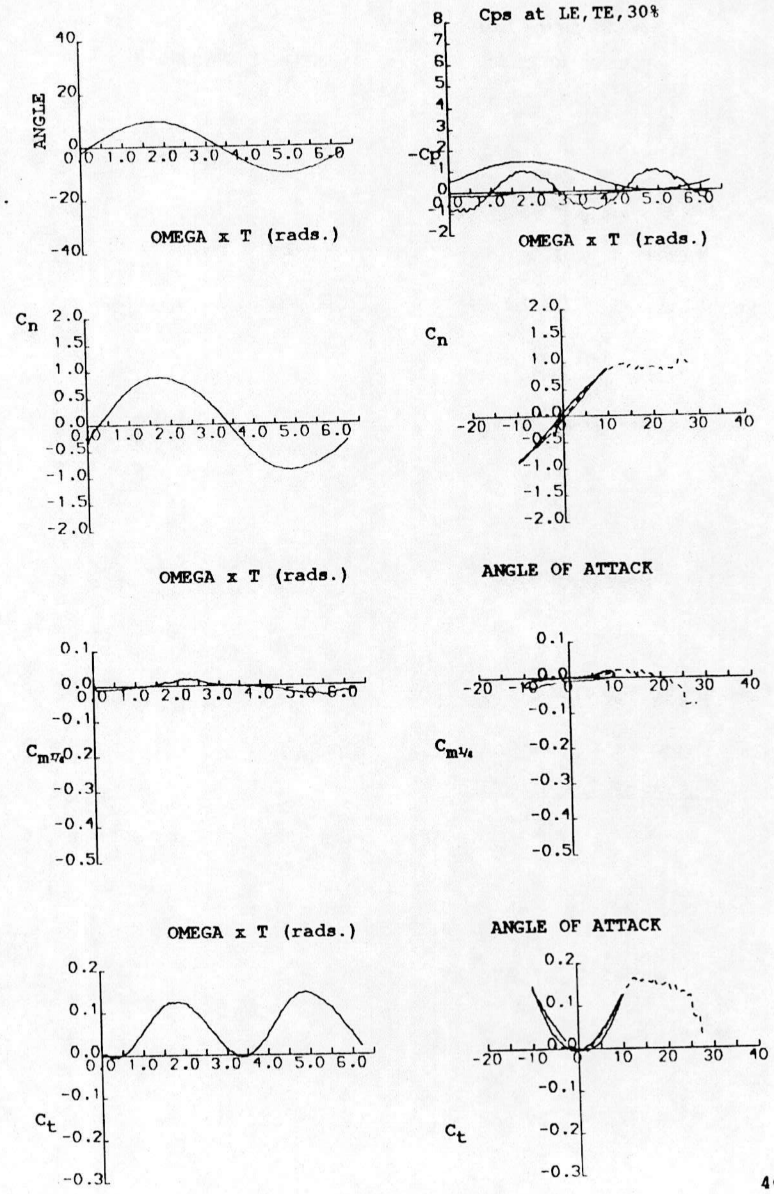
AIR TEMPERATURE = 25.3°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55271

REYNOLDS NUMBER = 1636085.

DYNAMIC PRESSURE = 1225.00 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

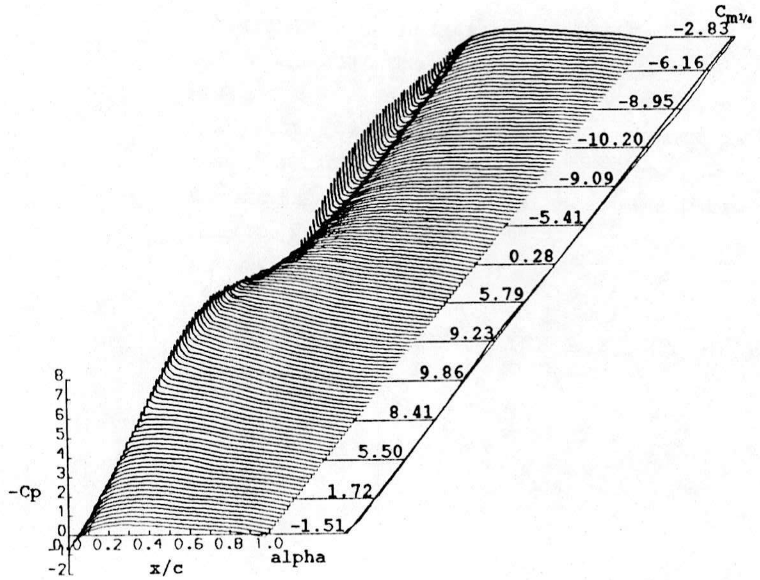
MACH NUMBER = 0.133

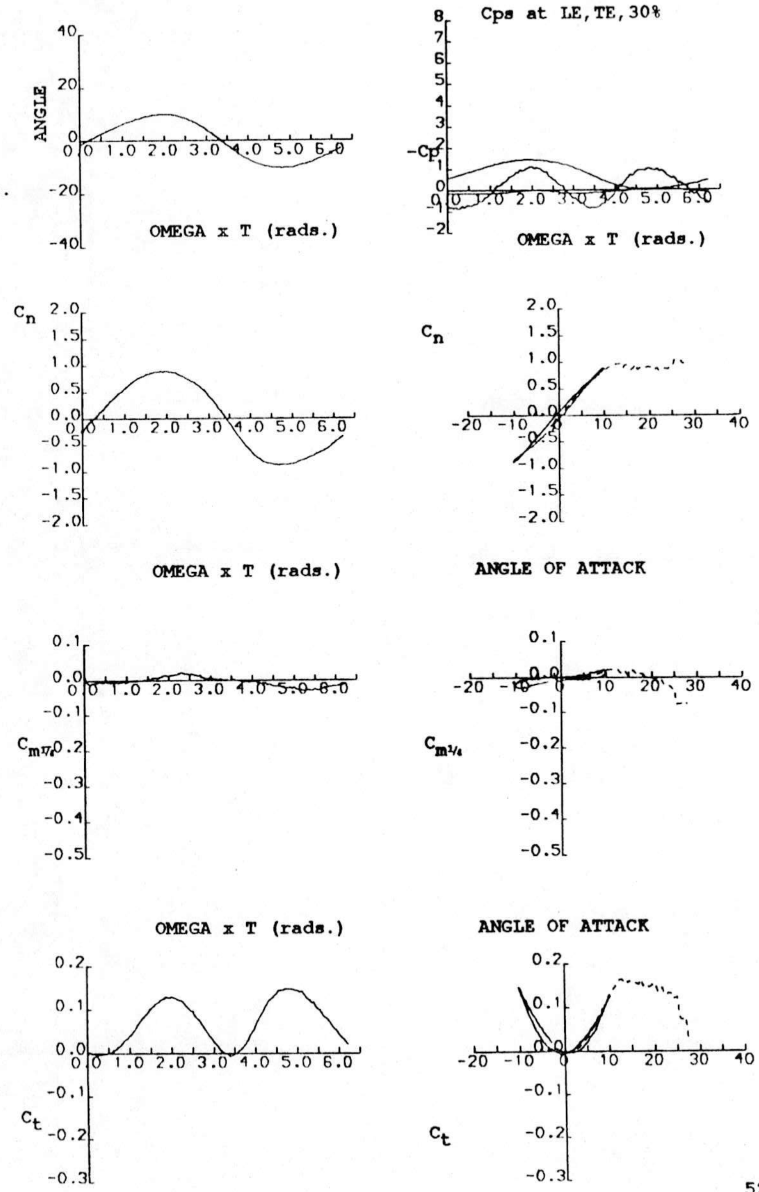
AIR TEMPERATURE = 22.2°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14611

REYNOLDS NUMBER = 1554816.

DYNAMIC PRESSURE = 1139.29 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

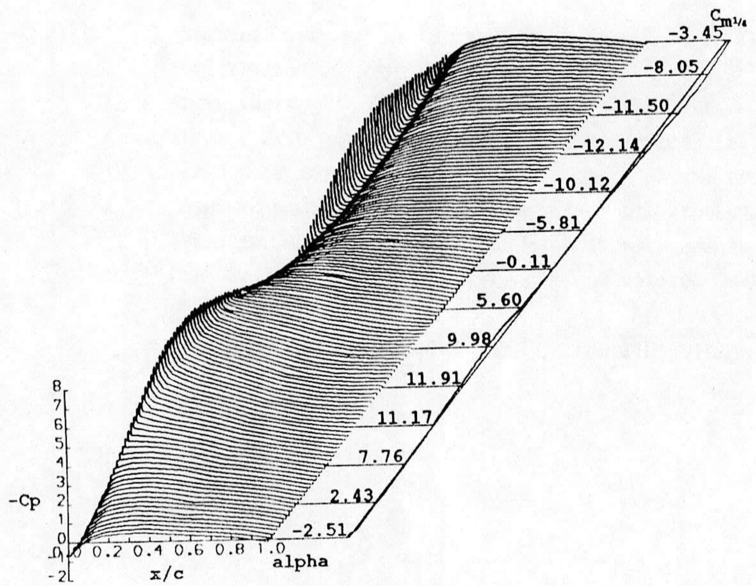
MACH NUMBER = 0.129

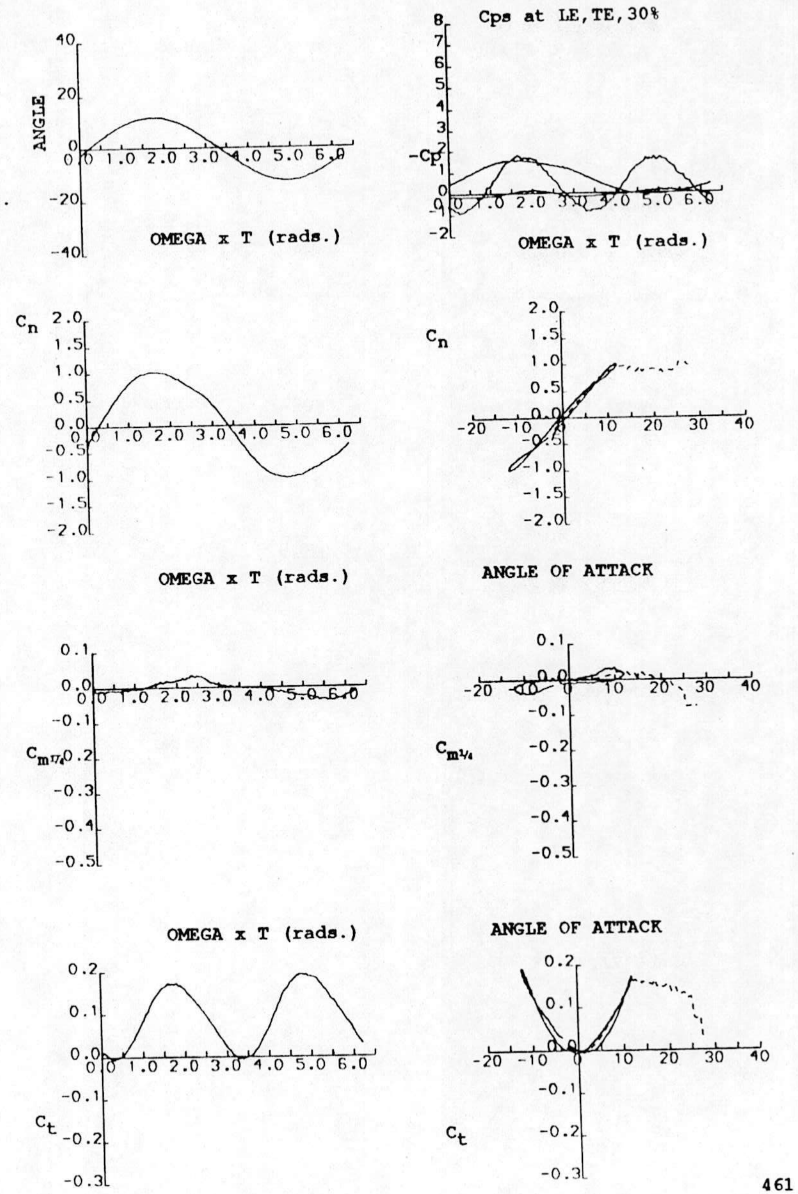
AIR TEMPERATURE = 25.6°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 12.20°

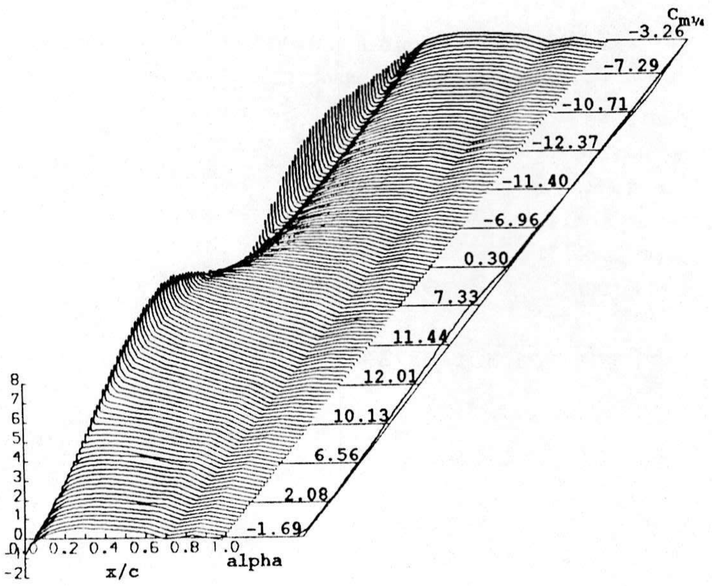


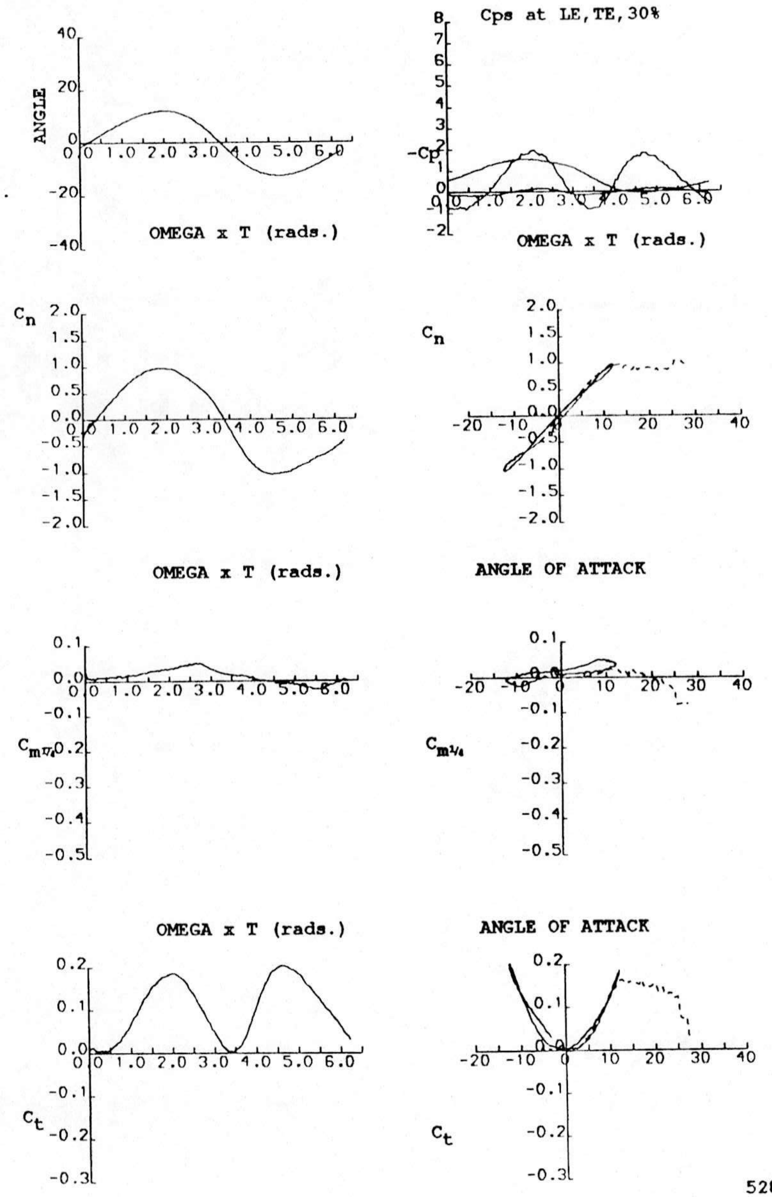


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55281
REYNOLDS NUMBER = 1631829.
DYNAMIC PRESSURE = 1225.00 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.133
AIR TEMPERATURE = 22.8°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 12.20°

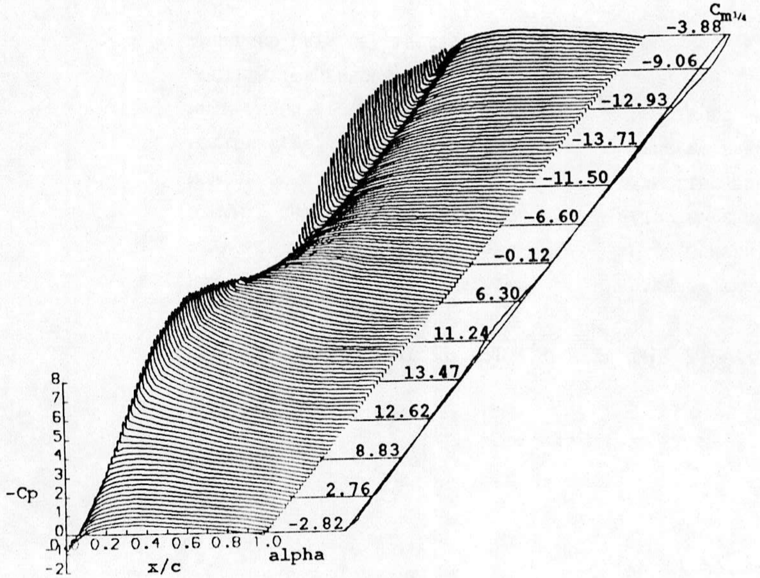


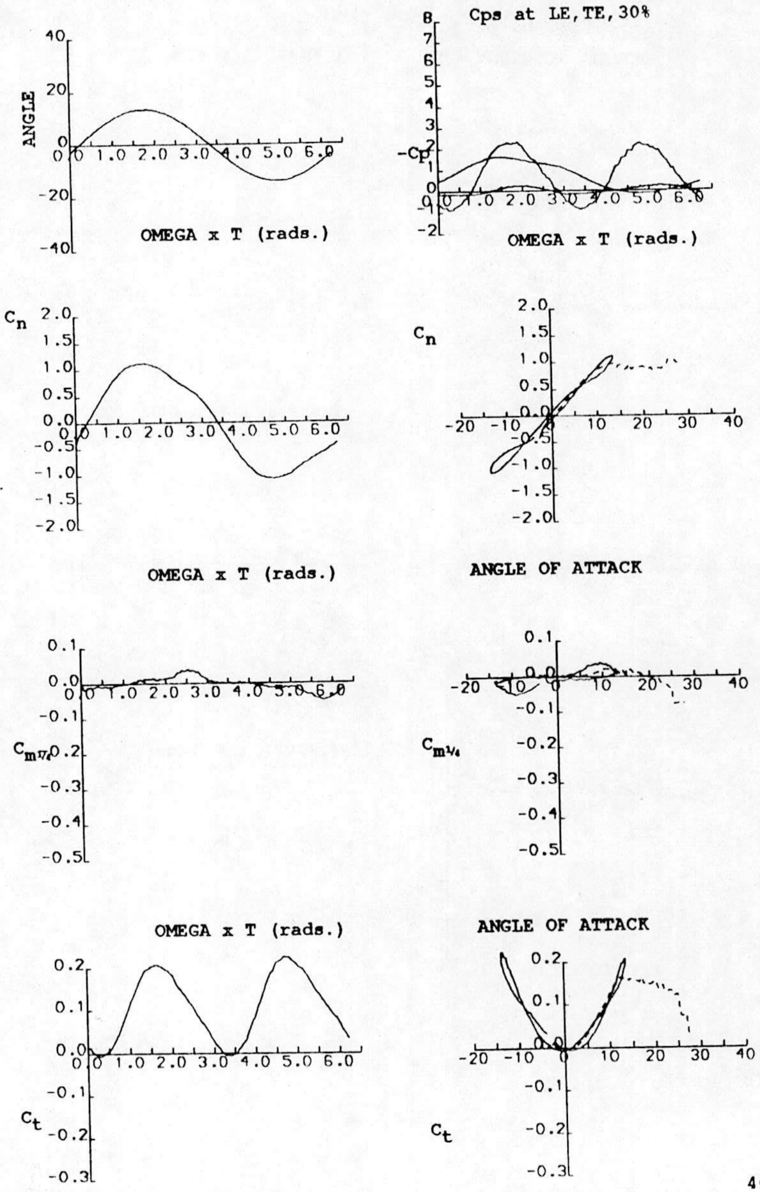


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14621
REYNOLDS NUMBER = 1553484.
DYNAMIC PRESSURE = 1139.29 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 25.8°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.047
AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55291

REYNOLDS NUMBER = 1629003.

DYNAMIC PRESSURE = 1225.00 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

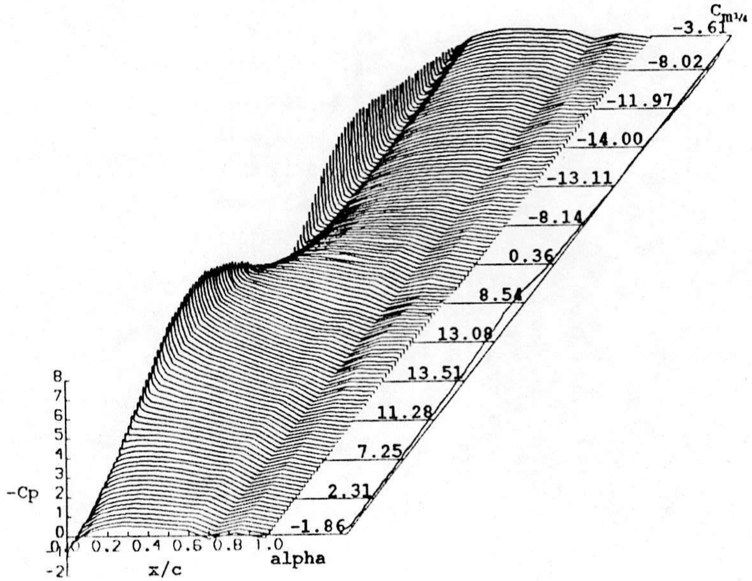
MACH NUMBER = 0.133

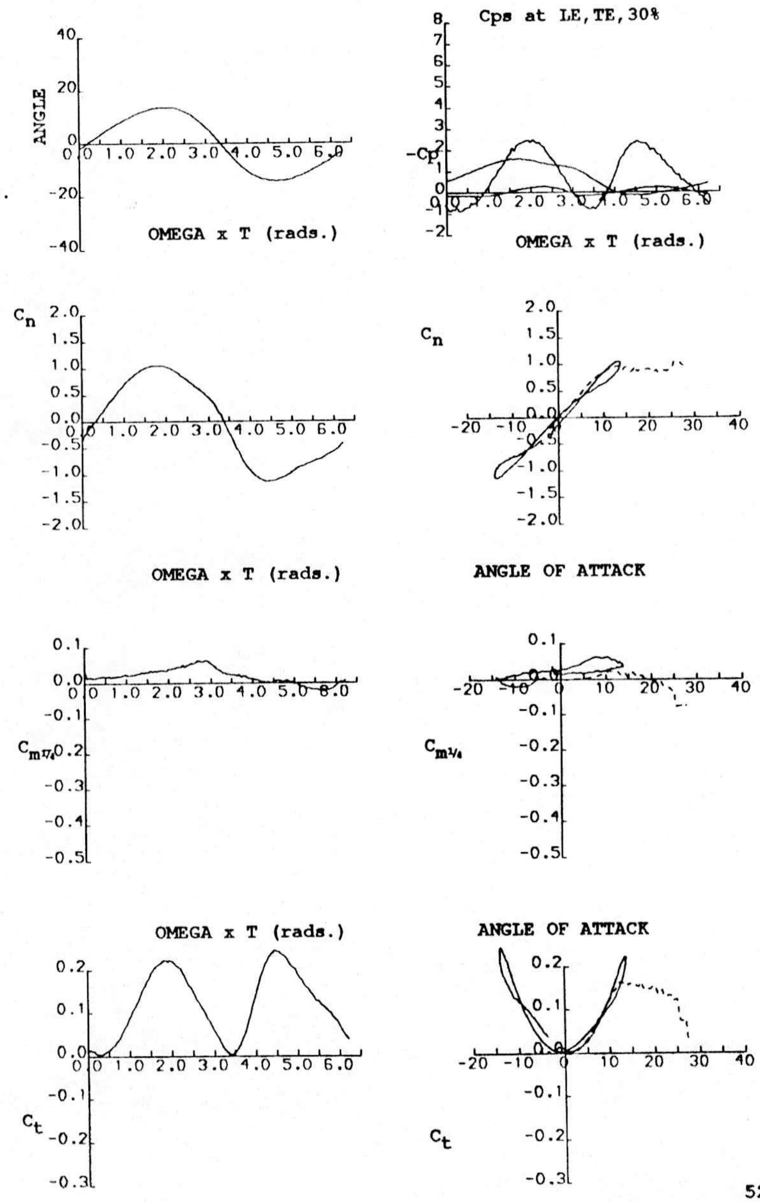
AIR TEMPERATURE = 23.2°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14631

REYNOLDS NUMBER = 1552153.

DYNAMIC PRESSURE = 1139.29 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

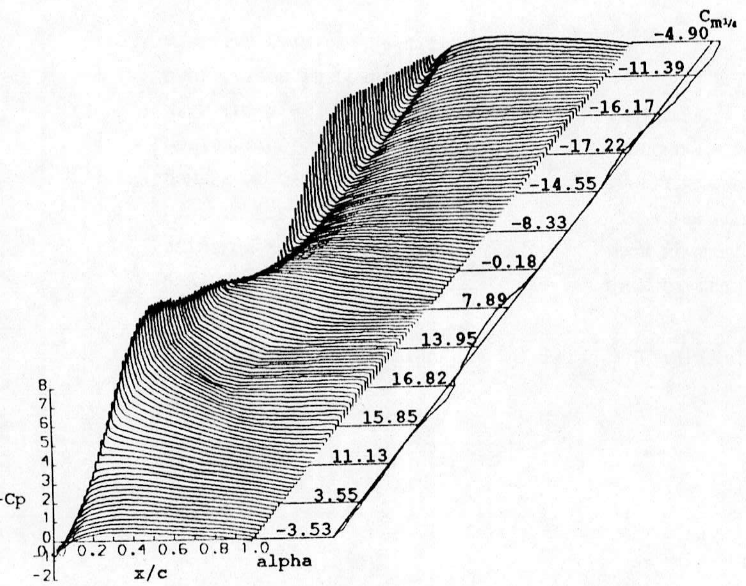
MACH NUMBER = 0.129

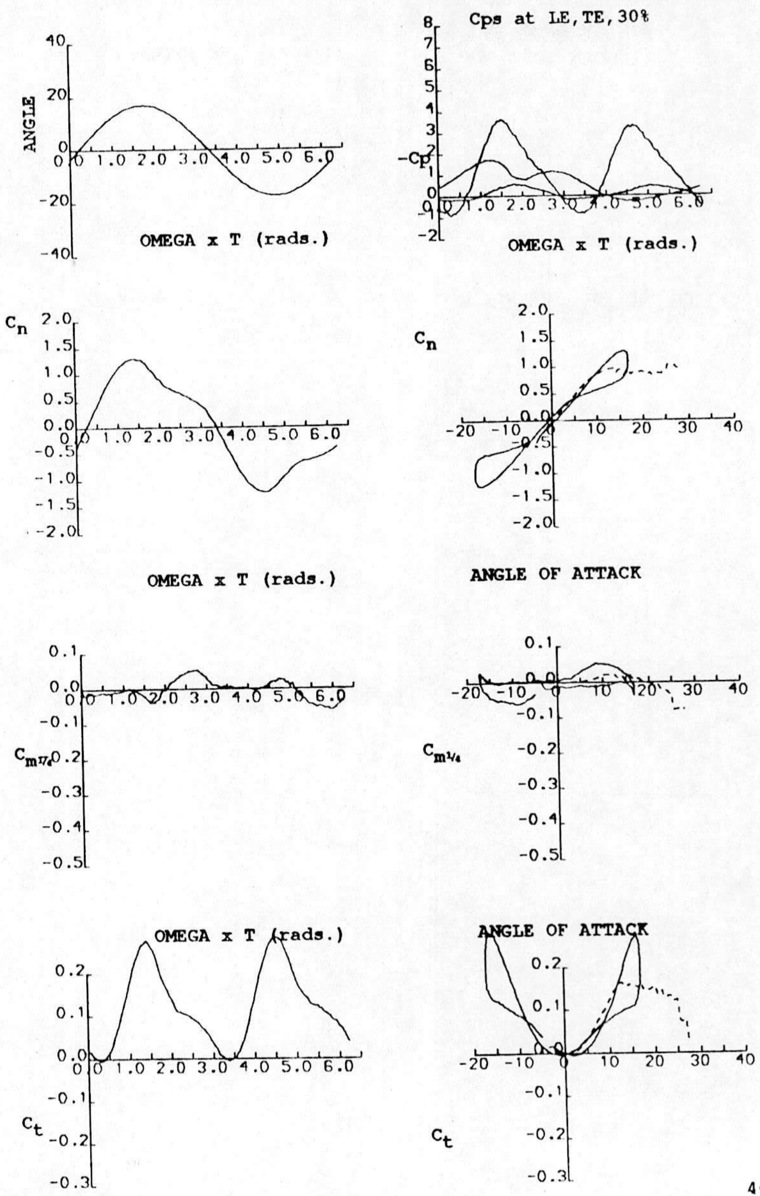
AIR TEMPERATURE = 26.0°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 17.40°

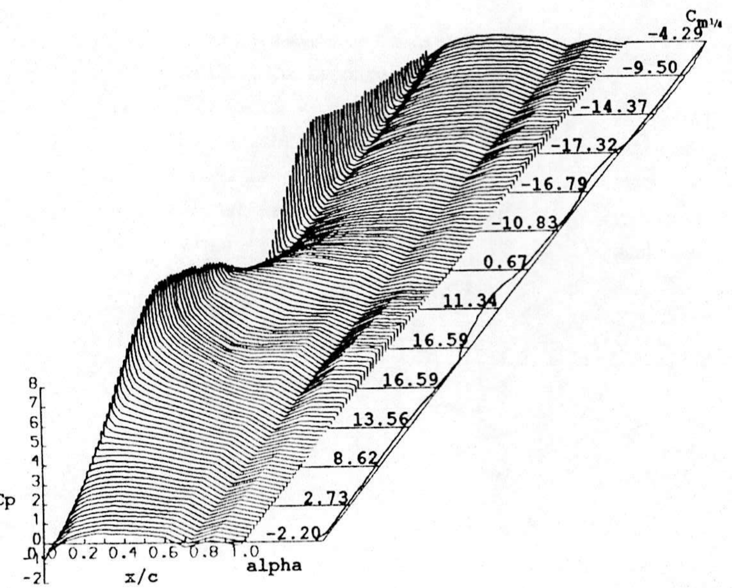


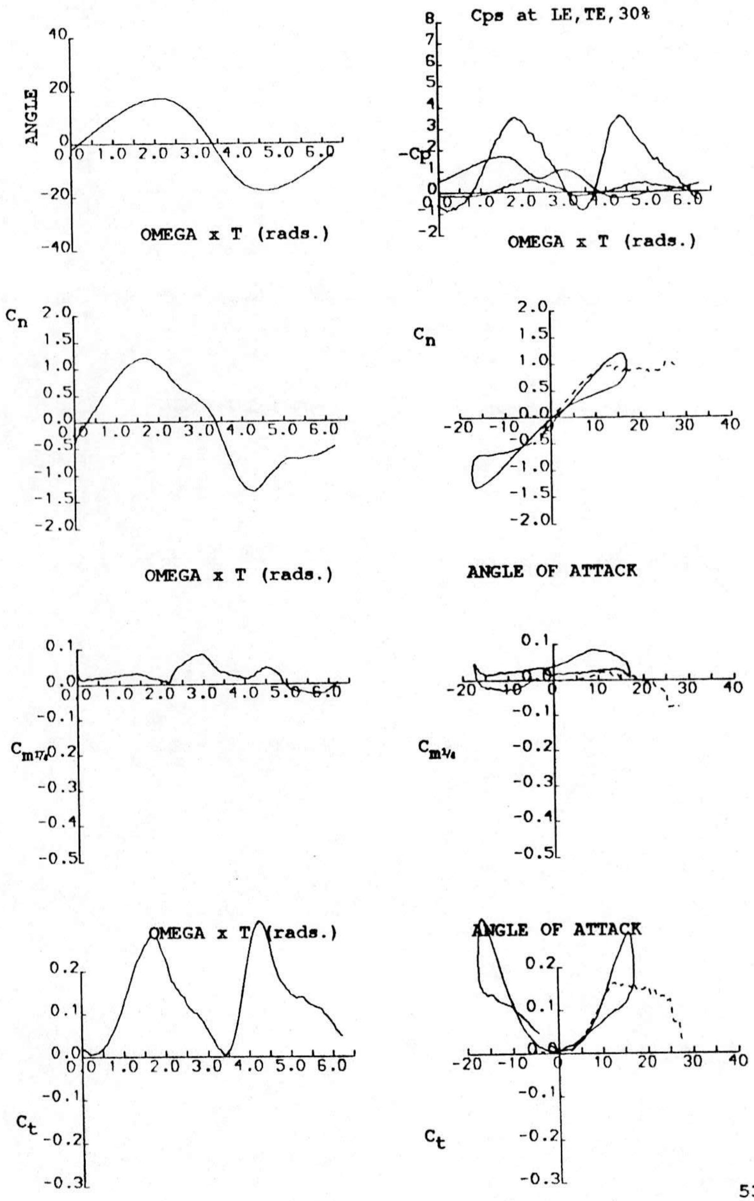


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55301
REYNOLDS NUMBER = 1626187.
DYNAMIC PRESSURE = 1225.00 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.218 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.133
AIR TEMPERATURE = 23.6°C
SAMPLING FREQUENCY = 155.91 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14641

REYNOLDS NUMBER = 1550825.

DYNAMIC PRESSURE = 1139.29 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

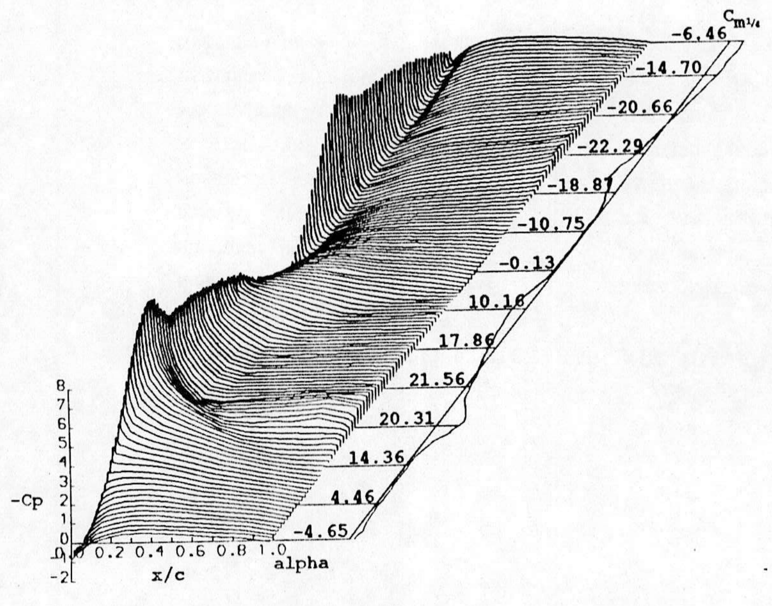
MACH NUMBER = 0.129

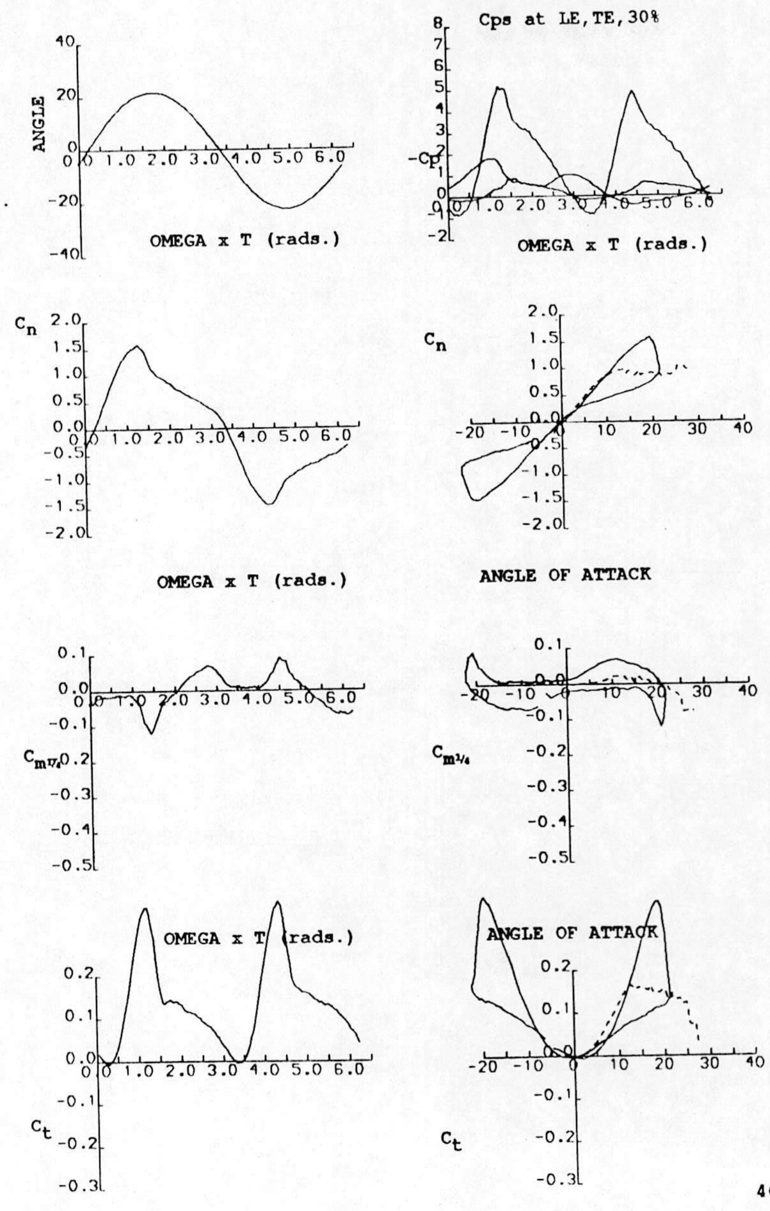
AIR TEMPERATURE = 26.2°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

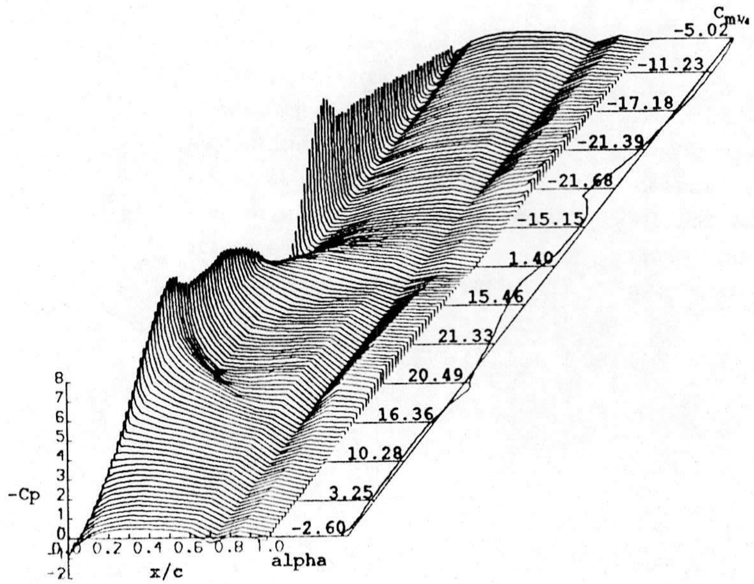
AMPLITUDE = 22.60°

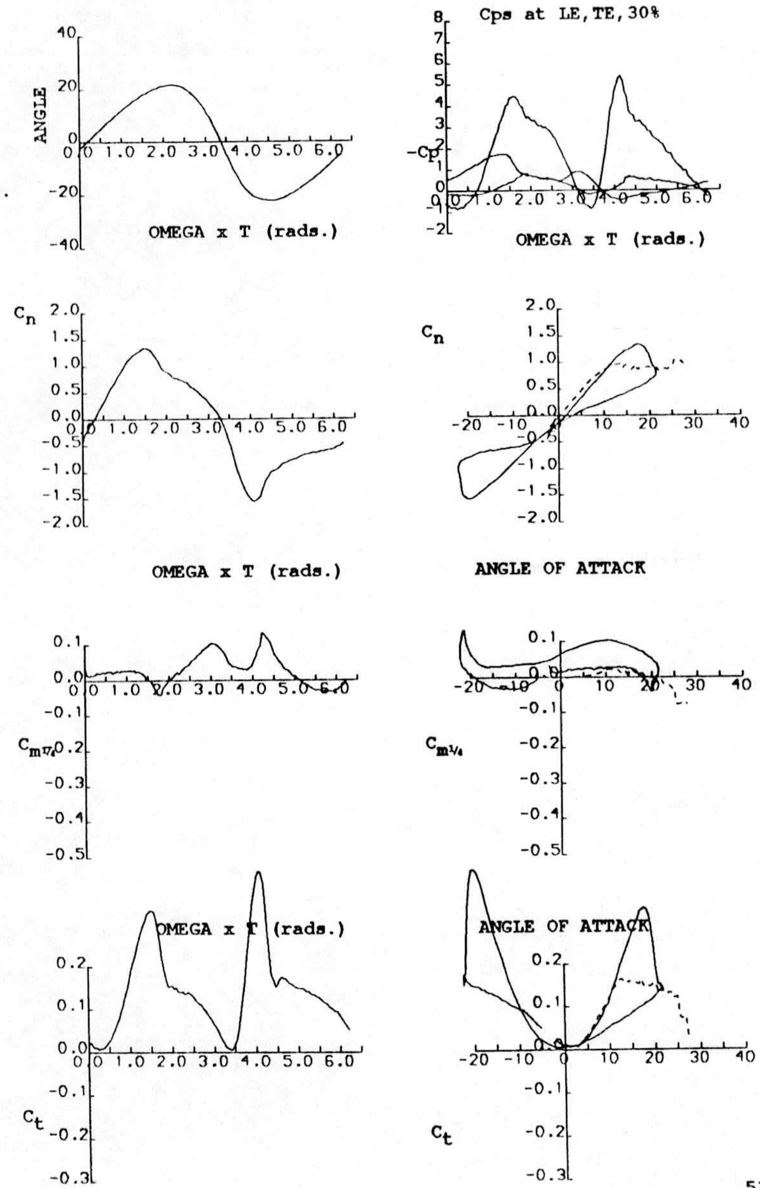




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55311	DATE OF TEST: 14/11/91
REYNOLDS NUMBER = 1623379.	MACH NUMBER = 0.133
DYNAMIC PRESSURE = 1225.00 Nm^{-2}	AIR TEMPERATURE = 24.0°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 155.91 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.046
MEAN ANGLE = 0.00°	AMPLITUDE = 22.60°
OSCILLATION FREQUENCY = 1.218 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14651

REYNOLDS NUMBER = 1550162.

DYNAMIC PRESSURE = 1139.29 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

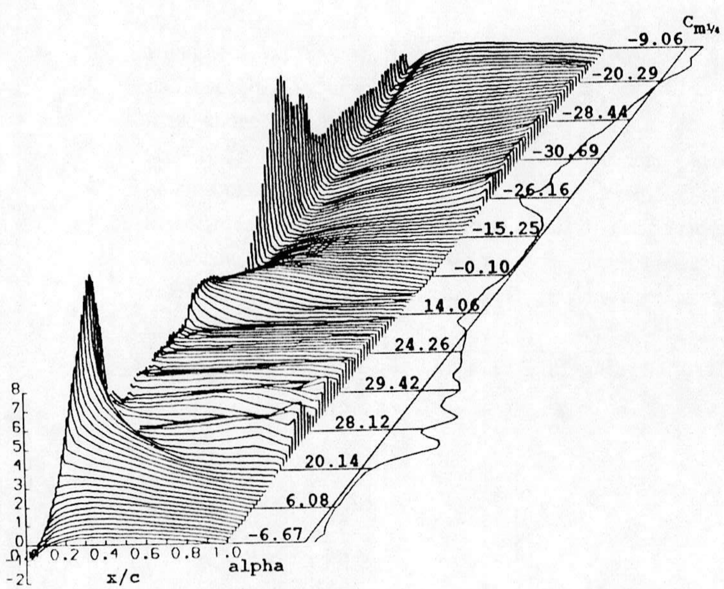
MACH NUMBER = 0.129

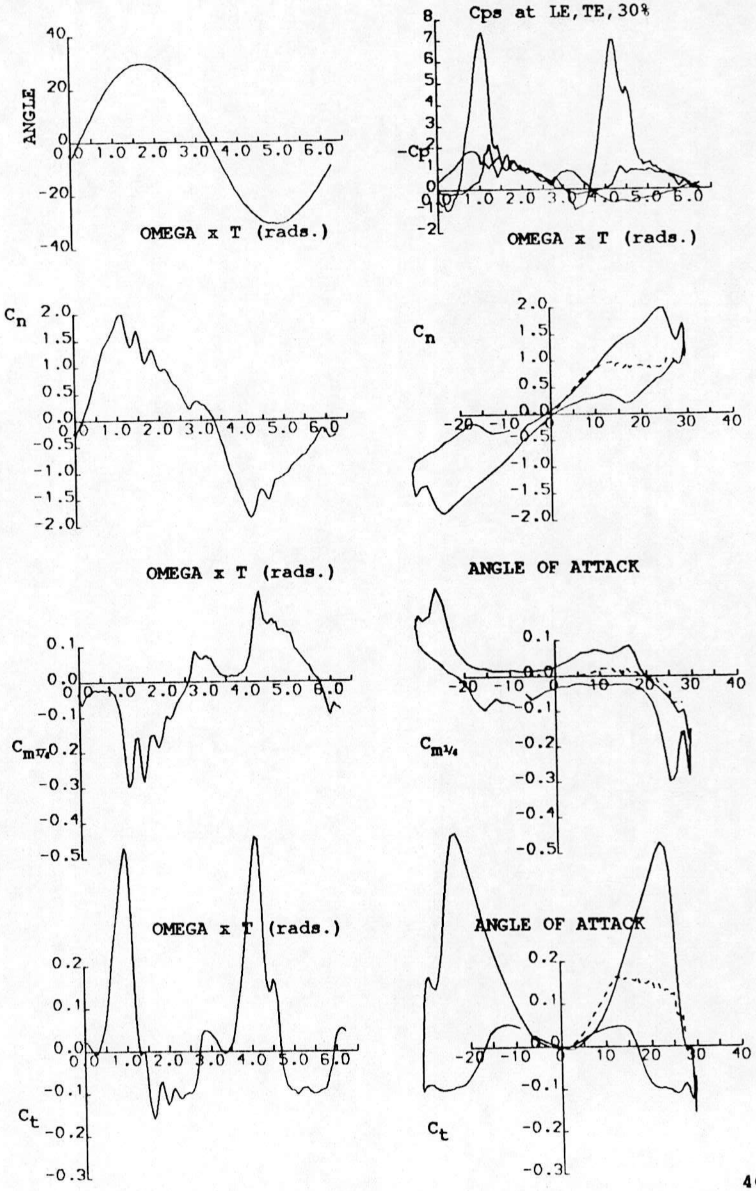
AIR TEMPERATURE = 26.3°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.047

AMPLITUDE = 32.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55321

REYNOLDS NUMBER = 1620581.

DYNAMIC PRESSURE = 1225.00 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.218 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

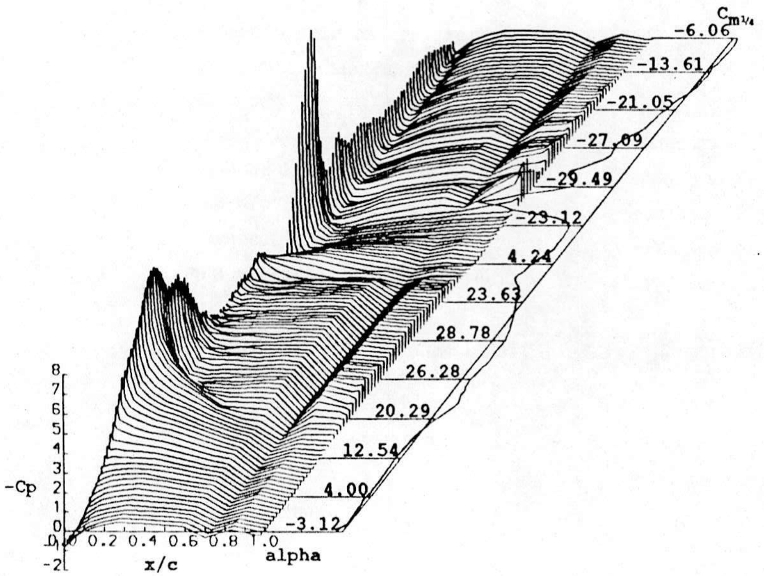
MACH NUMBER = 0.133

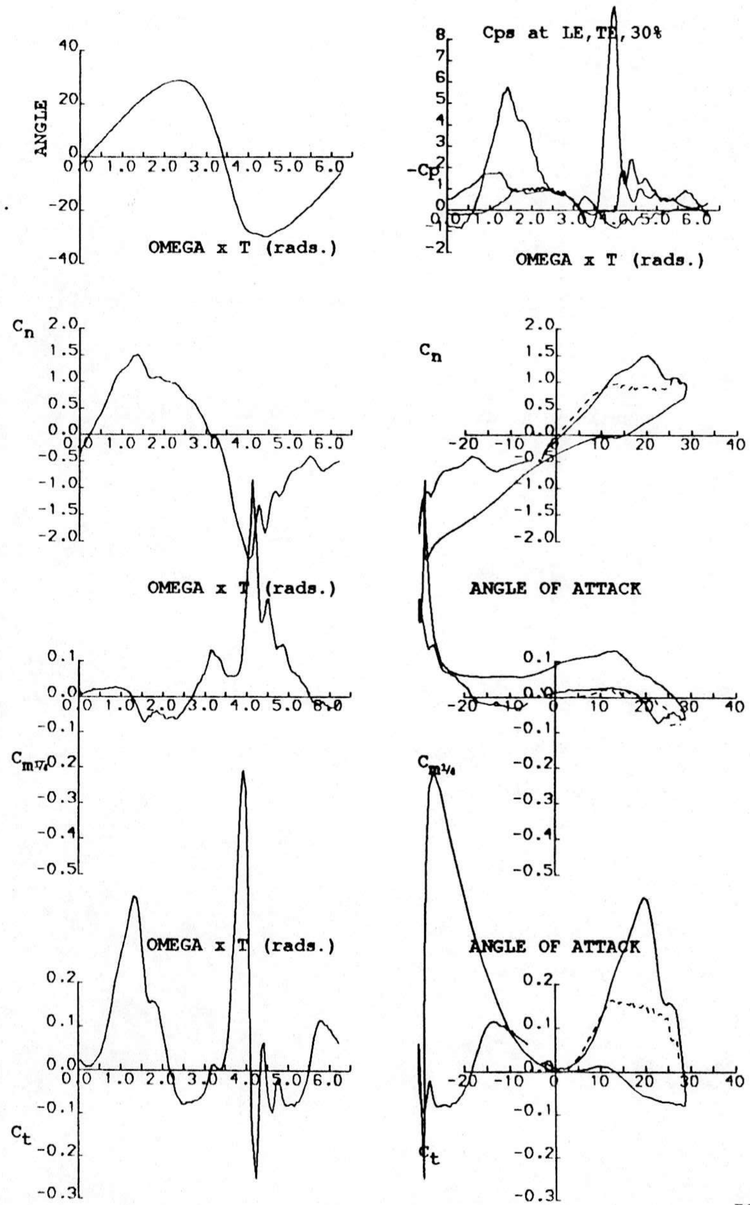
AIR TEMPERATURE = 24.4°C

SAMPLING FREQUENCY = 155.91 Hz.

REDUCED FREQUENCY = 0.046

AMPLITUDE = 32.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14661

REYNOLDS NUMBER = 1554665.

DYNAMIC PRESSURE = 1139.07 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

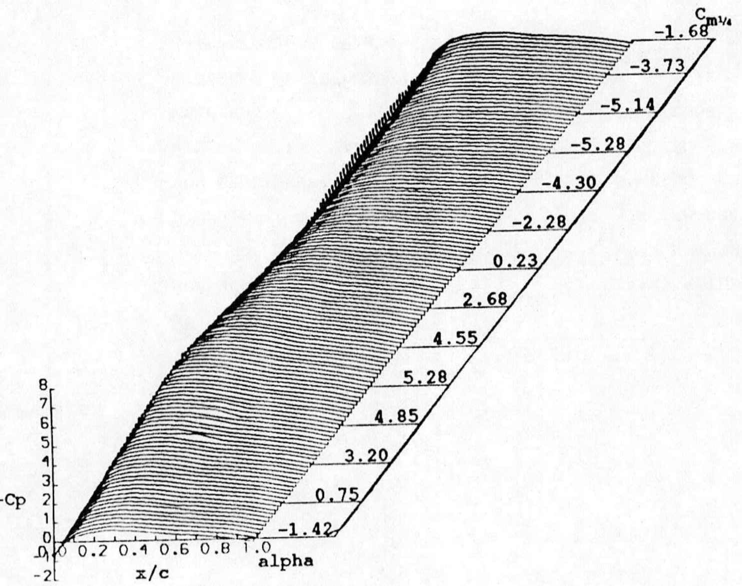
MACH NUMBER = 0.129

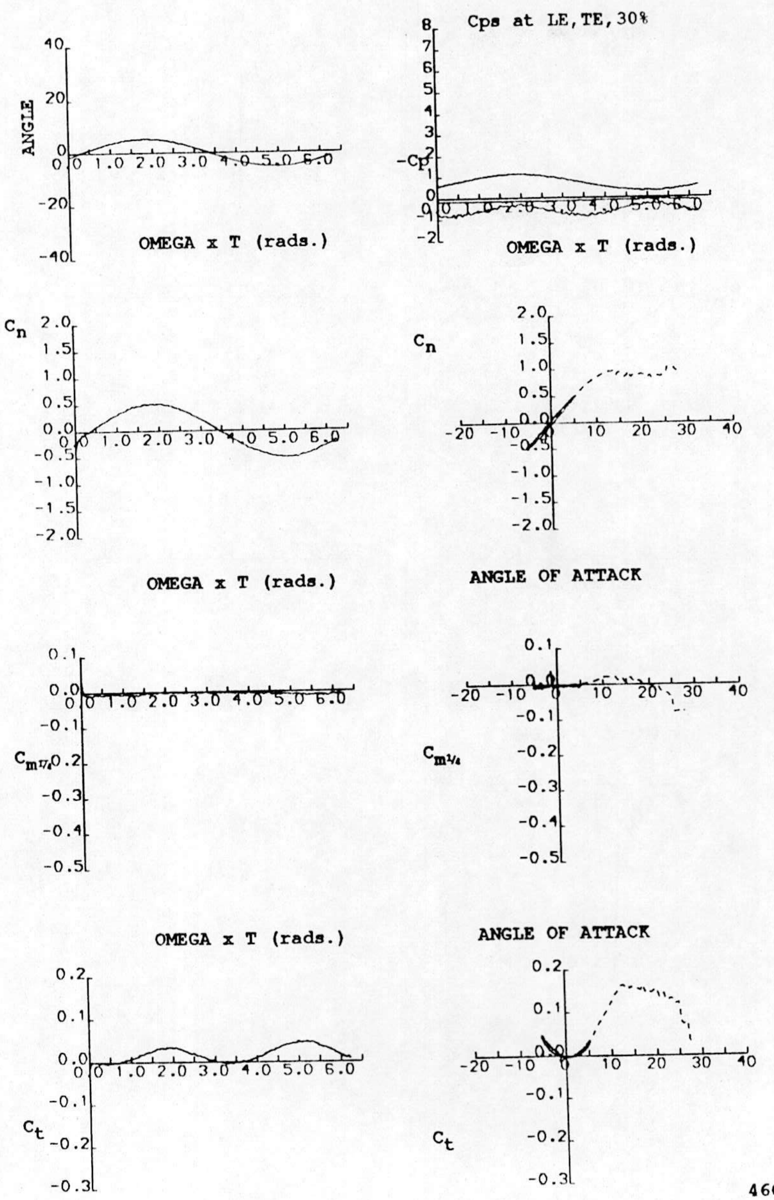
AIR TEMPERATURE = 25.6°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.057

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55331

REYNOLDS NUMBER = 1611746.

DYNAMIC PRESSURE = 1205.43 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

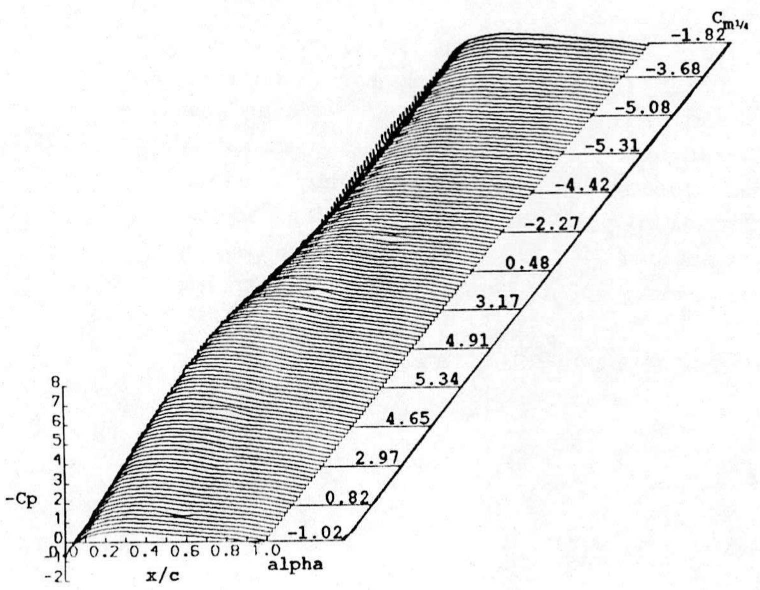
MACH NUMBER = 0.132

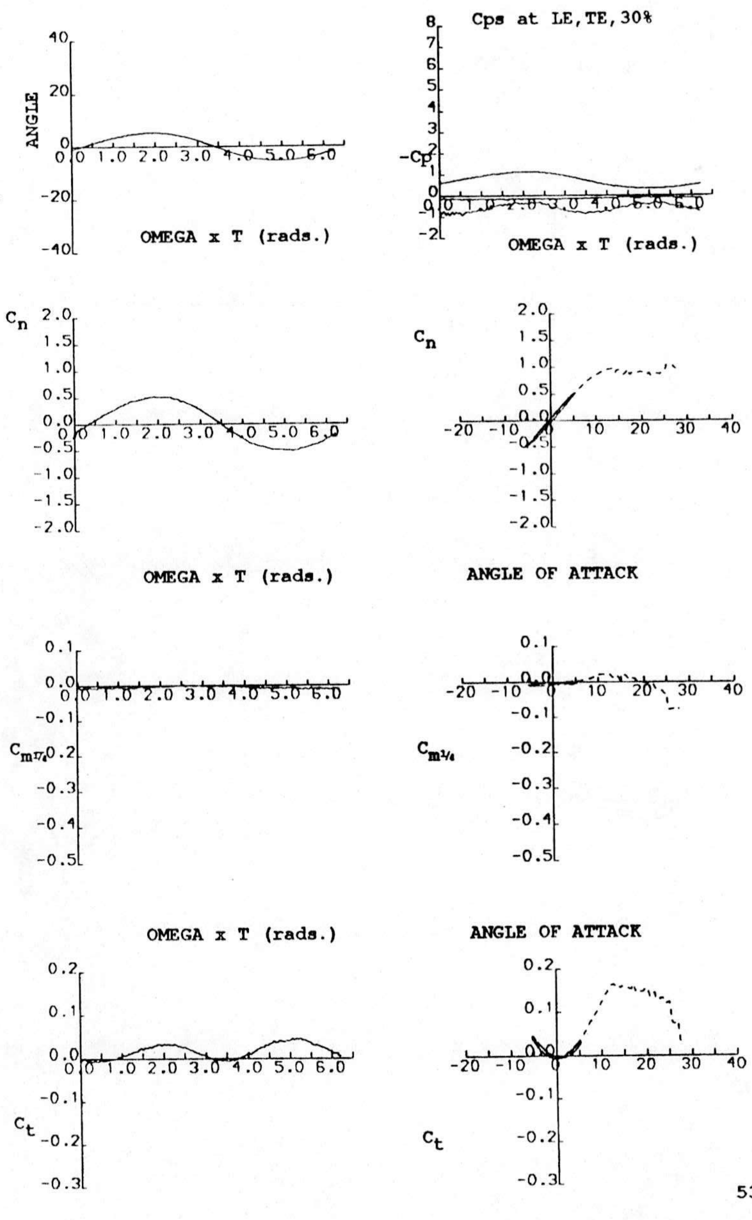
AIR TEMPERATURE = 23.8°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.055

AMPLITUDE = 5.40°

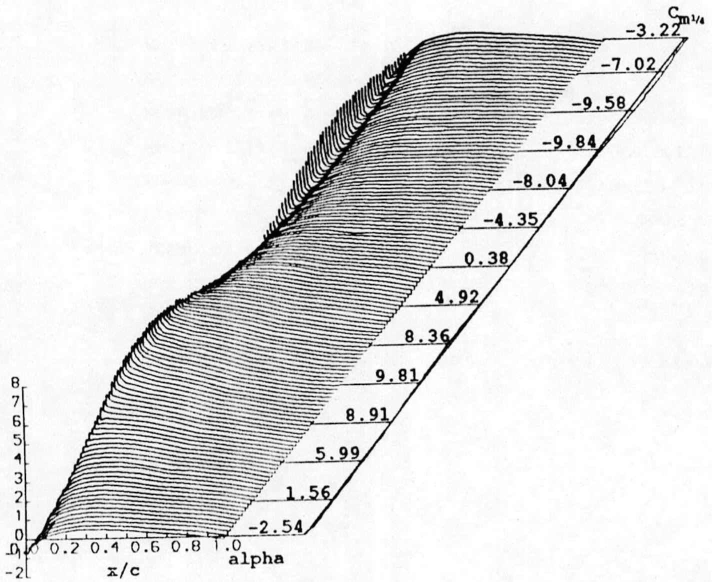


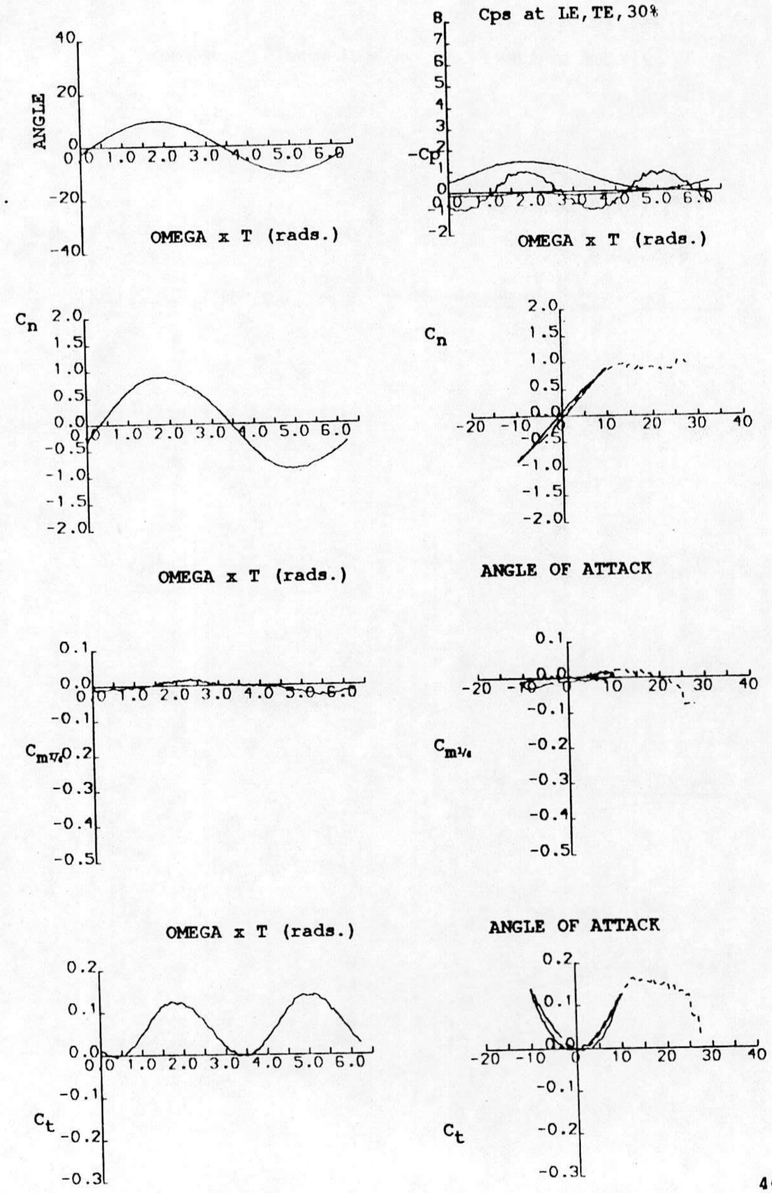


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14671
REYNOLDS NUMBER = 1552667.
DYNAMIC PRESSURE = 1139.07 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.462 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 25.9°C
SAMPLING FREQUENCY = 187.13 Hz.
REDUCED FREQUENCY = 0.057
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55341

REYNOLDS NUMBER = 1608273.

DYNAMIC PRESSURE = 1205.43 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

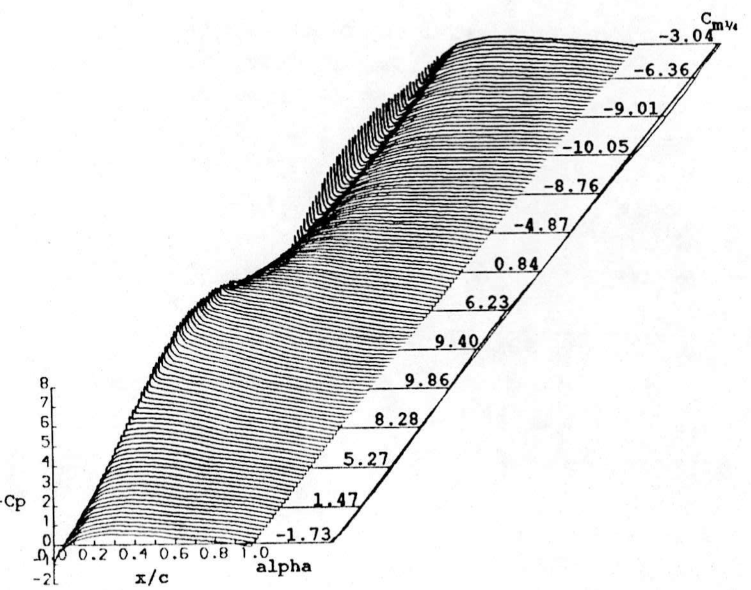
MACH NUMBER = 0.132

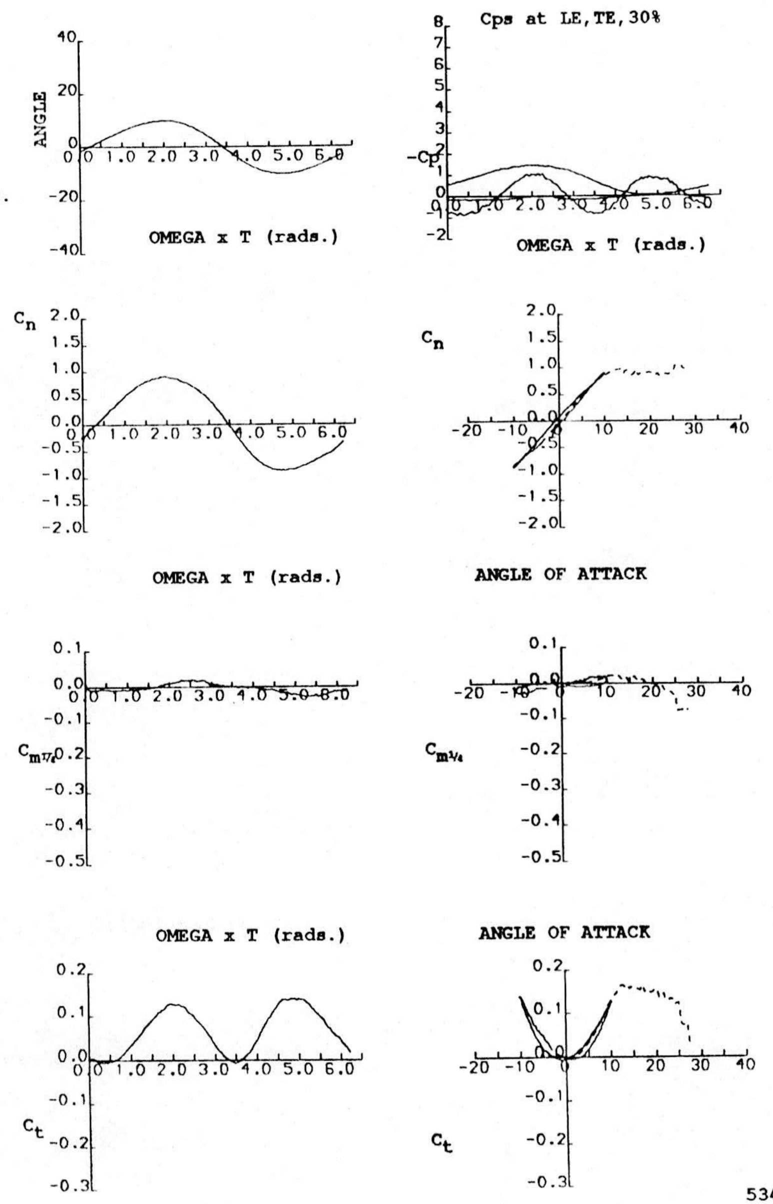
AIR TEMPERATURE = 24.3°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.055

AMPLITUDE = 10.00°

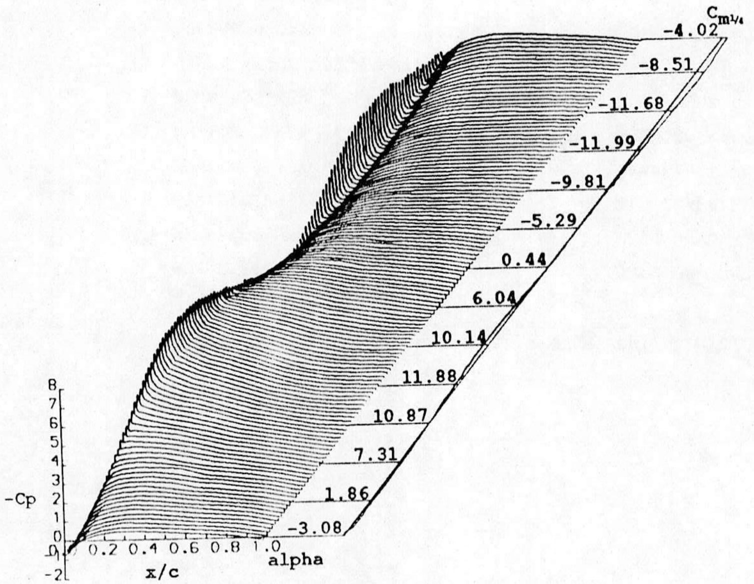


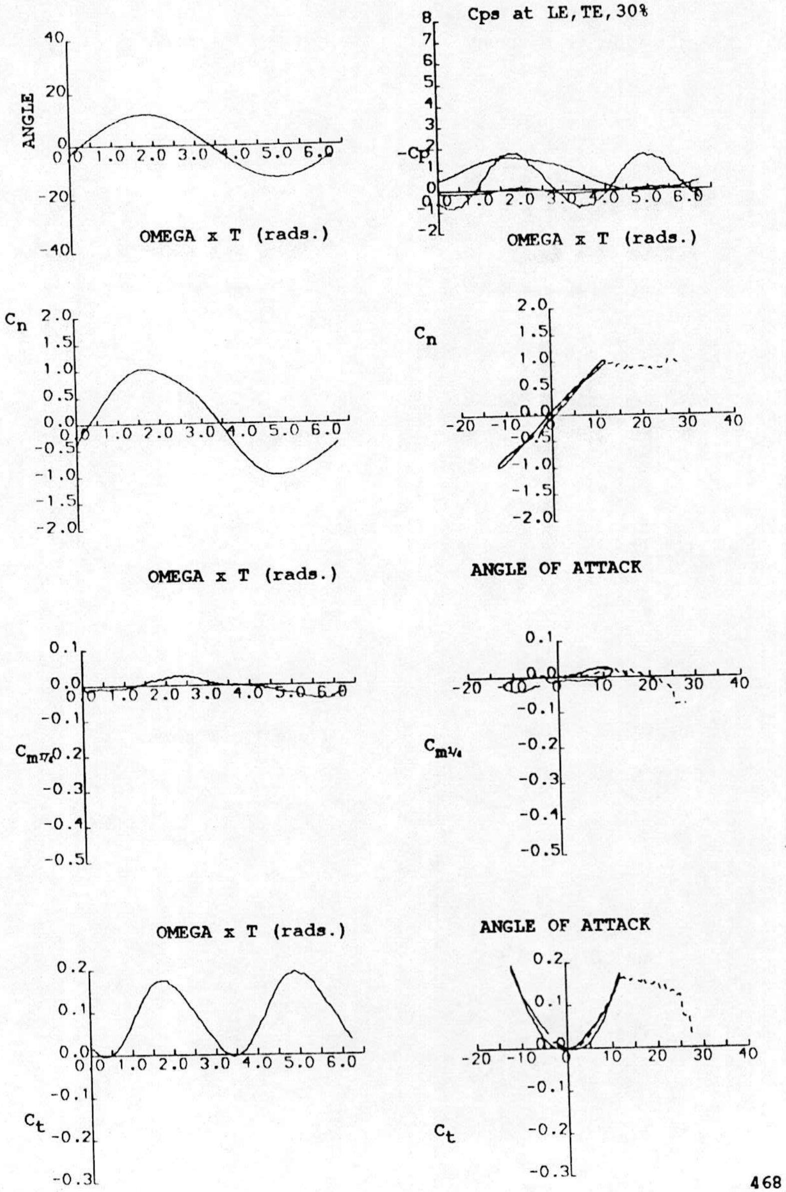


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14681
REYNOLDS NUMBER = 1551338.
DYNAMIC PRESSURE = 1139.07 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.462 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.129
AIR TEMPERATURE = 26.1°C
SAMPLING FREQUENCY = 187.13 Hz.
REDUCED FREQUENCY = 0.057
AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55351

REYNOLDS NUMBER = 1605504.

DYNAMIC PRESSURE = 1205.43 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

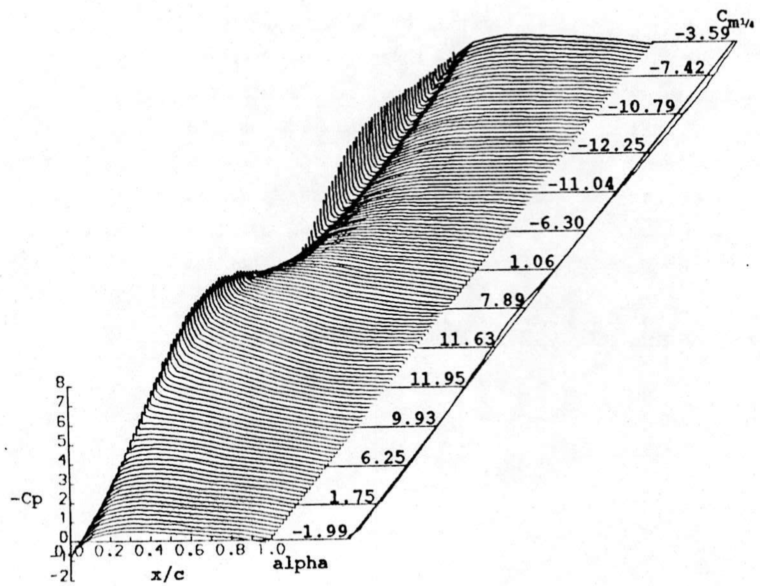
MACH NUMBER = 0.132

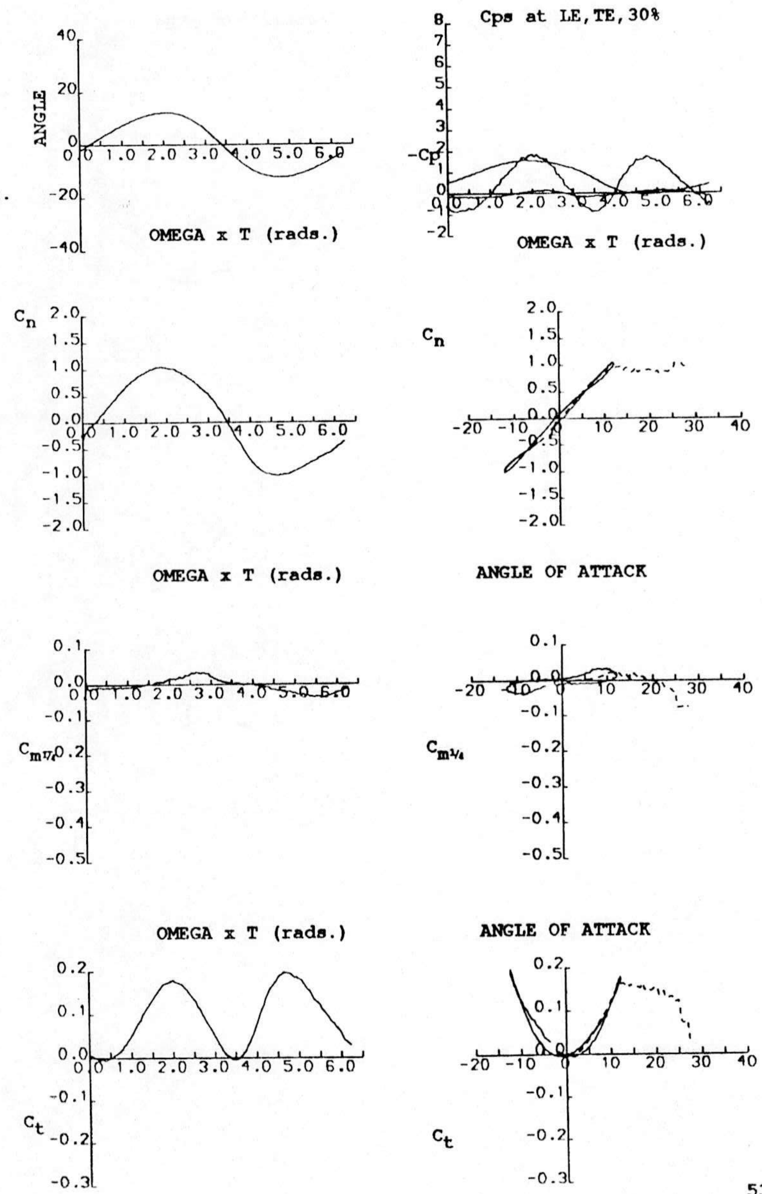
AIR TEMPERATURE = 24.7°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.055

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14691

REYNOLDS NUMBER = 1550011.

DYNAMIC PRESSURE = 1139.07 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

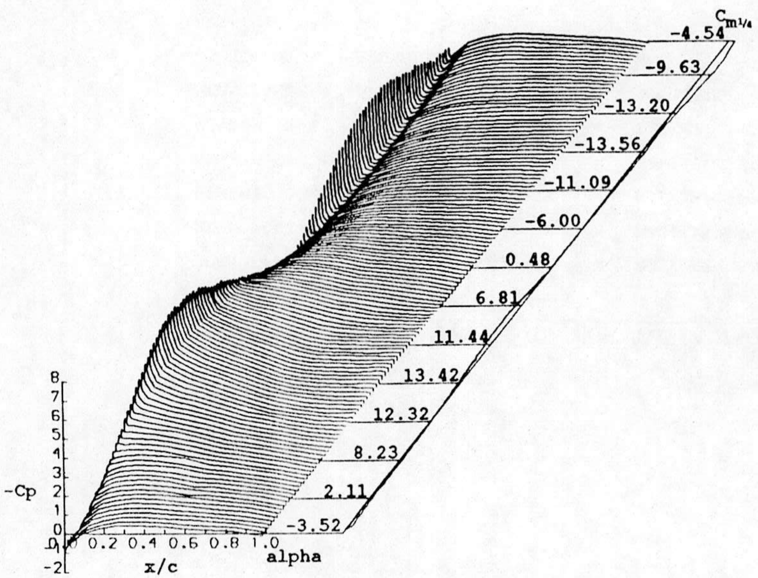
MACH NUMBER = 0.129

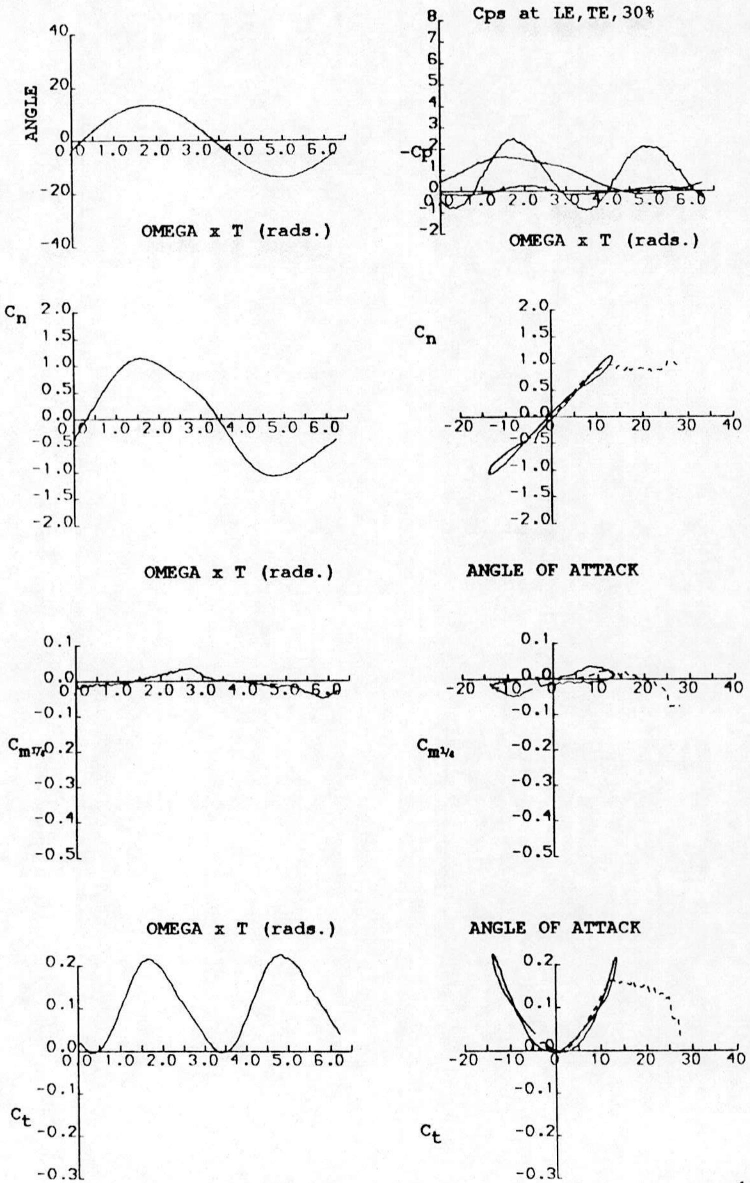
AIR TEMPERATURE = 26.3°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.057

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55361

REYNOLDS NUMBER = 1602744.

DYNAMIC PRESSURE = 1205.43 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

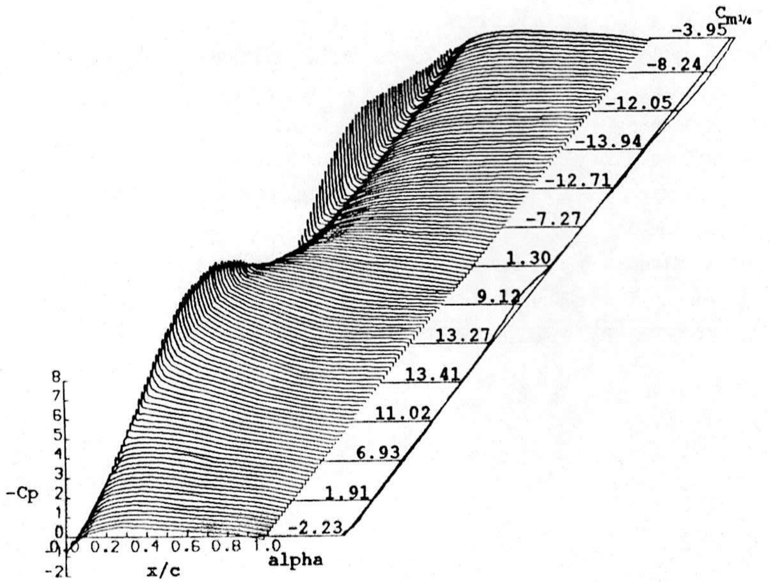
MACH NUMBER = 0.132

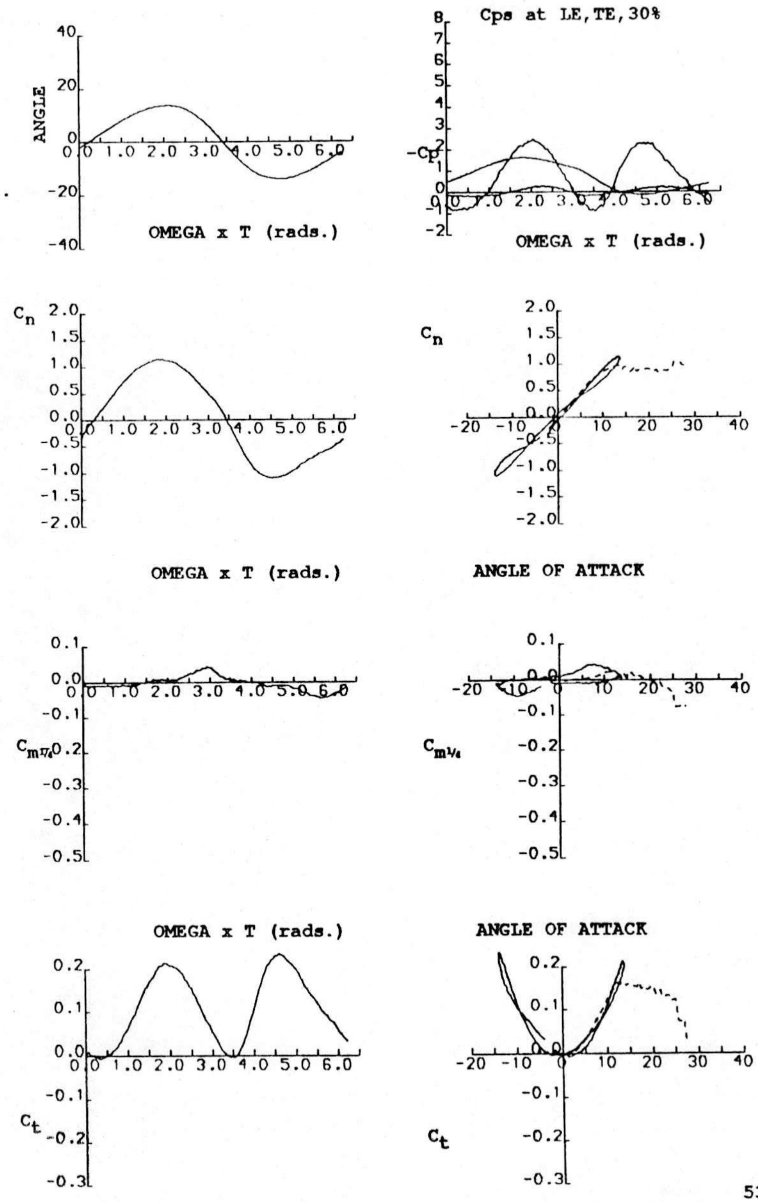
AIR TEMPERATURE = 25.1°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.055

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14701

REYNOLDS NUMBER = 1549348.

DYNAMIC PRESSURE = 1139.07 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

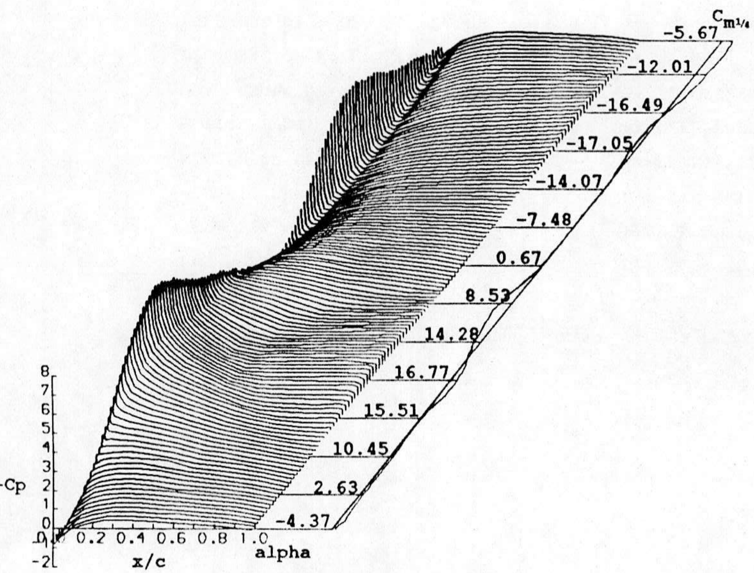
MACH NUMBER = 0.129

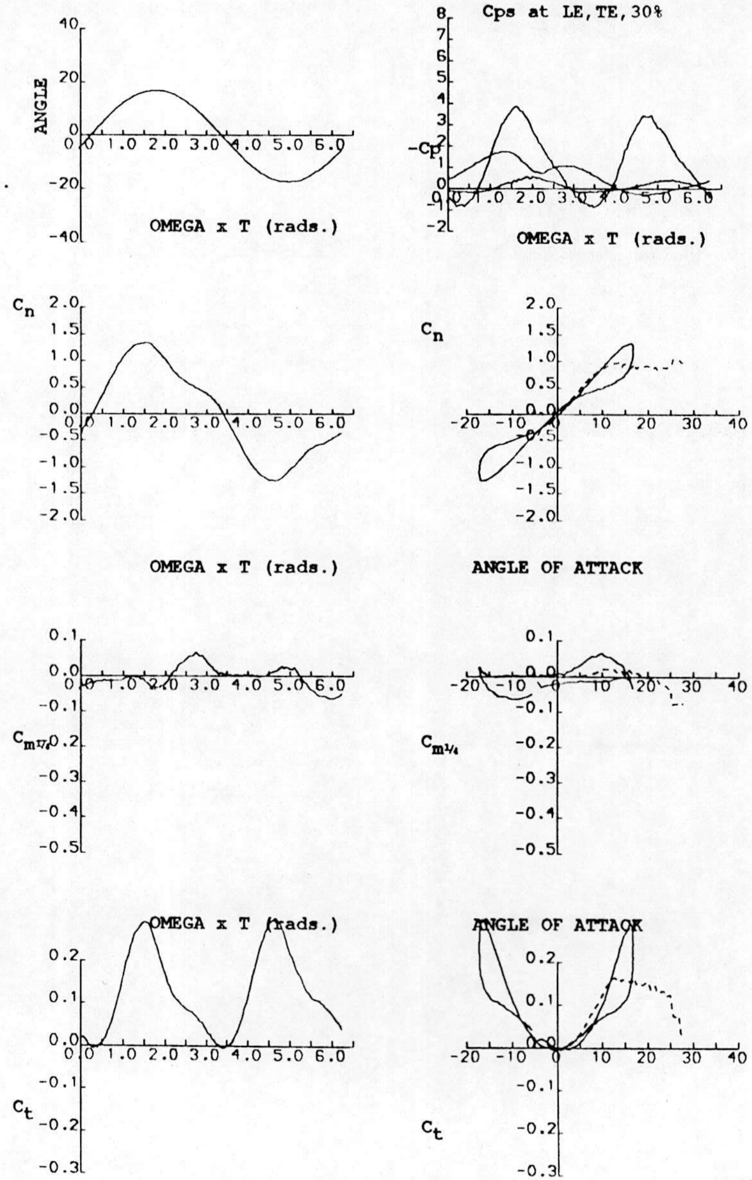
AIR TEMPERATURE = 26.4°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.057

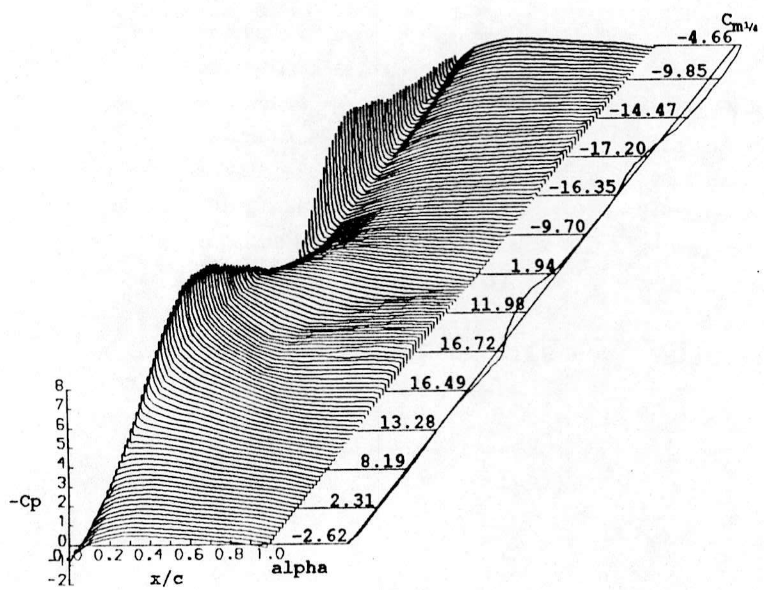
AMPLITUDE = 17.40°

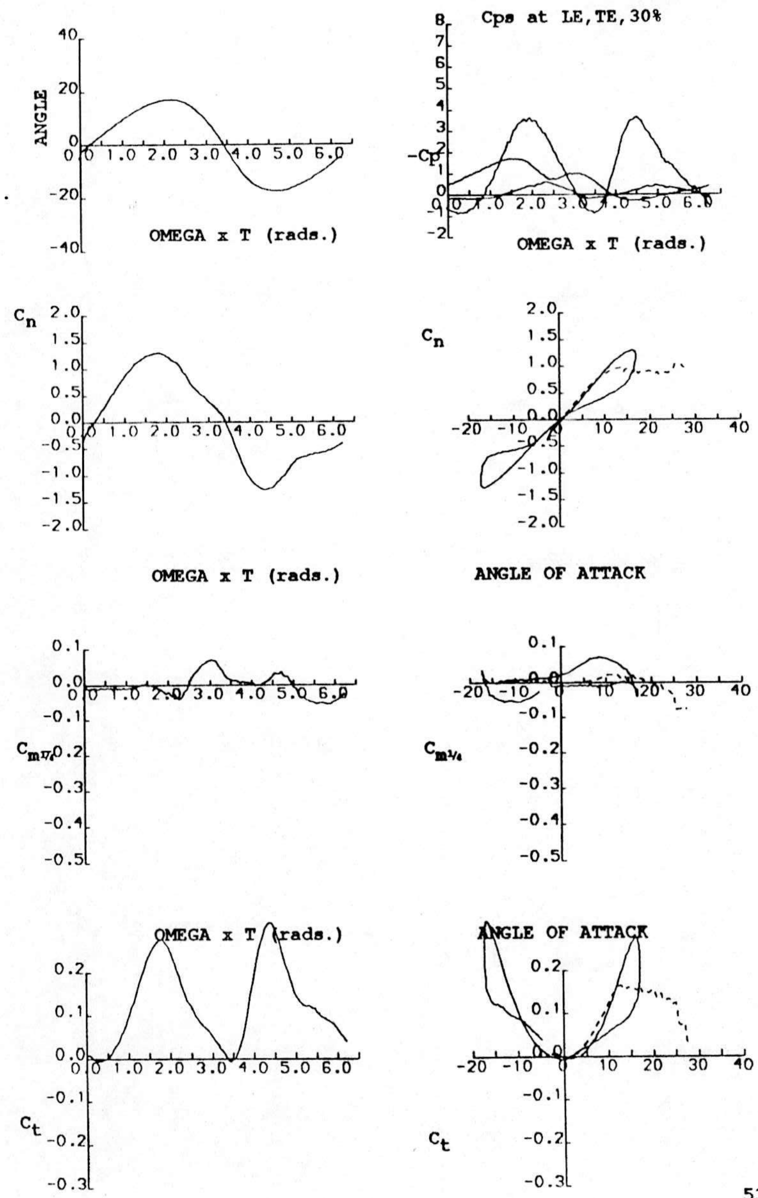




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55371	DATE OF TEST: 14/11/91
REYNOLDS NUMBER = 1599993.	MACH NUMBER = 0.132
DYNAMIC PRESSURE = 1205.43 Nm^{-2}	AIR TEMPERATURE = 25.5°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 187.13 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.055
MEAN ANGLE = 0.00°	AMPLITUDE = 17.40°
OSCILLATION FREQUENCY = 1.462 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14711

REYNOLDS NUMBER = 1548024.

DYNAMIC PRESSURE = 1139.07 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

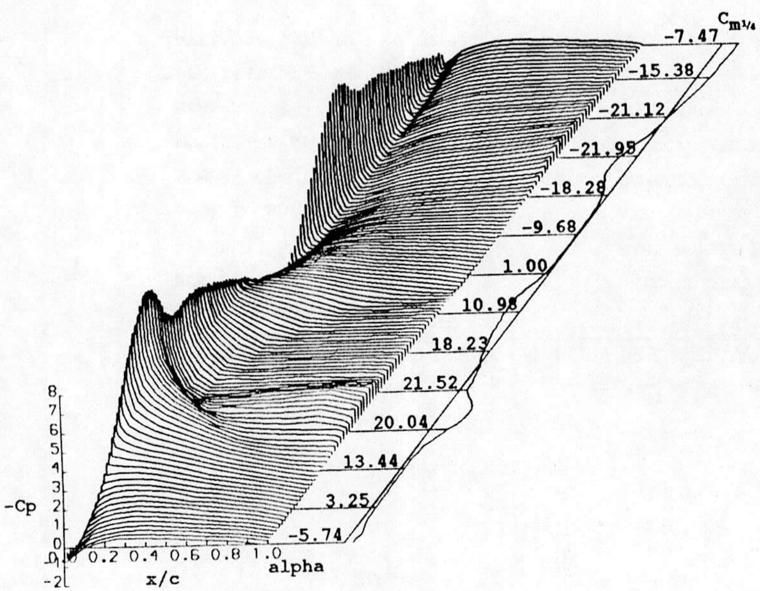
MACH NUMBER = 0.129

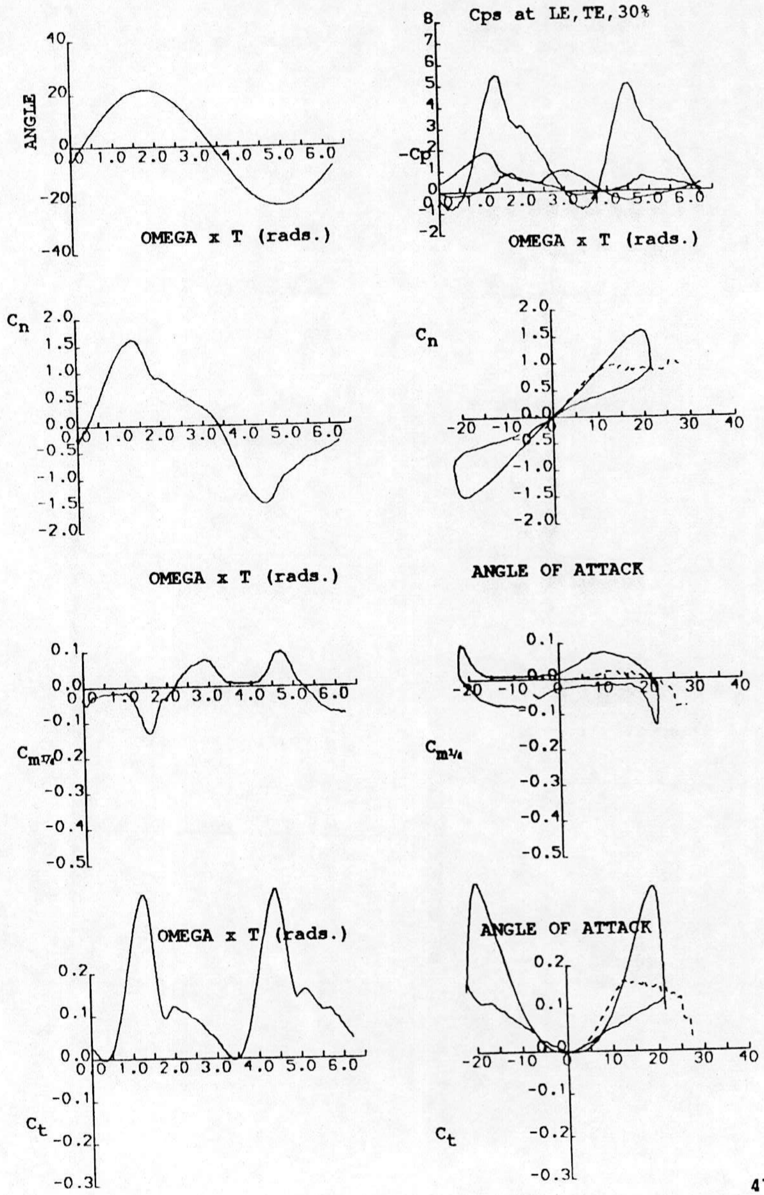
AIR TEMPERATURE = 26.6°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.057

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55381

REYNOLDS NUMBER = 1597936.

DYNAMIC PRESSURE = 1205.43 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

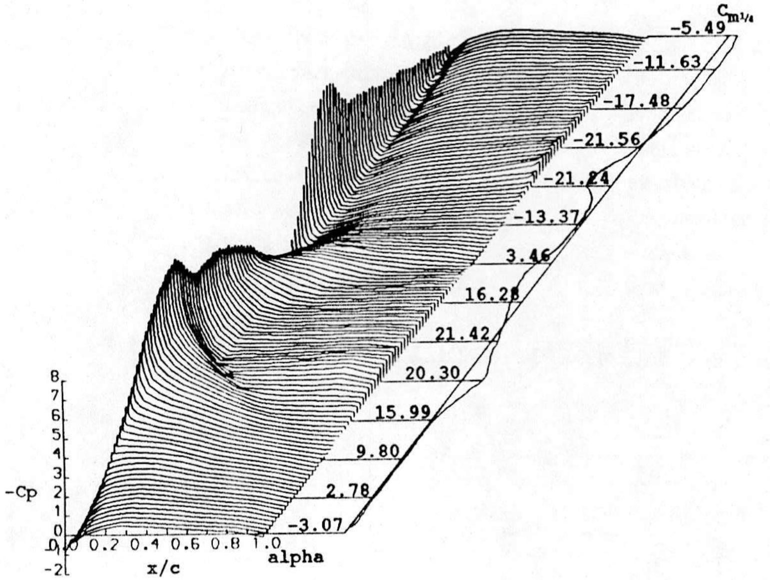
MACH NUMBER = 0.132

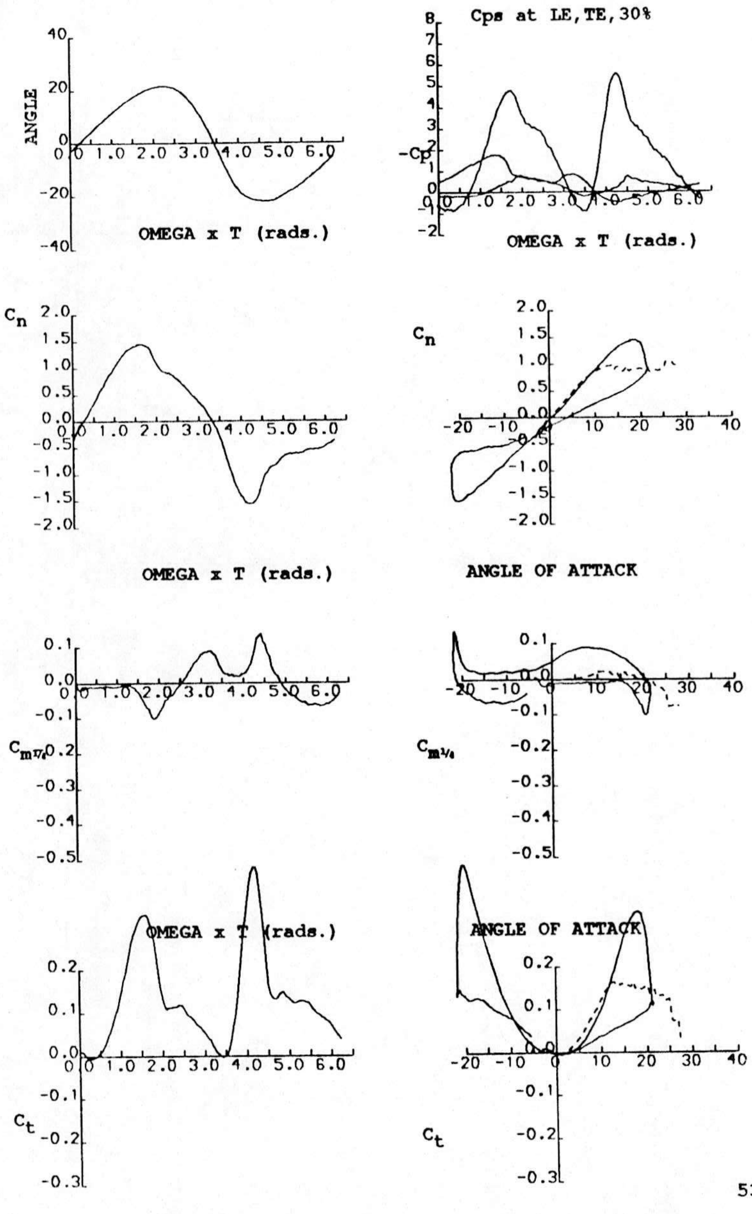
AIR TEMPERATURE = 25.8°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.055

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14721

REYNOLDS NUMBER = 1546702.

DYNAMIC PRESSURE = 1139.07 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

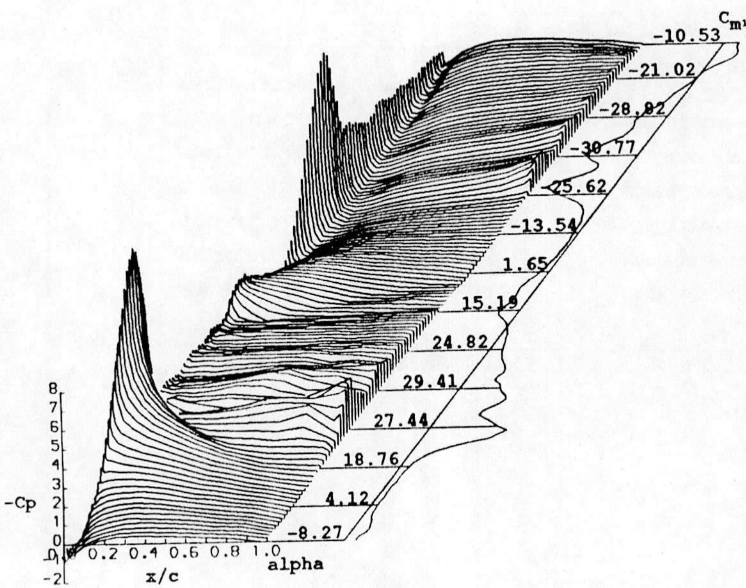
MACH NUMBER = 0.129

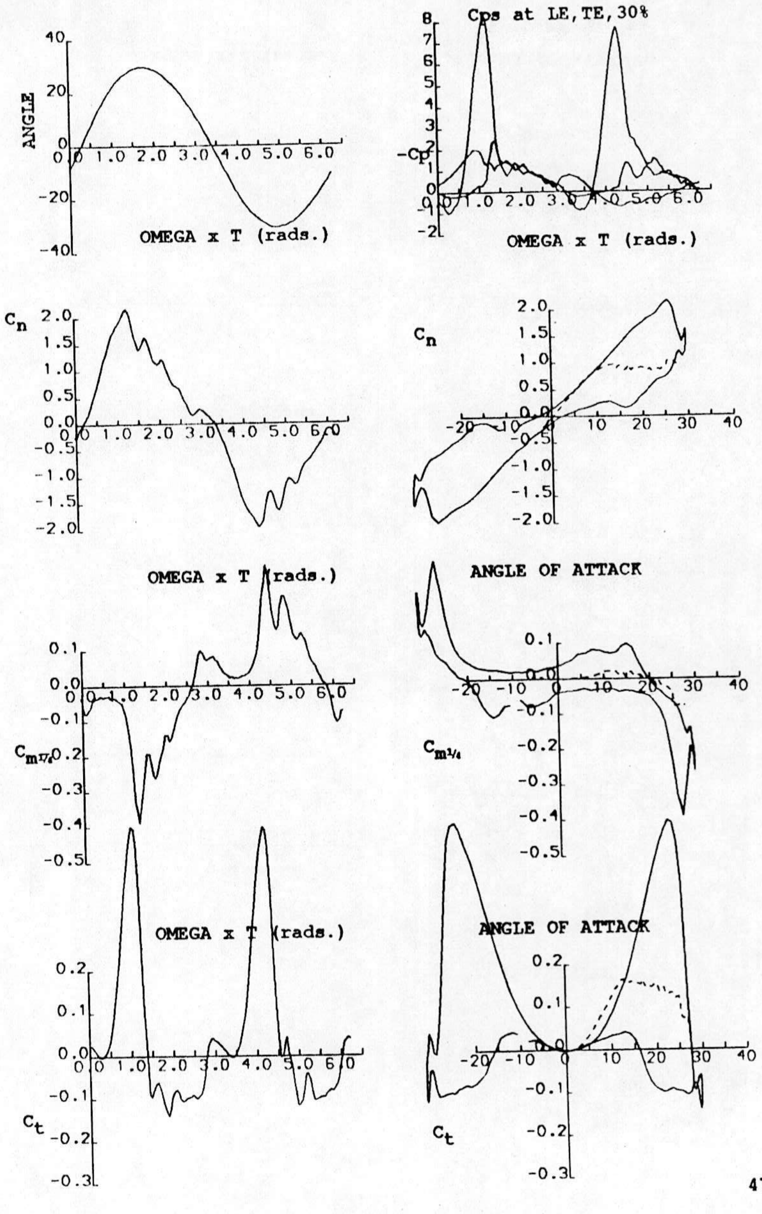
AIR TEMPERATURE = 26.8°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.057

AMPLITUDE = 32.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55391

REYNOLDS NUMBER = 1596568.

DYNAMIC PRESSURE = 1205.43 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.462 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

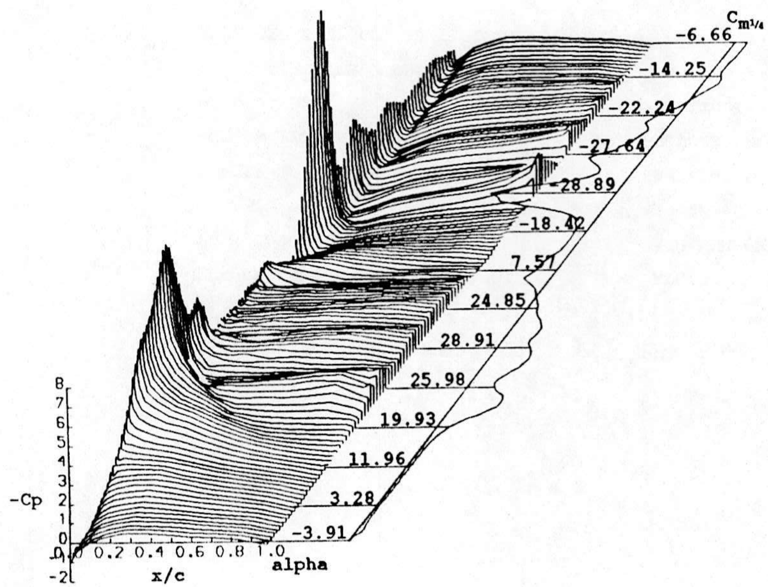
MACH NUMBER = 0.132

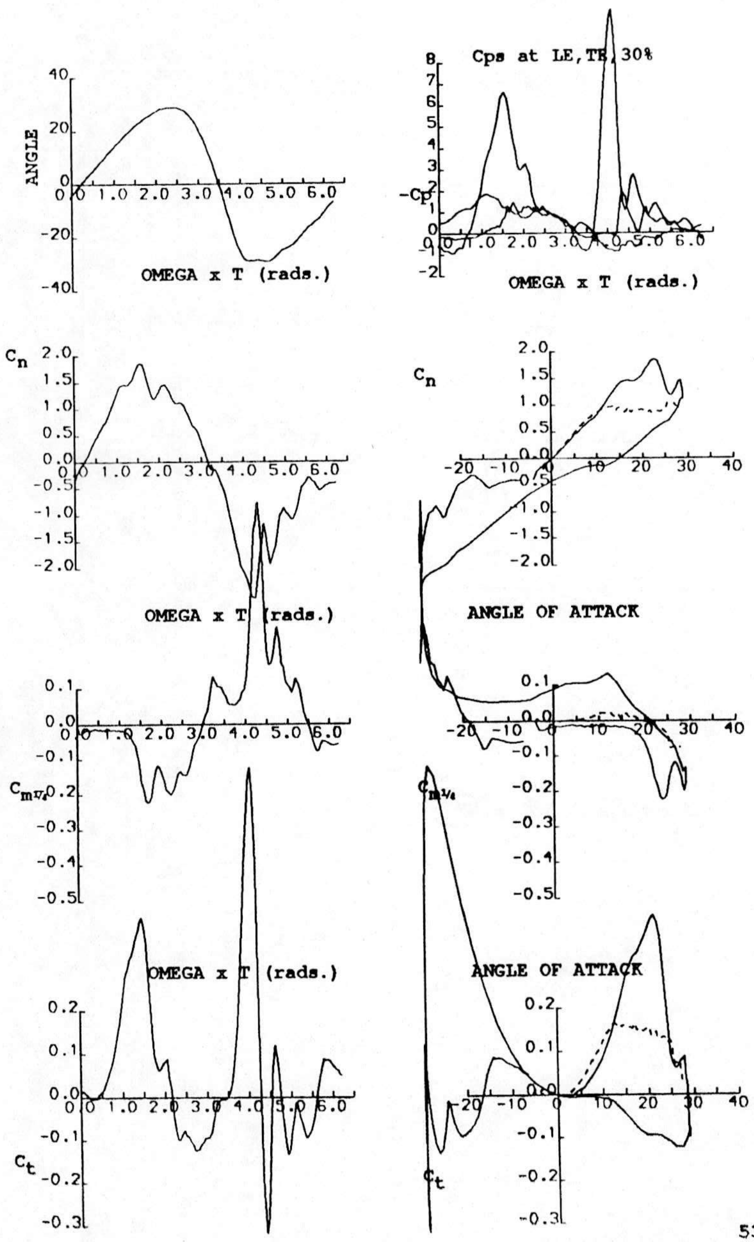
AIR TEMPERATURE = 26.0°C

SAMPLING FREQUENCY = 187.13 Hz.

REDUCED FREQUENCY = 0.055

AMPLITUDE = 32.00°

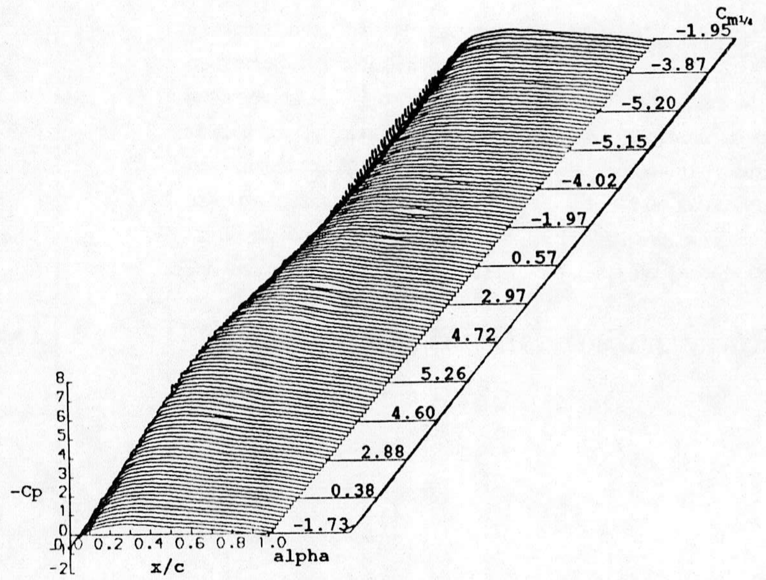


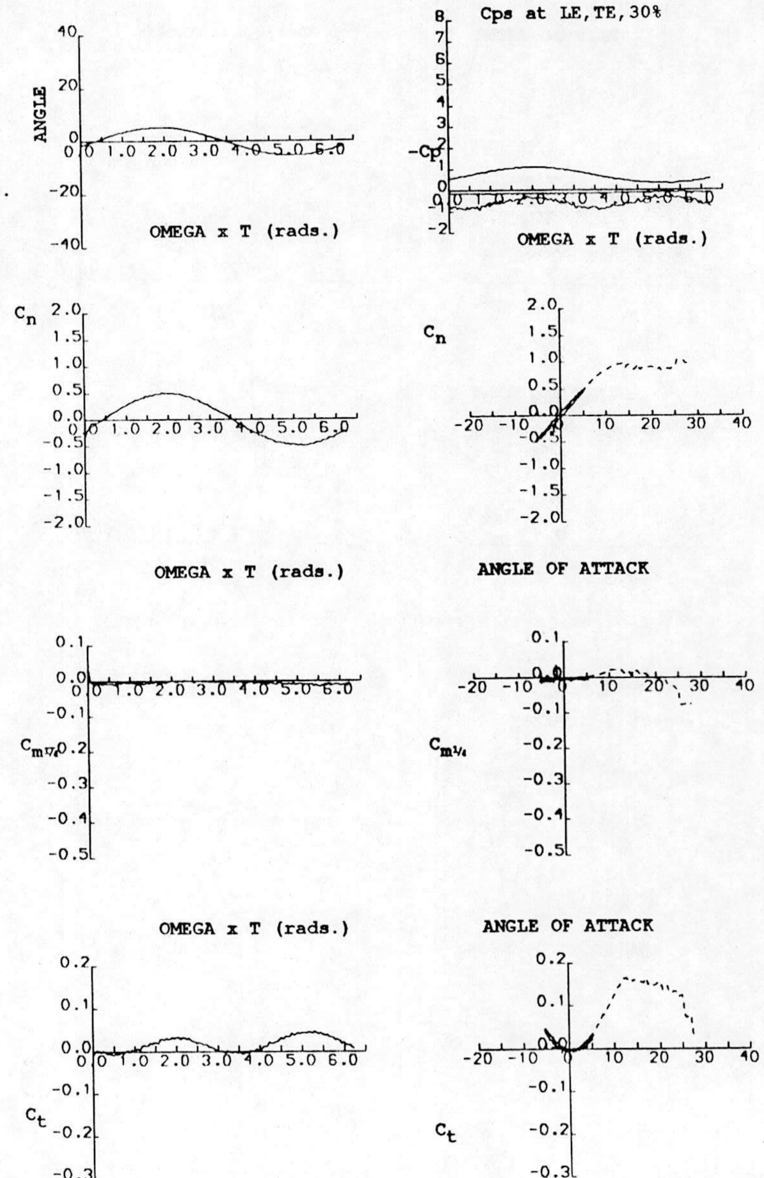


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14731
REYNOLDS NUMBER = 1547059.
DYNAMIC PRESSURE = 1131.83 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.128
AIR TEMPERATURE = 26.0°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.071
AMPLITUDE = 5.40°

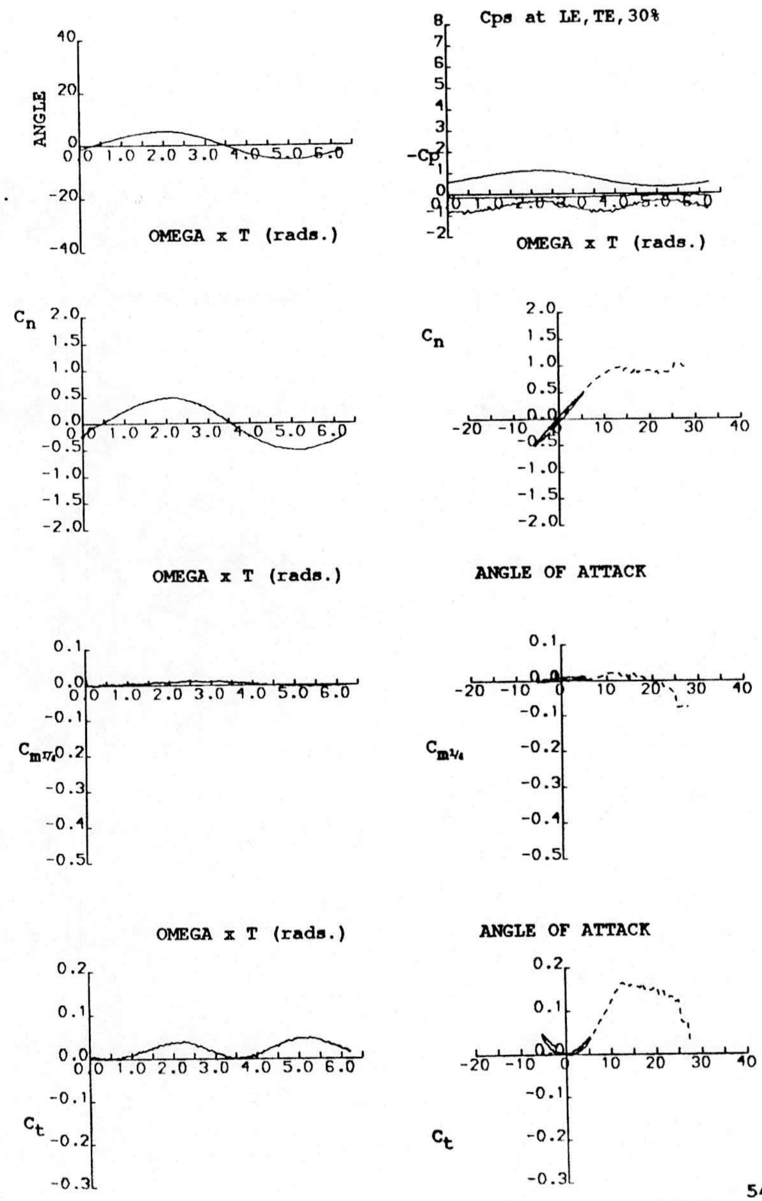


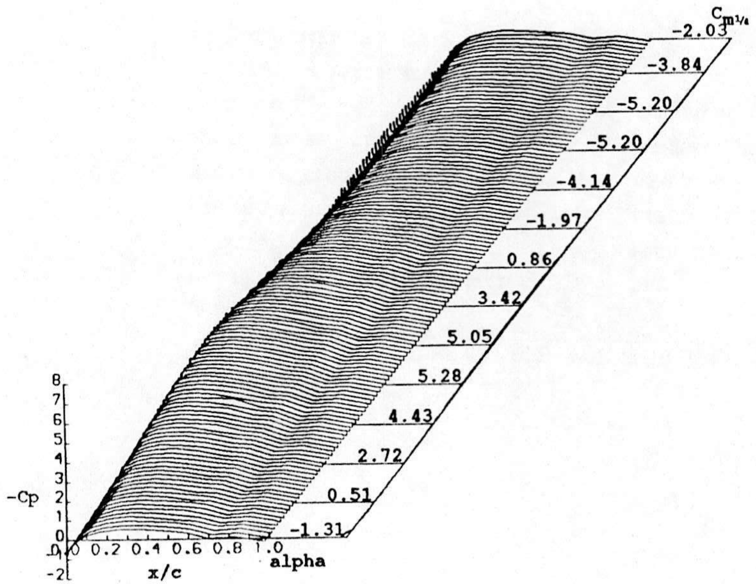


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55401
REYNOLDS NUMBER = 1609922.
DYNAMIC PRESSURE = 1207.90 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.132
AIR TEMPERATURE = 24.3°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.069
AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14741

REYNOLDS NUMBER = 1545074.

DYNAMIC PRESSURE = 1131.83 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

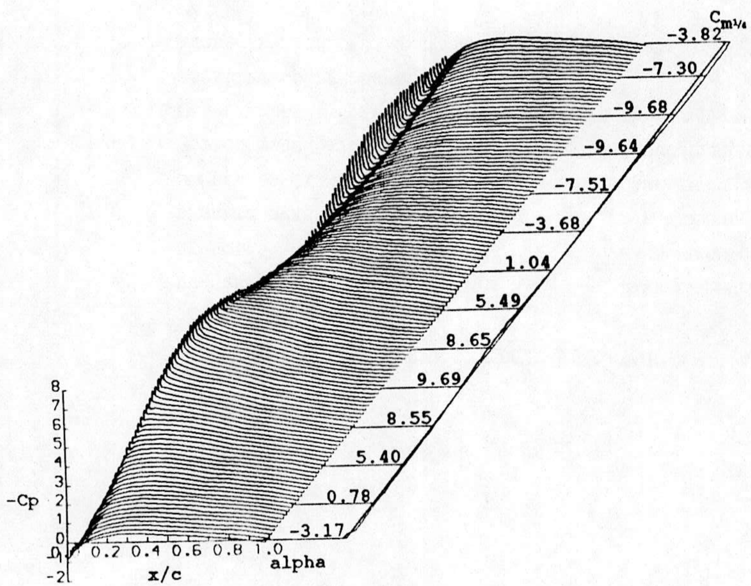
MACH NUMBER = 0.128

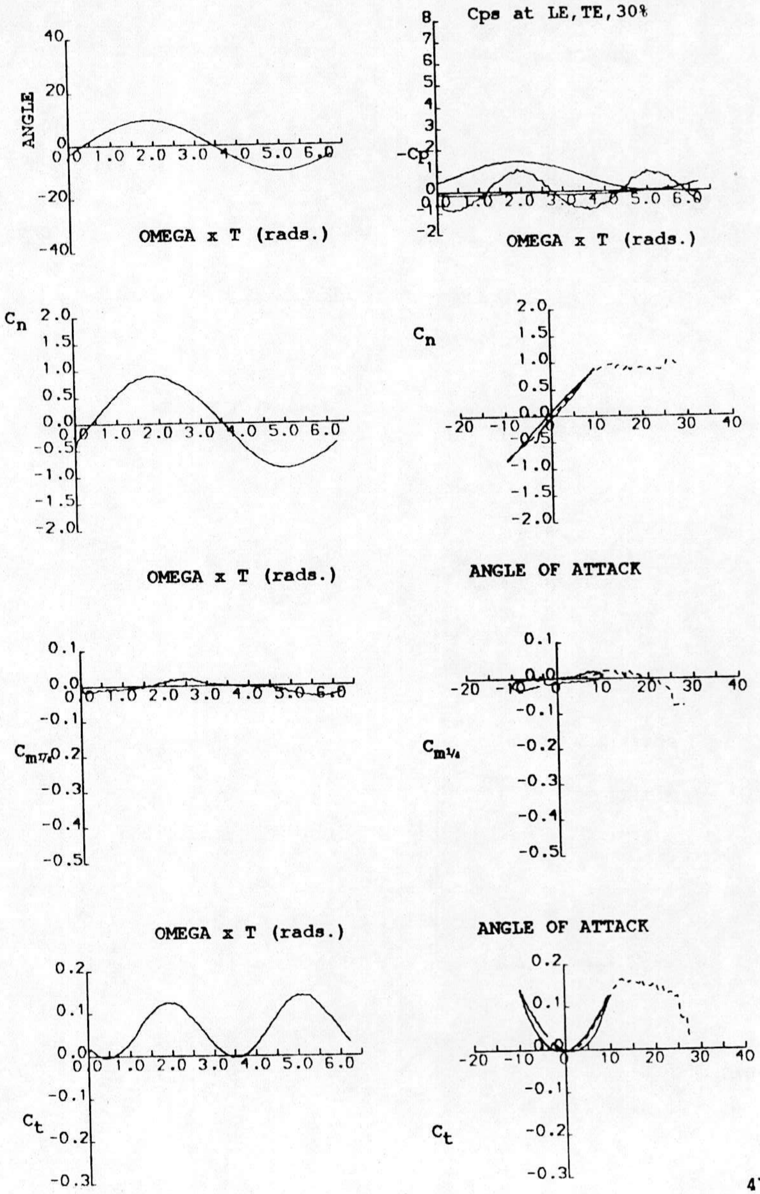
AIR TEMPERATURE = 26.3°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.071

AMPLITUDE = 10.00°

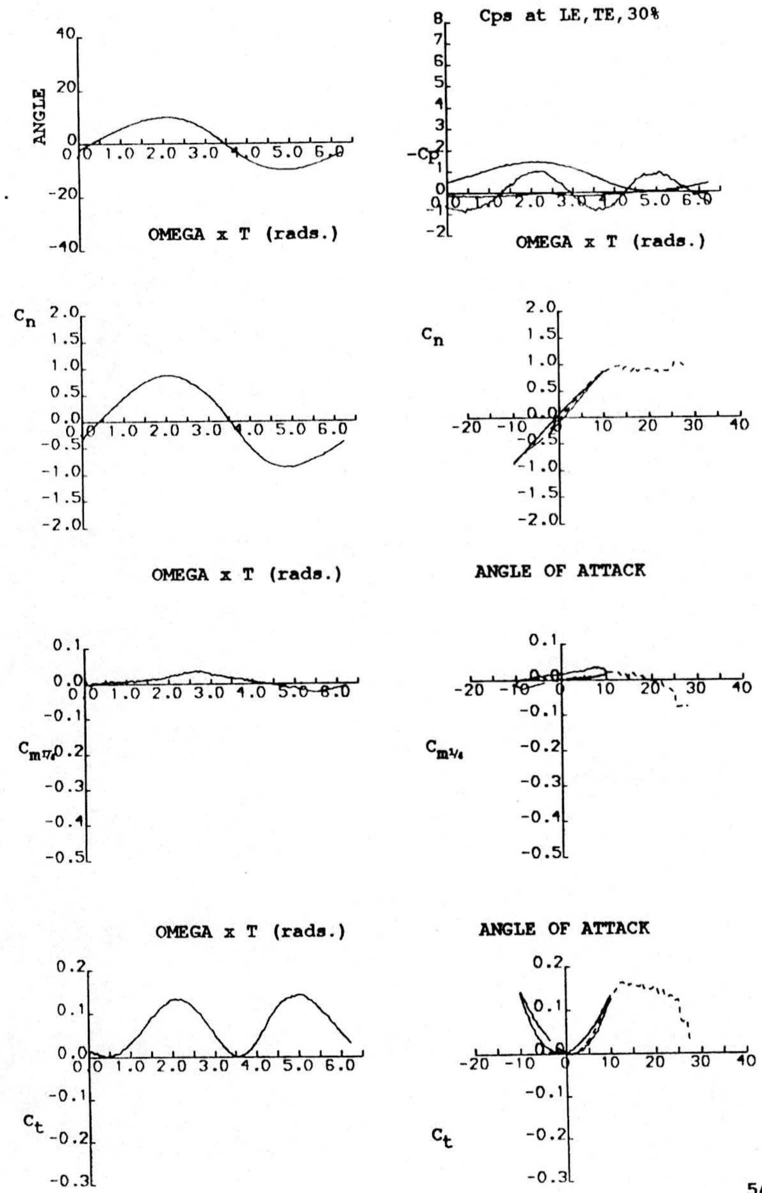


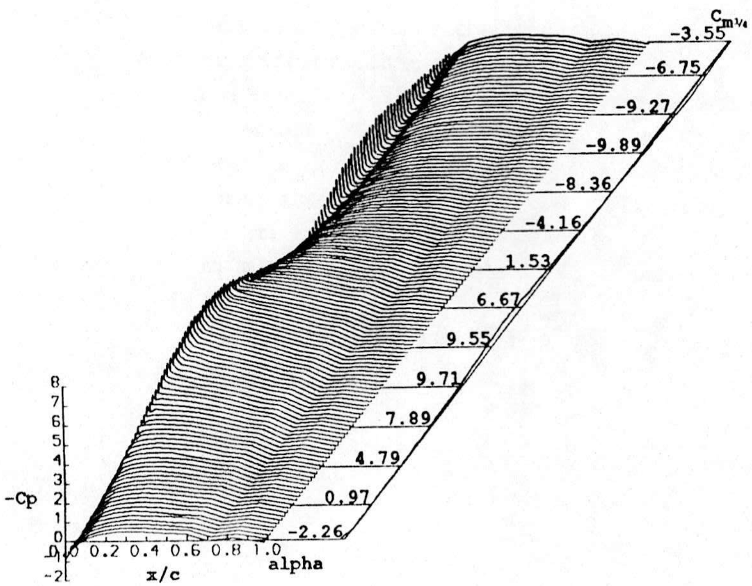


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55411
REYNOLDS NUMBER = 1606459.
DYNAMIC PRESSURE = 1207.90 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.132
AIR TEMPERATURE = 24.8°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.069
AMPLITUDE = 10.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14751

REYNOLDS NUMBER = 1543753.

DYNAMIC PRESSURE = 1131.83 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

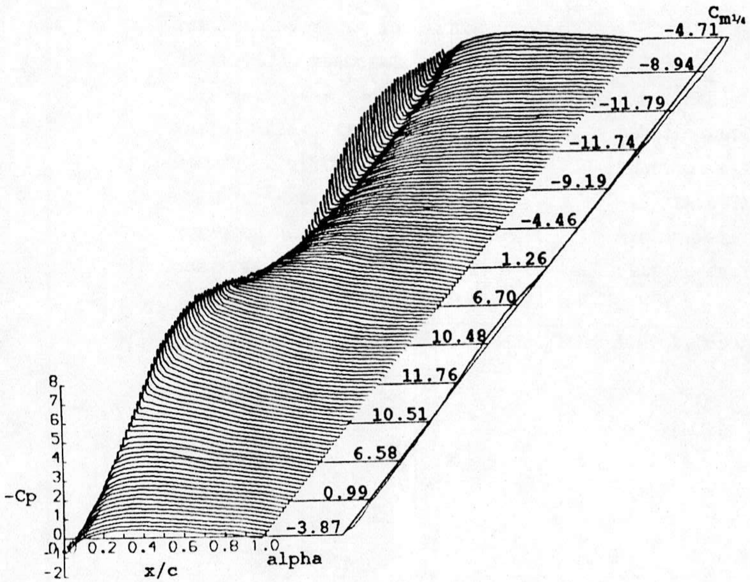
MACH NUMBER = 0.128

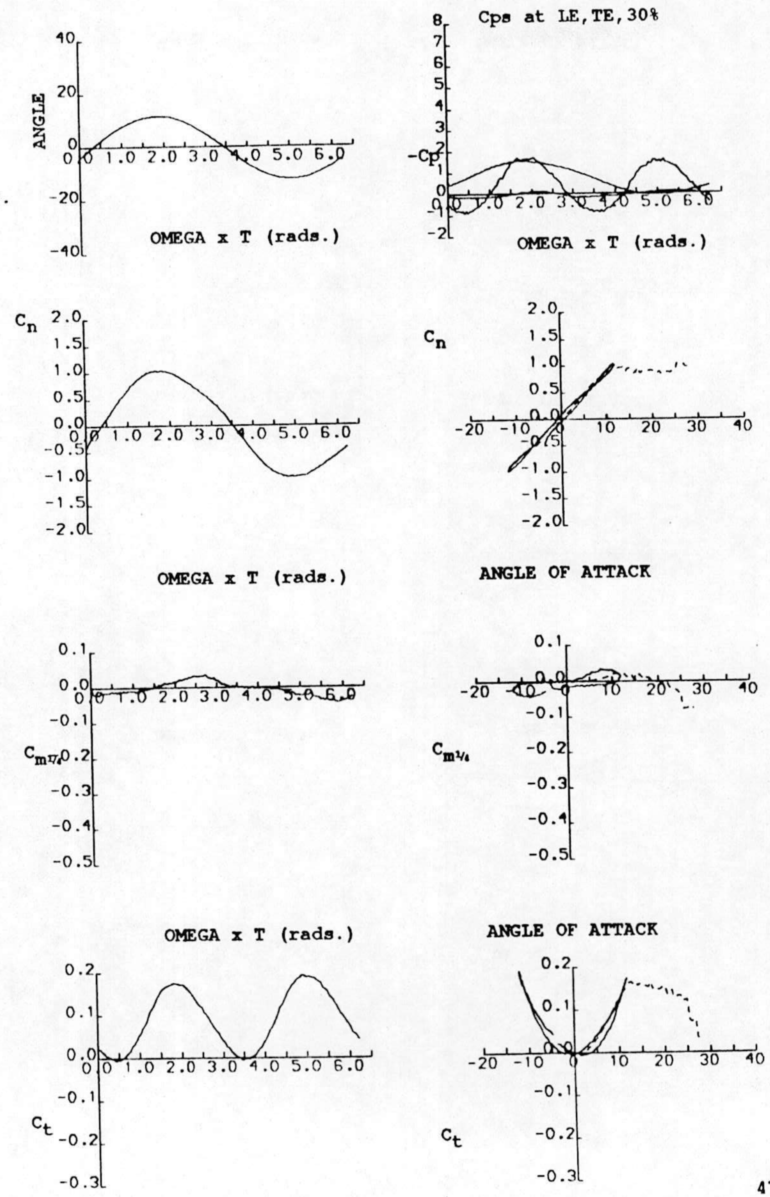
AIR TEMPERATURE = 26.5°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.071

AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55421

REYNOLDS NUMBER = 1604387.

DYNAMIC PRESSURE = 1207.90 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

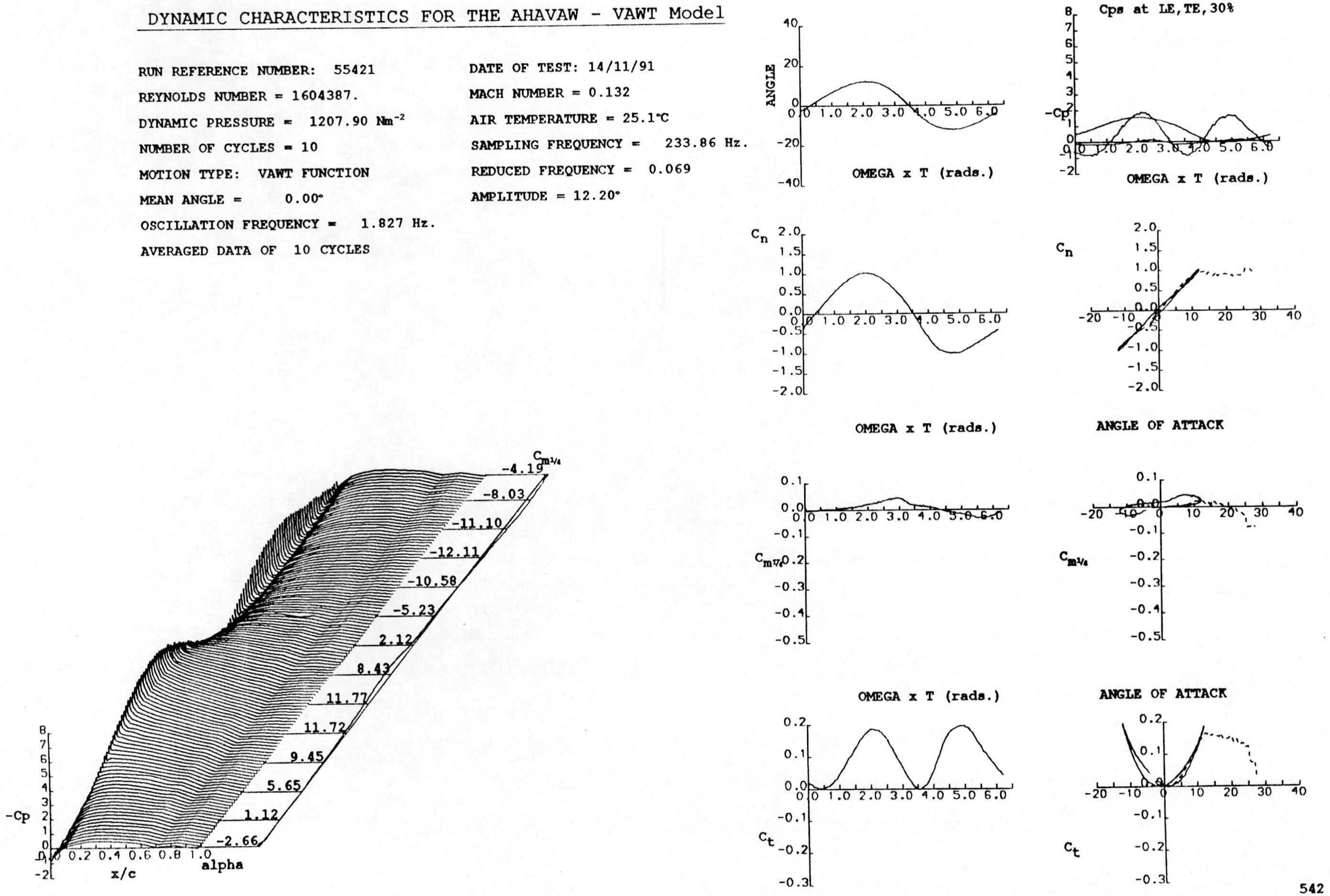
MACH NUMBER = 0.132

AIR TEMPERATURE = 25.1°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.069

AMPLITUDE = 12.20°



DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14761

REYNOLDS NUMBER = 1542434.

DYNAMIC PRESSURE = 1131.83 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

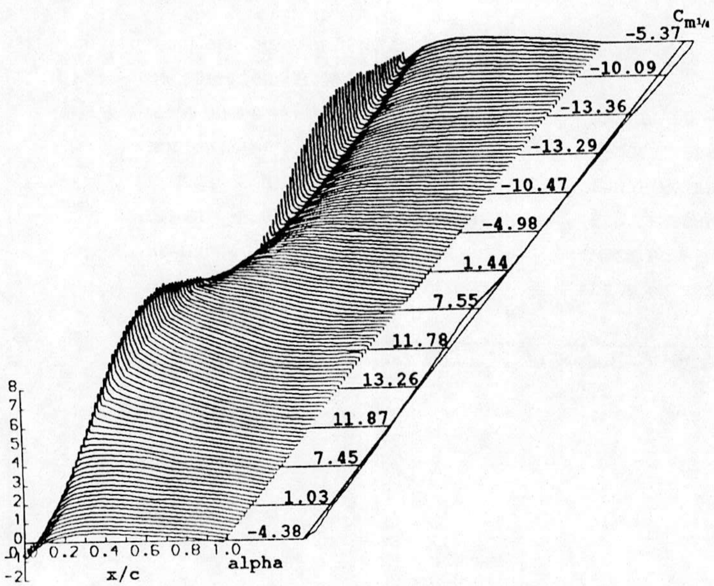
MACH NUMBER = 0.128

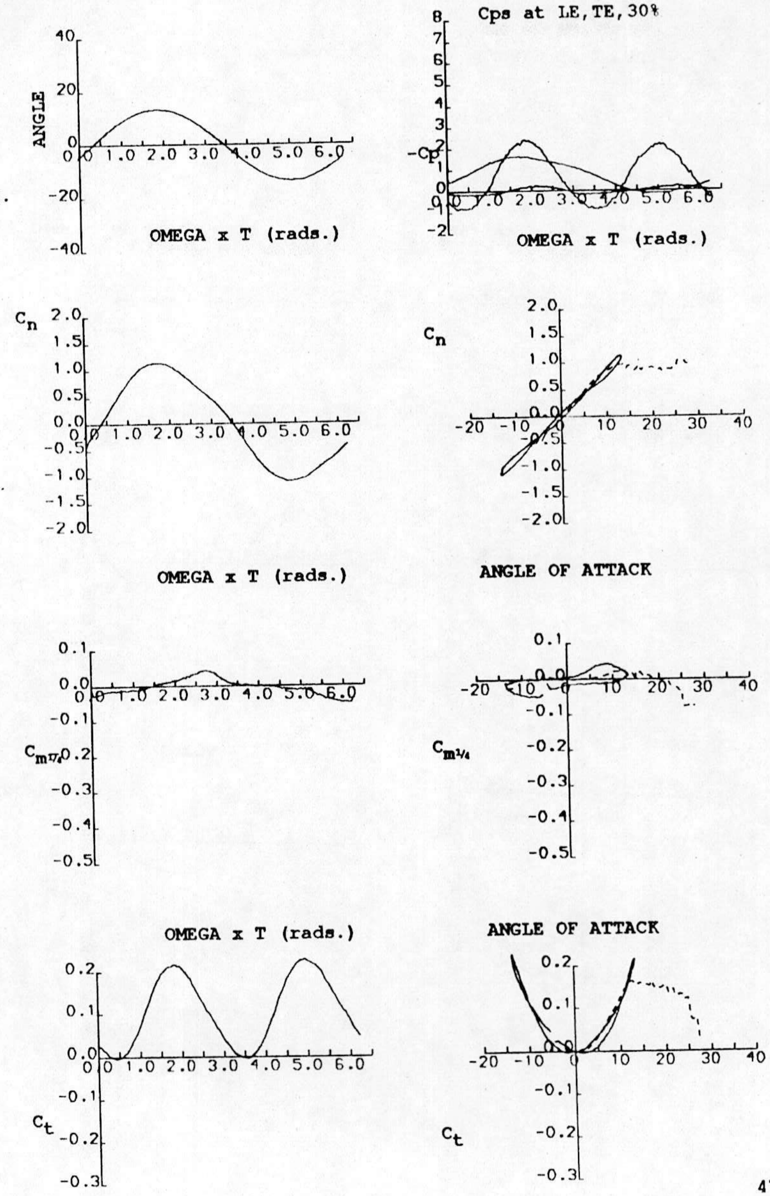
AIR TEMPERATURE = 26.7°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.071

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55431

REYNOLDS NUMBER = 1602322.

DYNAMIC PRESSURE = 1207.90 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

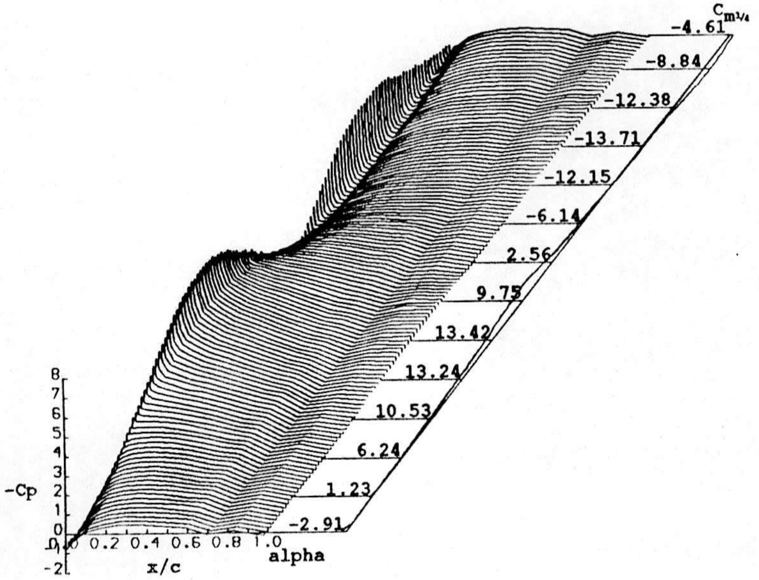
MACH NUMBER = 0.132

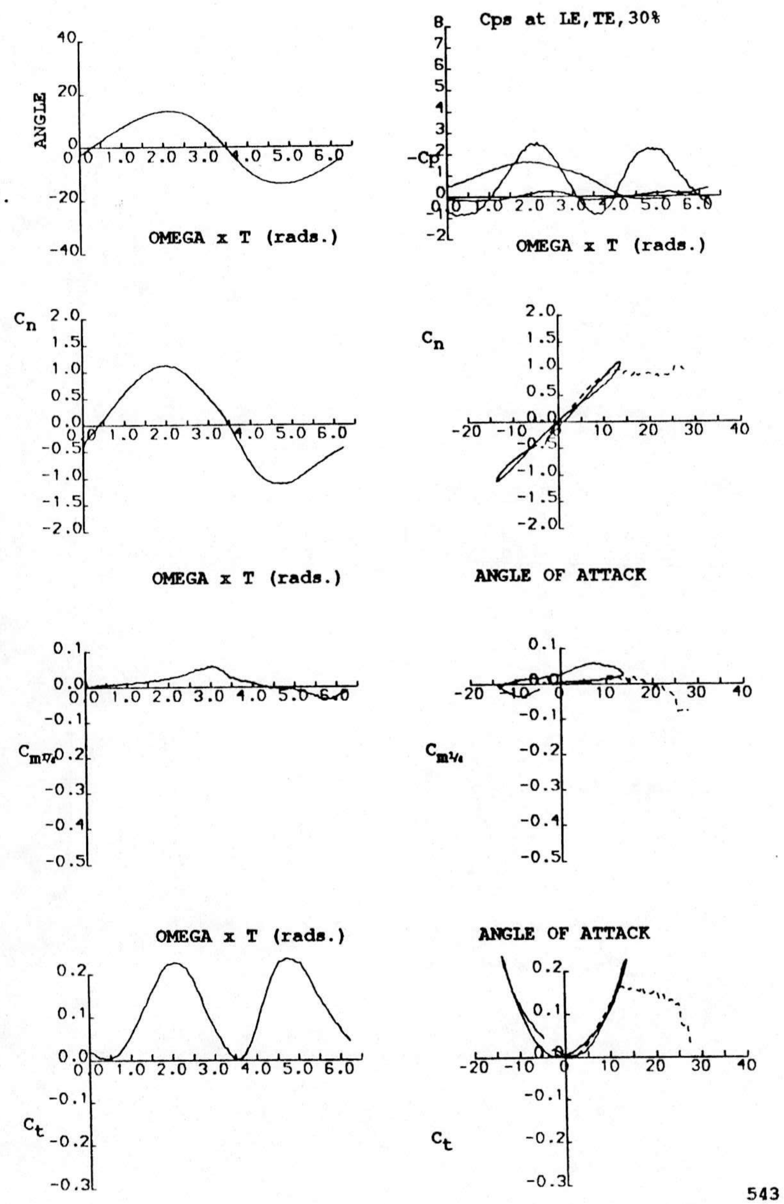
AIR TEMPERATURE = 25.4°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.069

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14771

REYNOLDS NUMBER = 1541776.

DYNAMIC PRESSURE = 1131.83 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91

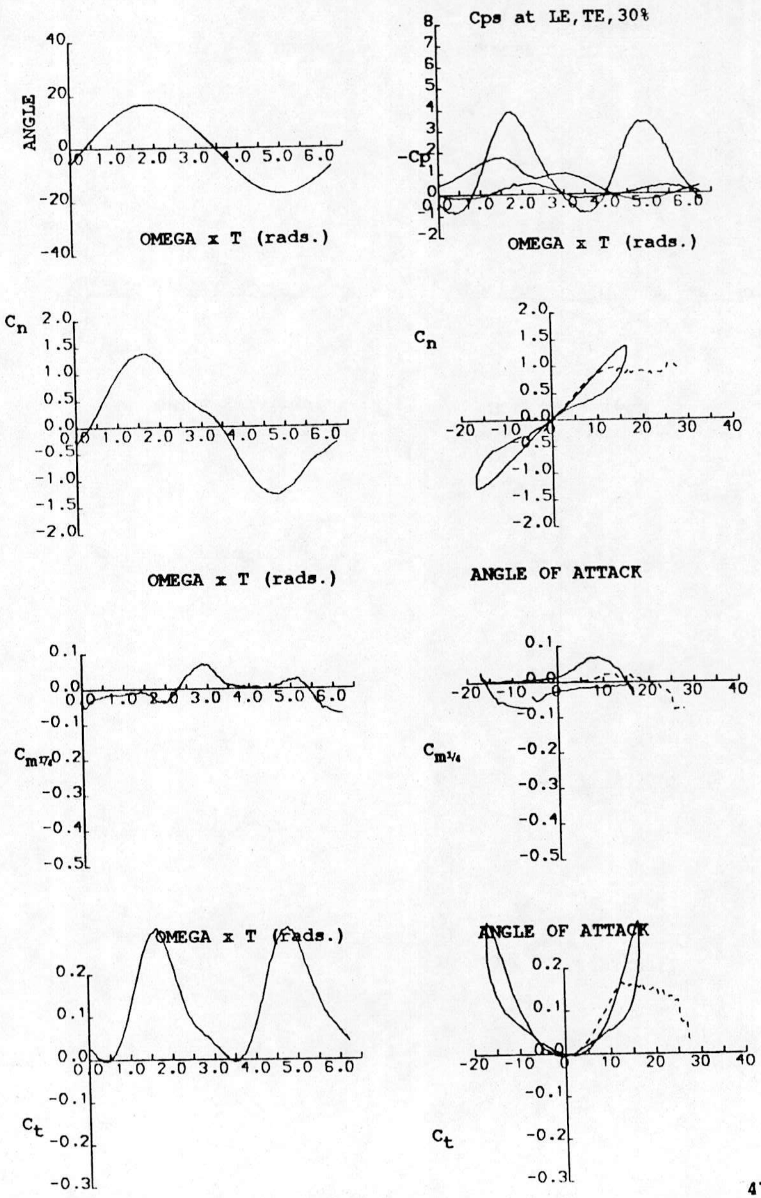
MACH NUMBER = 0.128

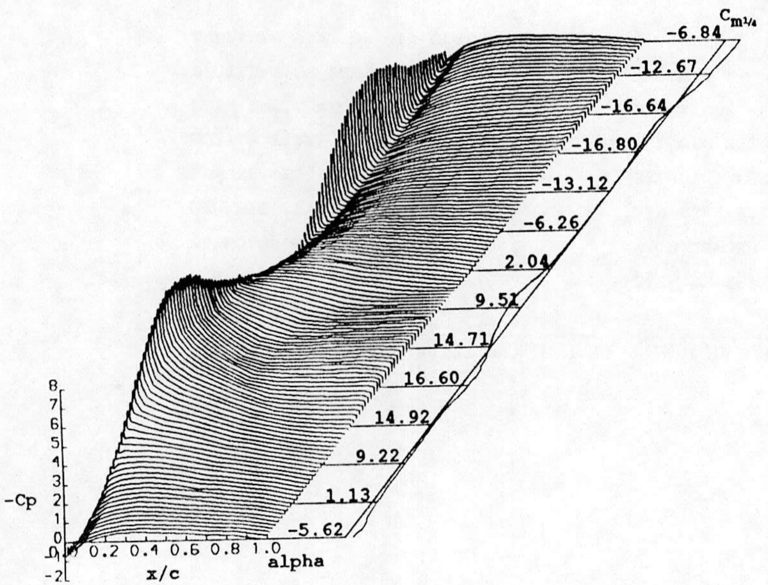
AIR TEMPERATURE = 26.8°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.071

AMPLITUDE = 17.40°

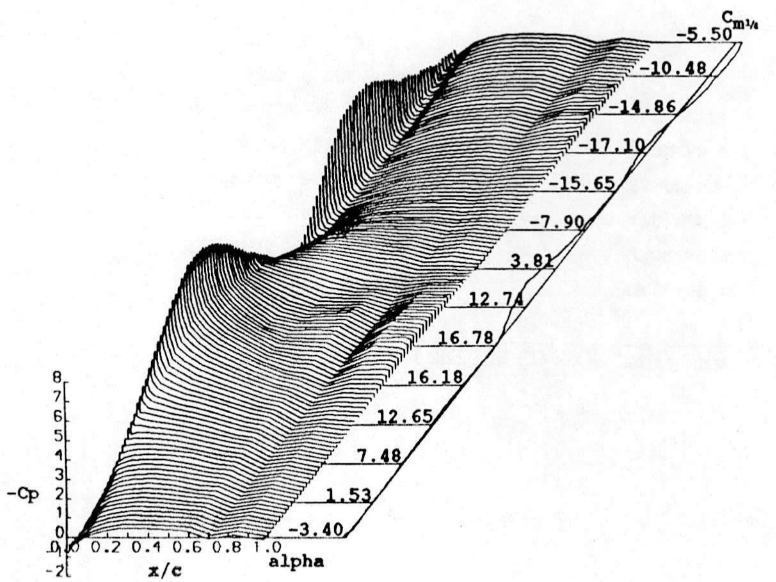


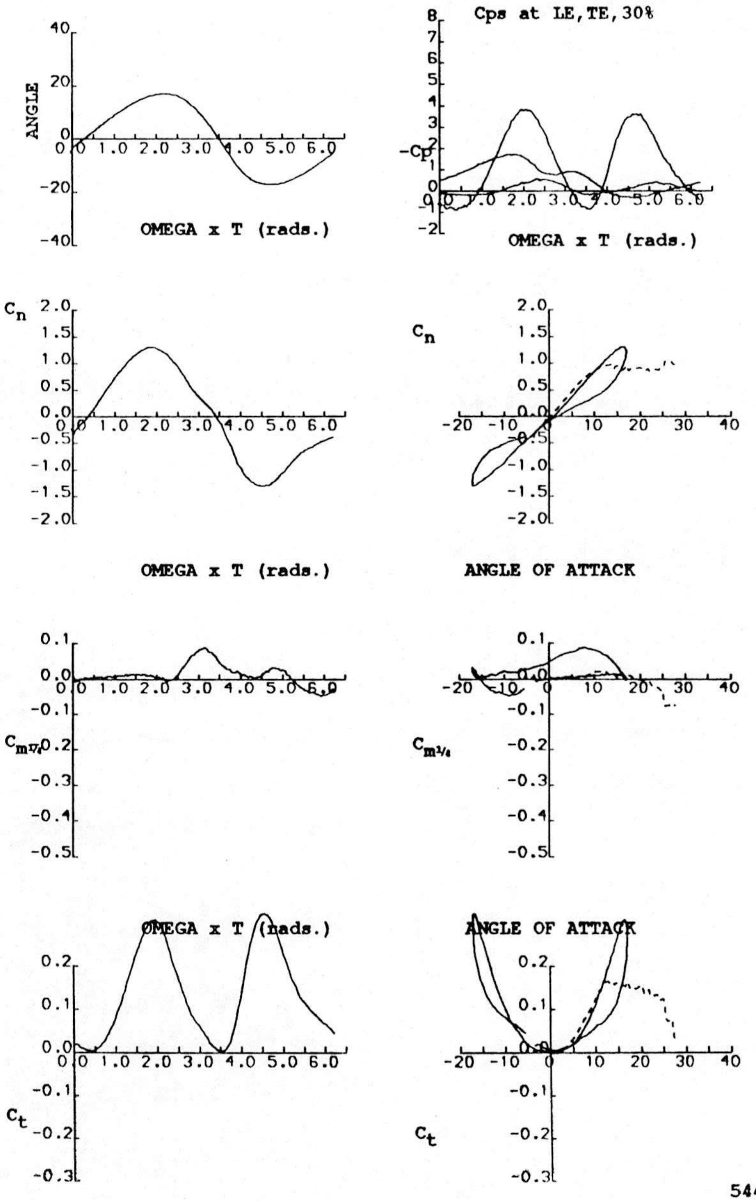


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55441
REYNOLDS NUMBER = 1600947.
DYNAMIC PRESSURE = 1207.90 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.132
AIR TEMPERATURE = 25.6°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.069
AMPLITUDE = 17.40°

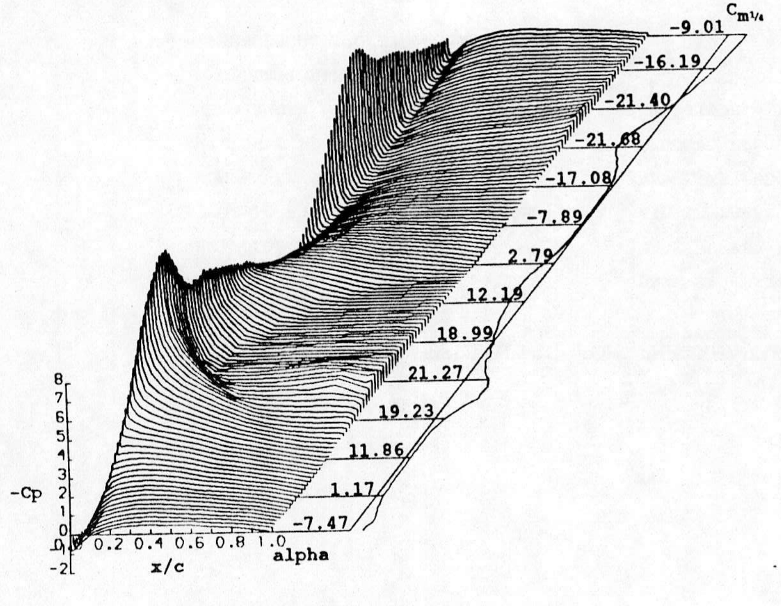


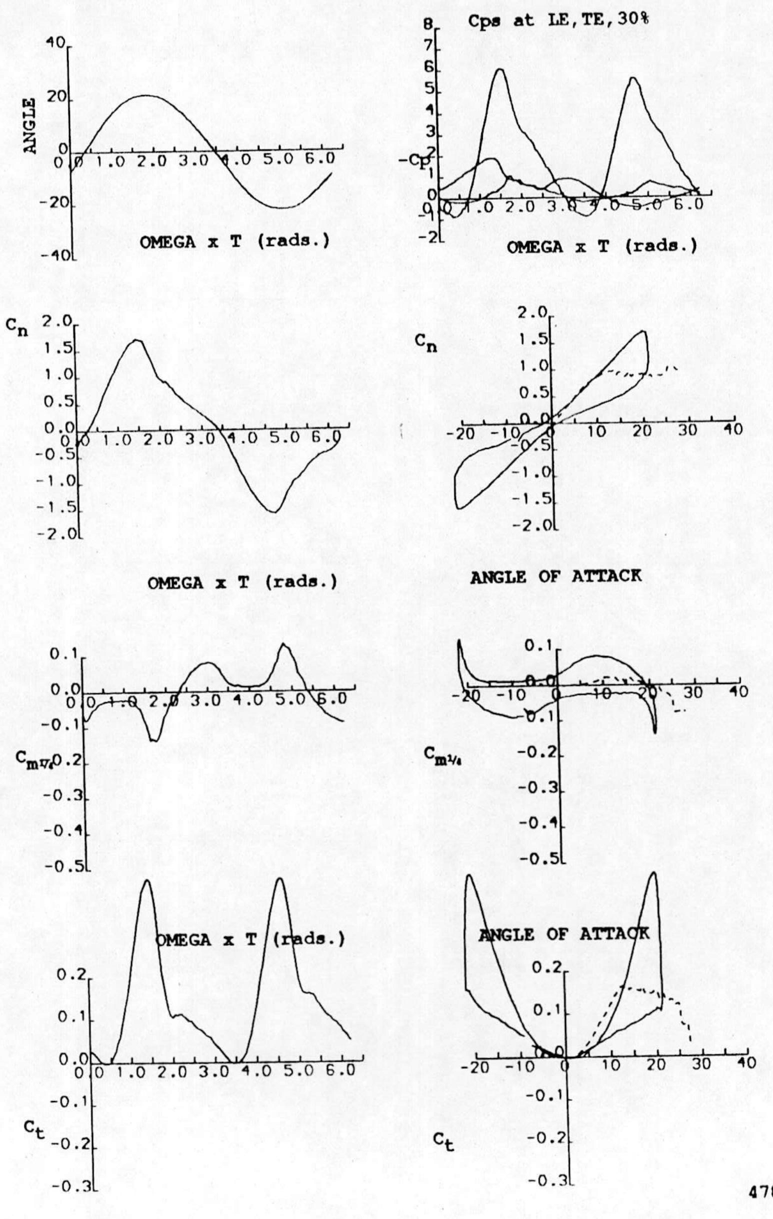


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14781
REYNOLDS NUMBER = 1540460.
DYNAMIC PRESSURE = 1131.83 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.128
AIR TEMPERATURE = 27.0°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.071
AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55451

REYNOLDS NUMBER = 1598205.

DYNAMIC PRESSURE = 1207.90 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91

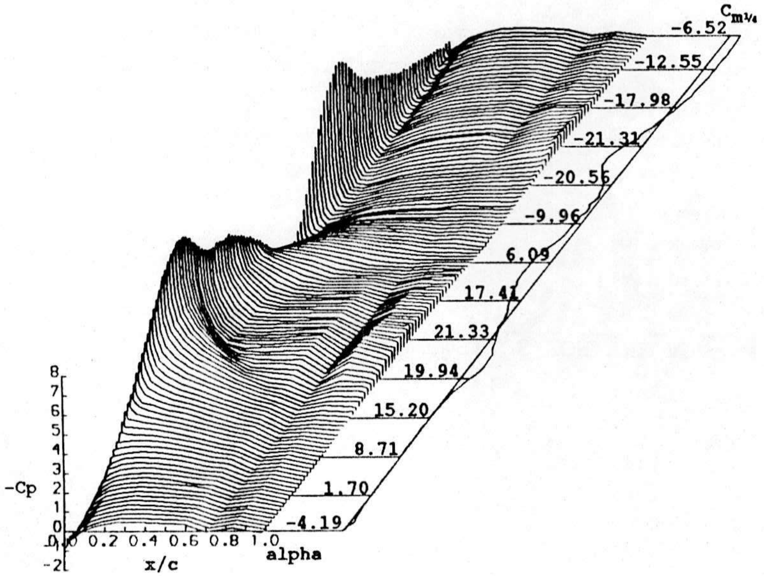
MACH NUMBER = 0.132

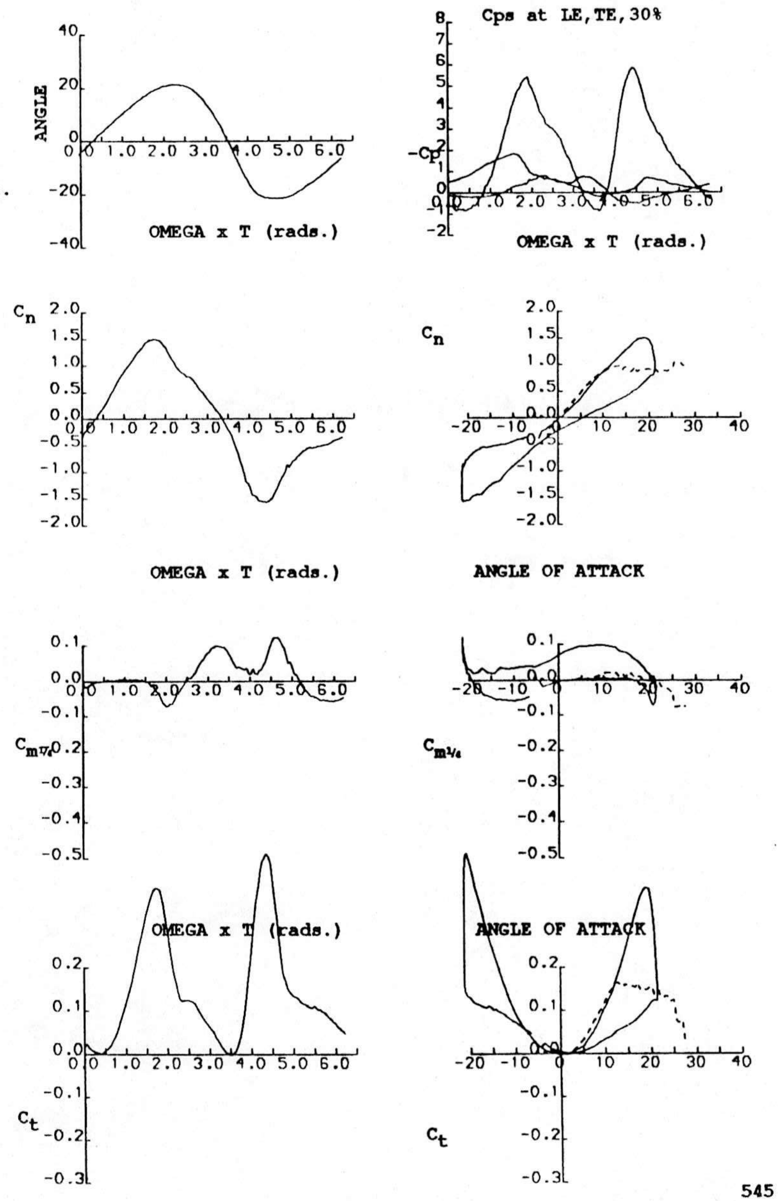
AIR TEMPERATURE = 26.0°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.069

AMPLITUDE = 22.60°

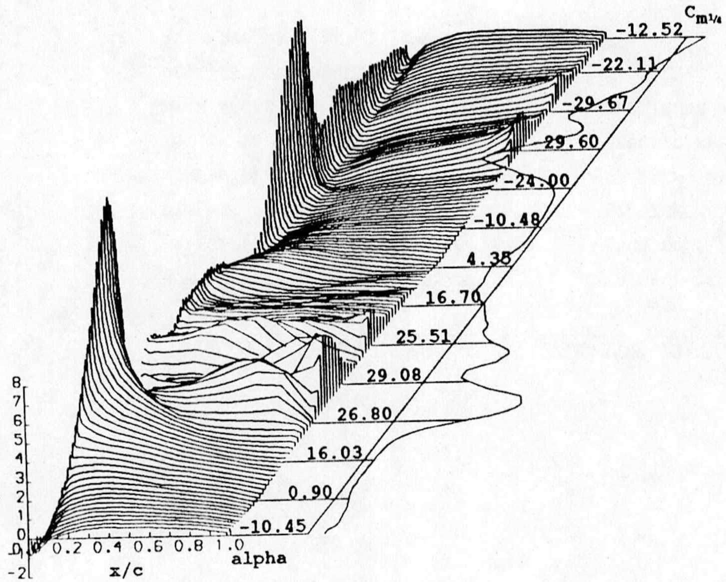


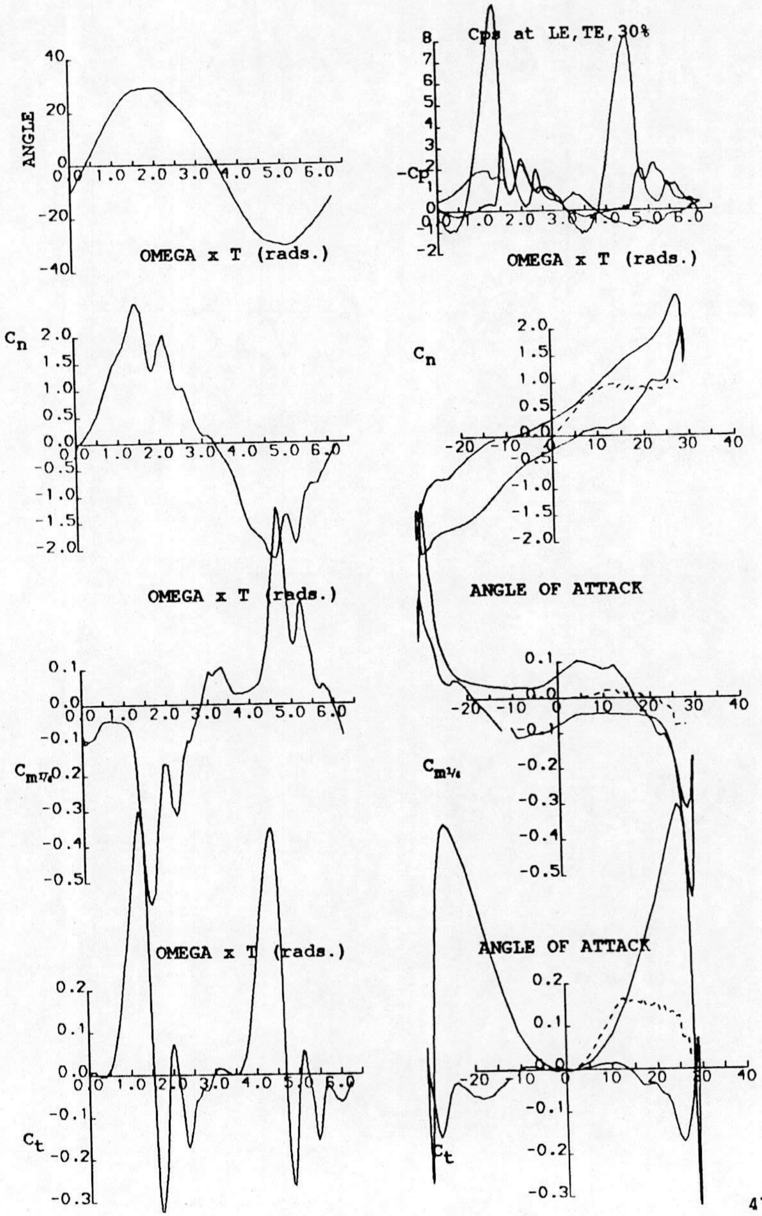


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 14791
REYNOLDS NUMBER = 1539147.
DYNAMIC PRESSURE = 1131.83 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 12/11/91
MACH NUMBER = 0.128
AIR TEMPERATURE = 27.2°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.071
AMPLITUDE = 32.00°

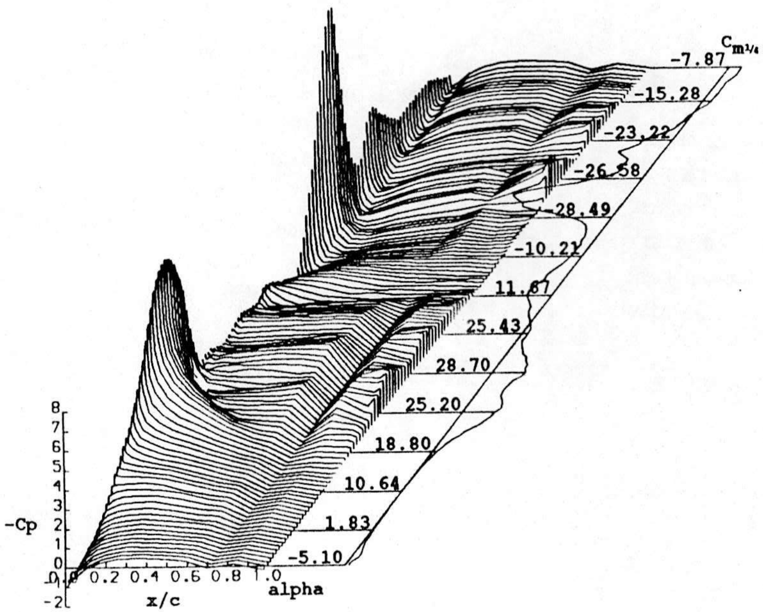


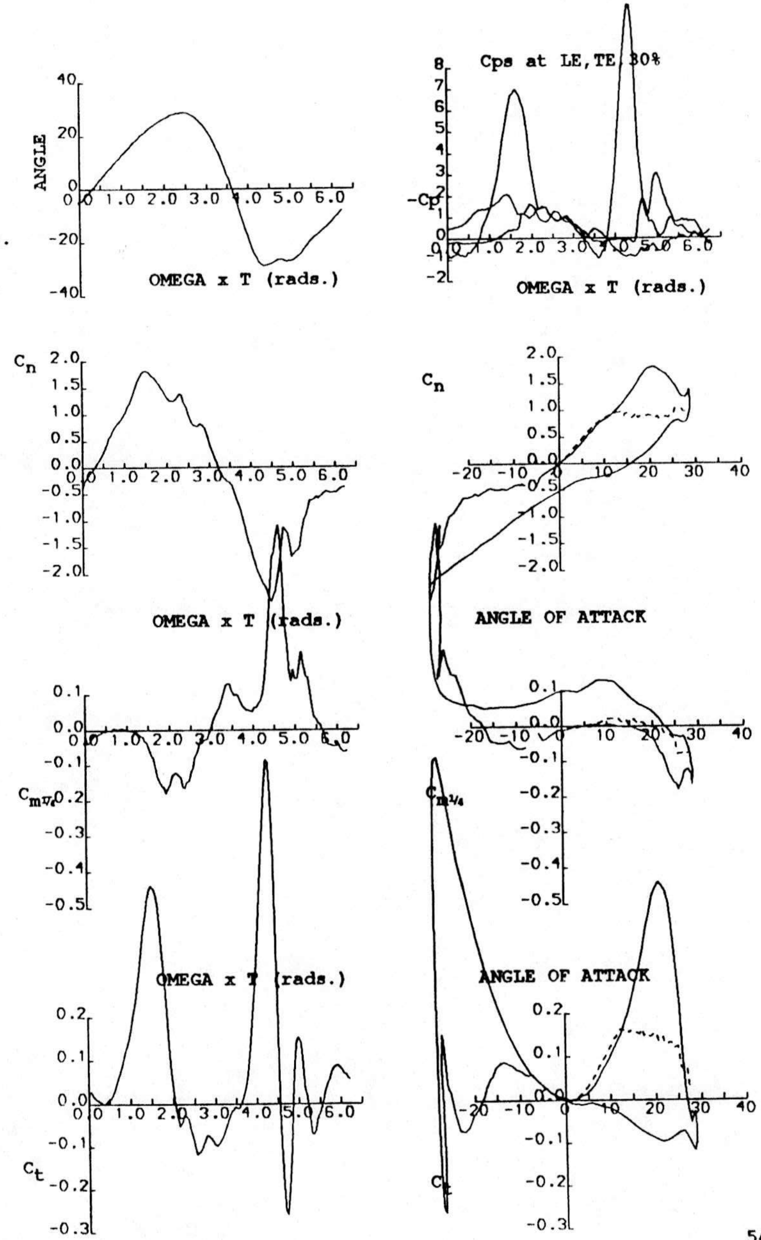


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55461
REYNOLDS NUMBER = 1597520.
DYNAMIC PRESSURE = 1207.90 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 14/11/91
MACH NUMBER = 0.132
AIR TEMPERATURE = 26.1°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.069
AMPLITUDE = 32.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 815671

REYNOLDS NUMBER = 1486123.

DYNAMIC PRESSURE = 978.49 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/1/92

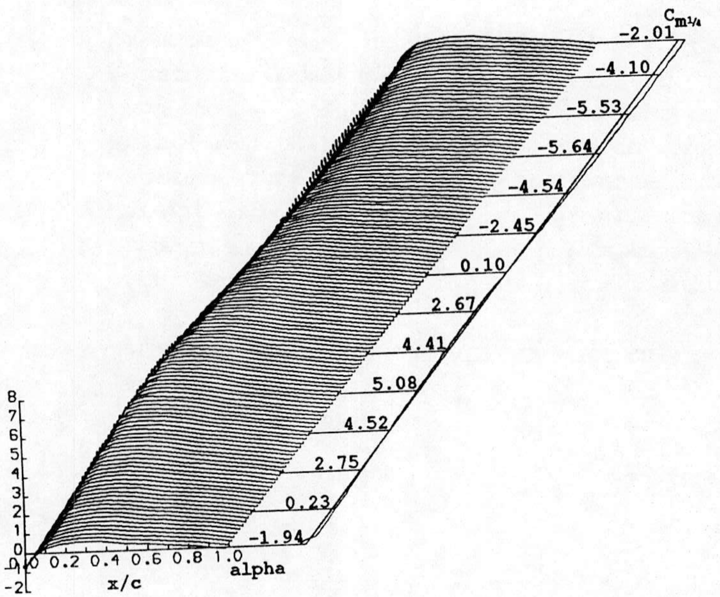
MACH NUMBER = 0.118

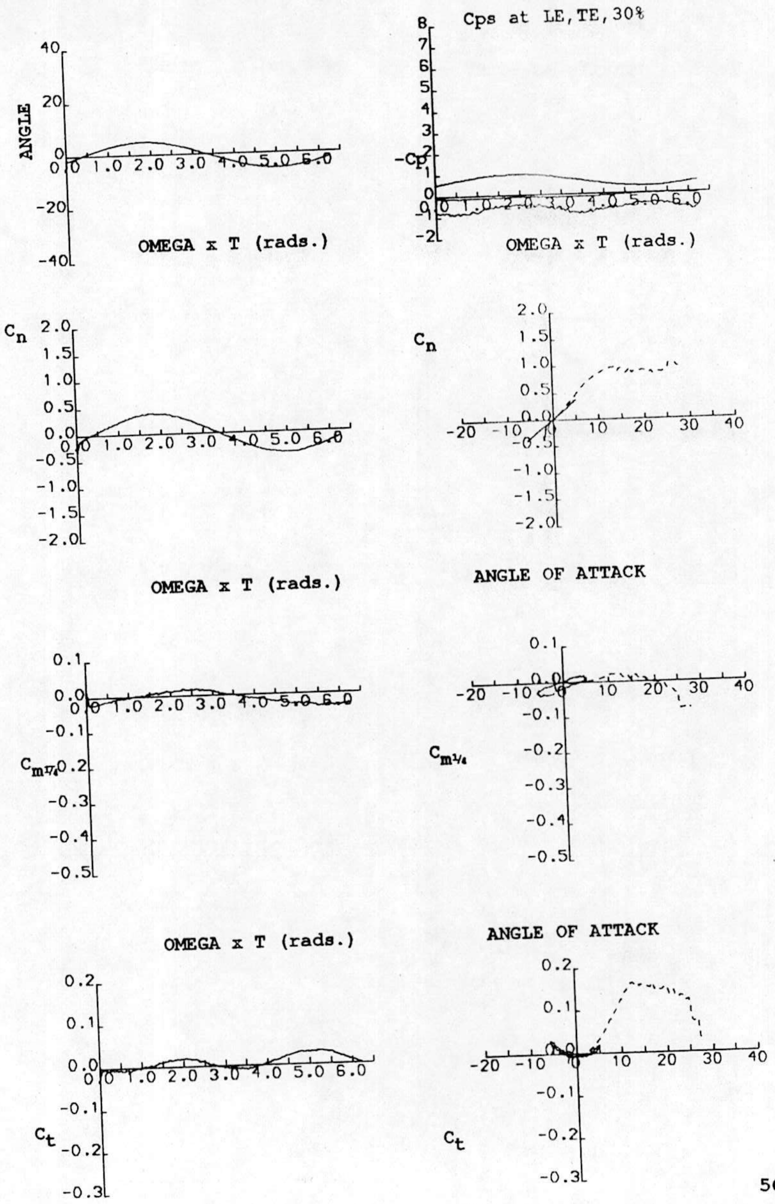
AIR TEMPERATURE = 21.7°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.078

AMPLITUDE = 5.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 815681

REYNOLDS NUMBER = 1484184.

DYNAMIC PRESSURE = 978.49 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/1/92

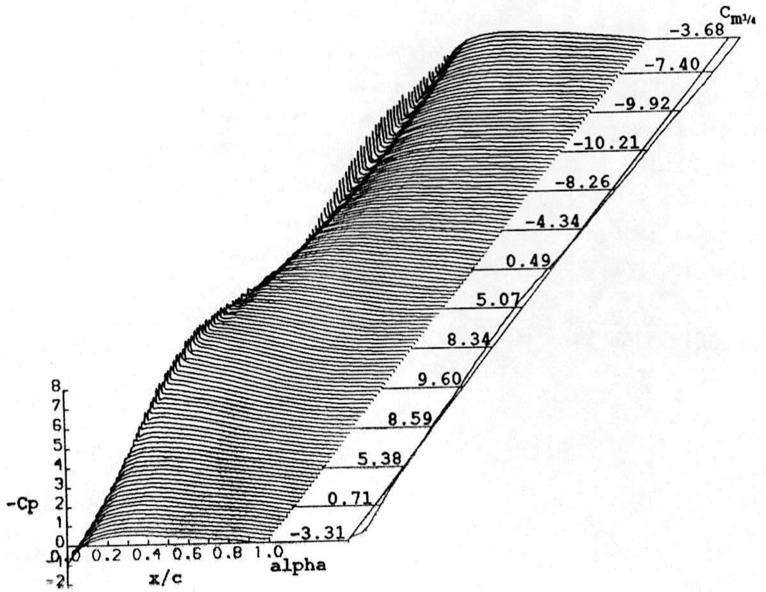
MACH NUMBER = 0.118

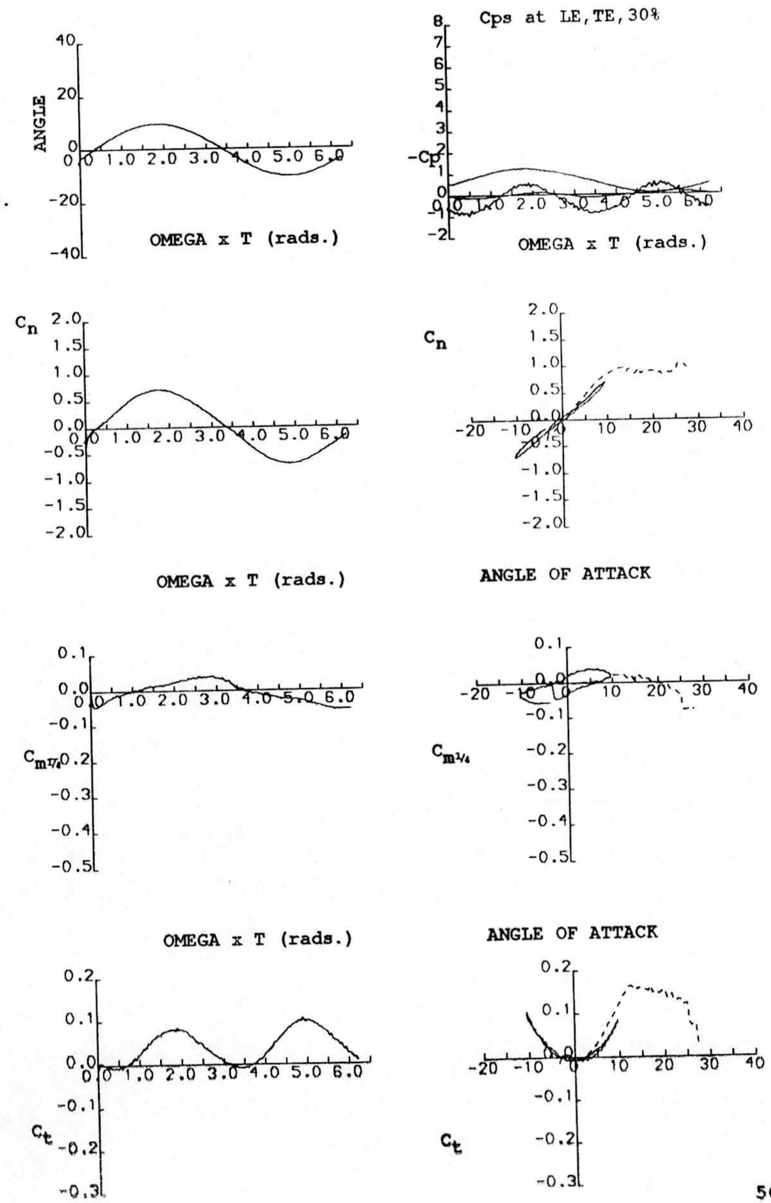
AIR TEMPERATURE = 22.0°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.078

AMPLITUDE = 10.00°

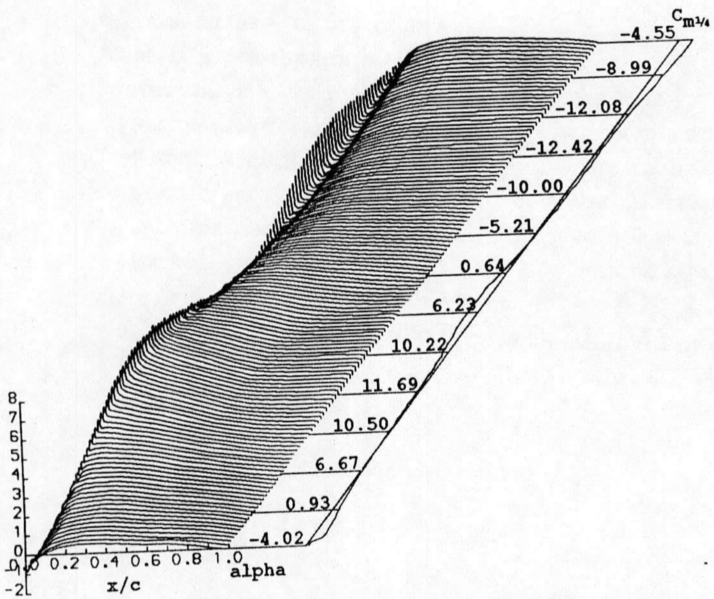


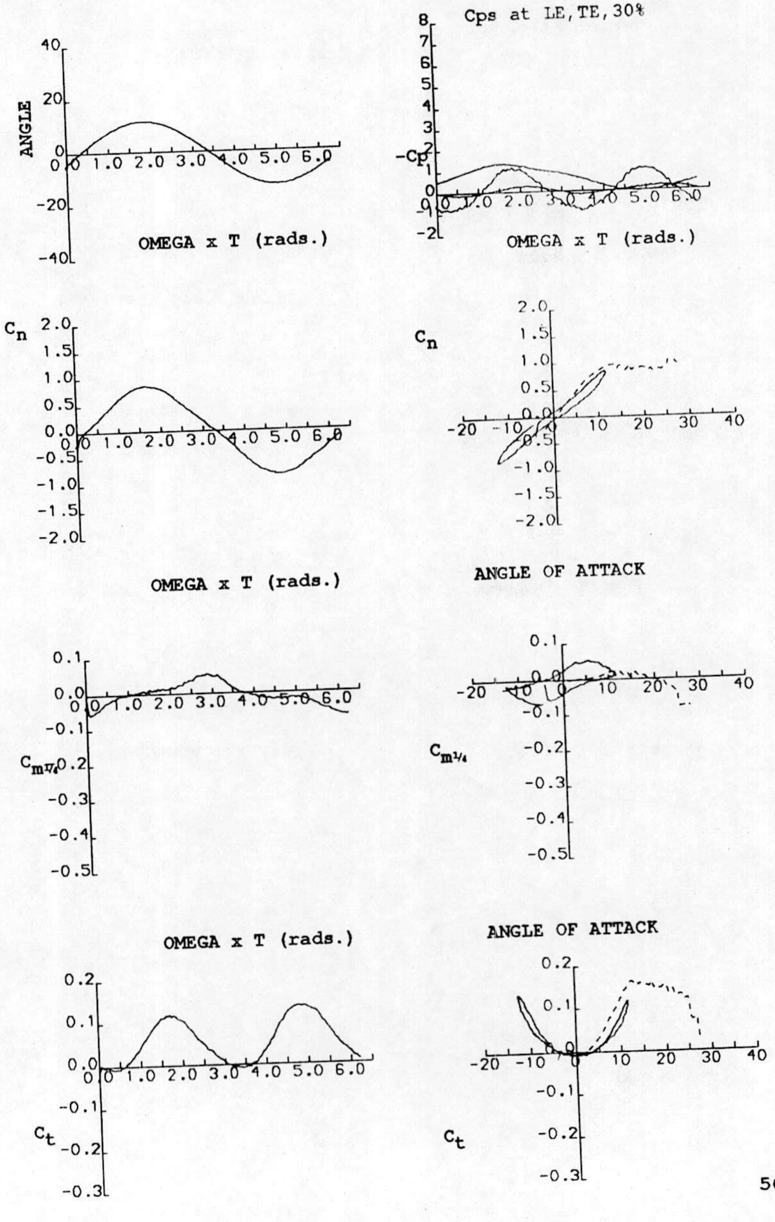


DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 815691
REYNOLDS NUMBER = 1482894.
DYNAMIC PRESSURE = 978.49 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: SINUSOIDAL
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.827 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/1/92
MACH NUMBER = 0.118
AIR TEMPERATURE = 22.2°C
SAMPLING FREQUENCY = 233.86 Hz.
REDUCED FREQUENCY = 0.078
AMPLITUDE = 12.20°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 815701

REYNOLDS NUMBER = 1482250.

DYNAMIC PRESSURE = 978.49 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/1/92

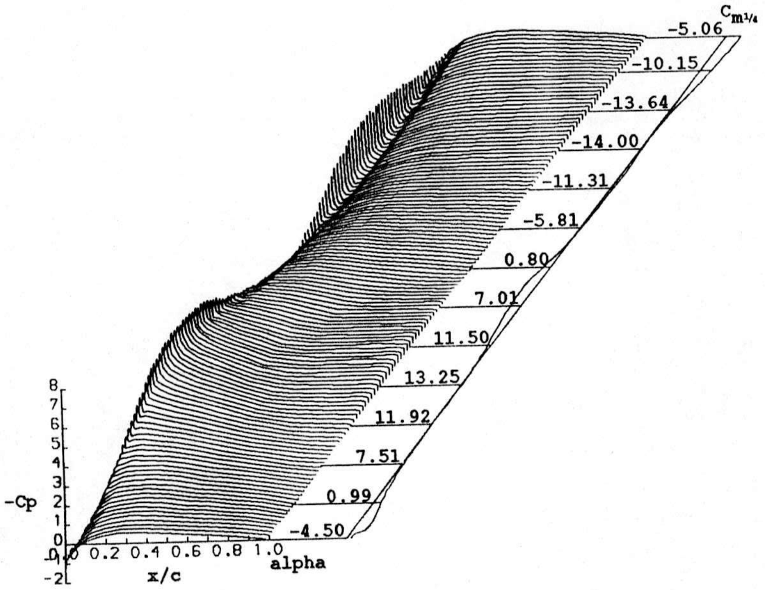
MACH NUMBER = 0.118

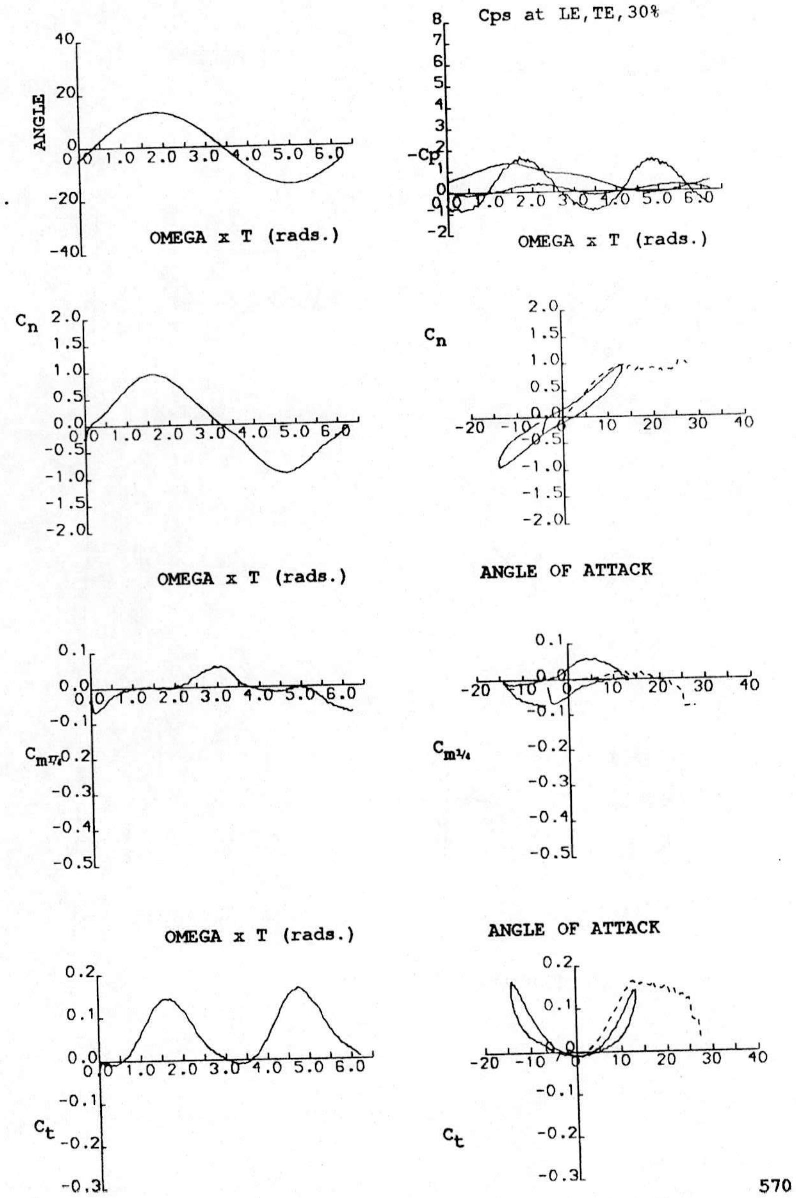
AIR TEMPERATURE = 22.3°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.078

AMPLITUDE = 13.80°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 815711

REYNOLDS NUMBER = 1480963.

DYNAMIC PRESSURE = 978.49 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/1/92

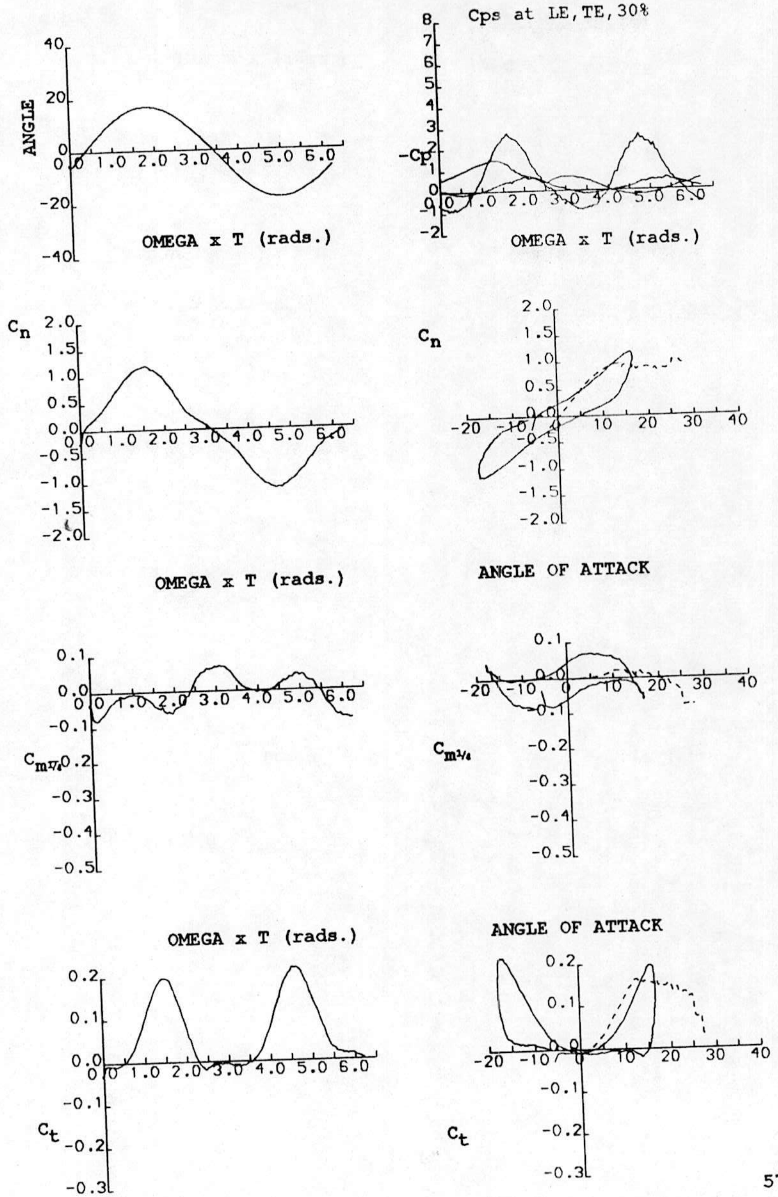
MACH NUMBER = 0.118

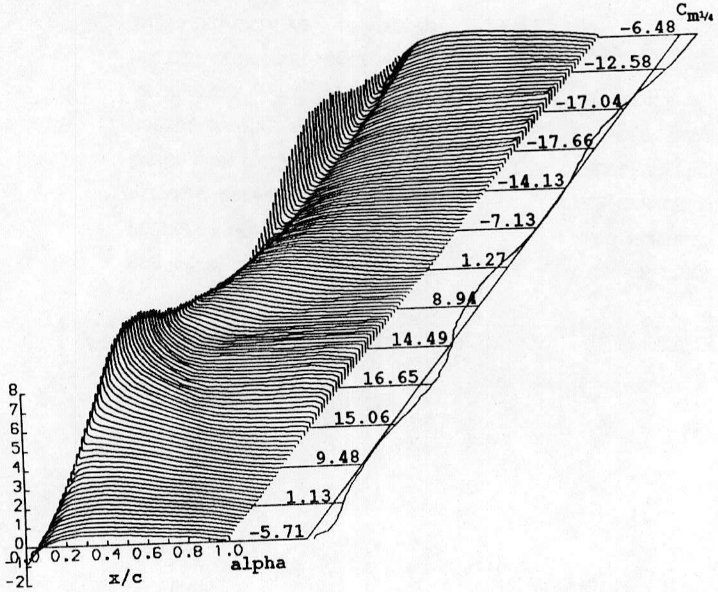
AIR TEMPERATURE = 22.5°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.078

AMPLITUDE = 17.40°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 815721

REYNOLDS NUMBER = 1479037.

DYNAMIC PRESSURE = 978.49 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/1/92

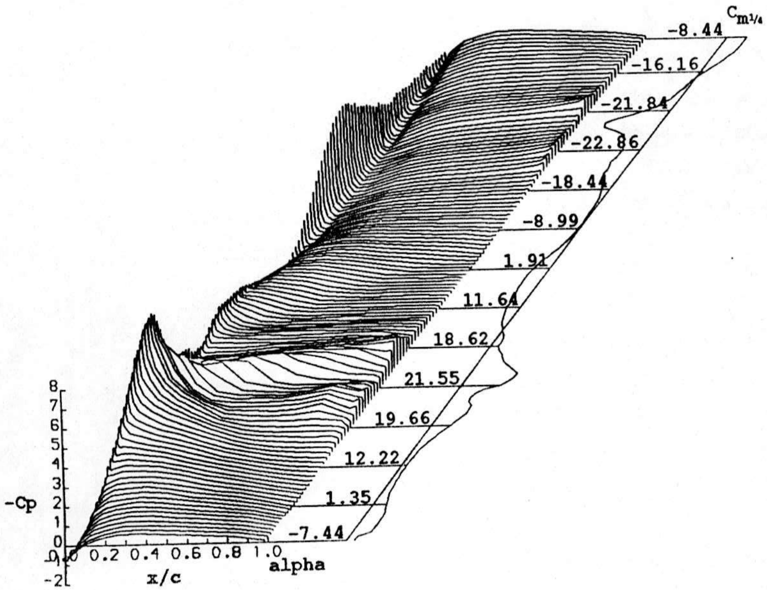
MACH NUMBER = 0.118

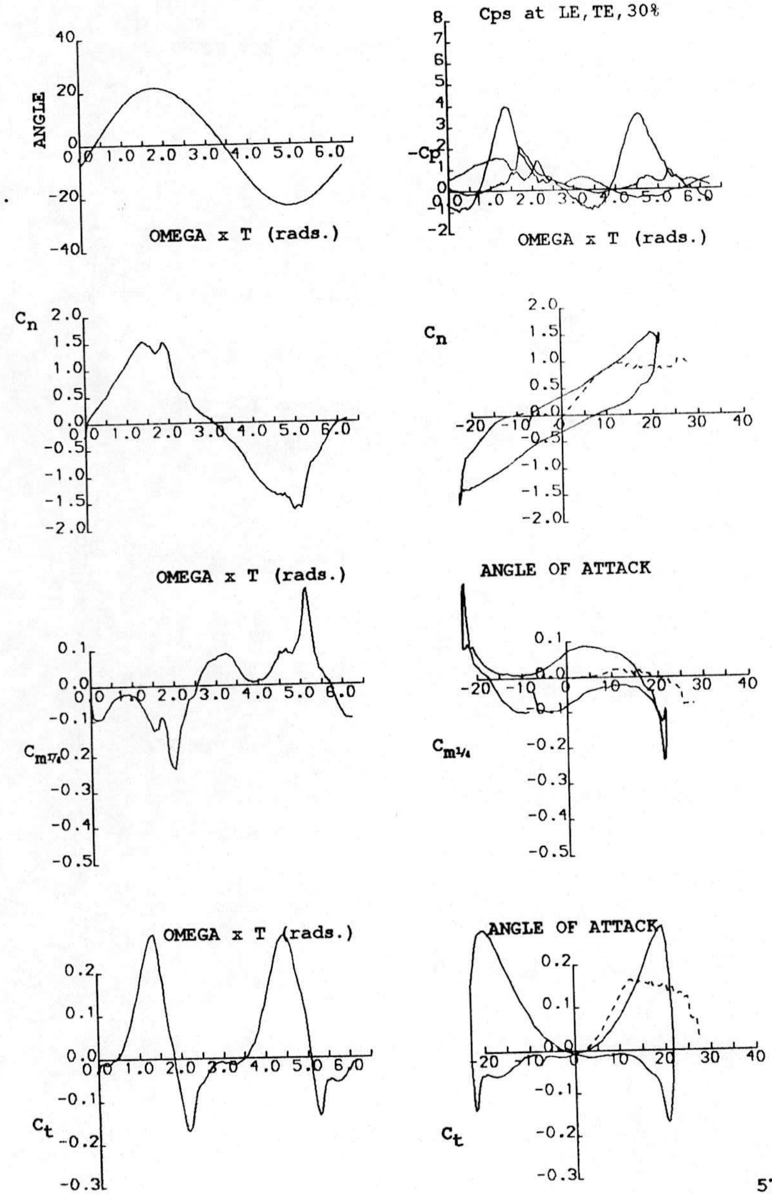
AIR TEMPERATURE = 22.8°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.078

AMPLITUDE = 22.60°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 815731

REYNOLDS NUMBER = 1477755.

DYNAMIC PRESSURE = 978.49 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: SINUSOIDAL

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.827 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 4/1/92

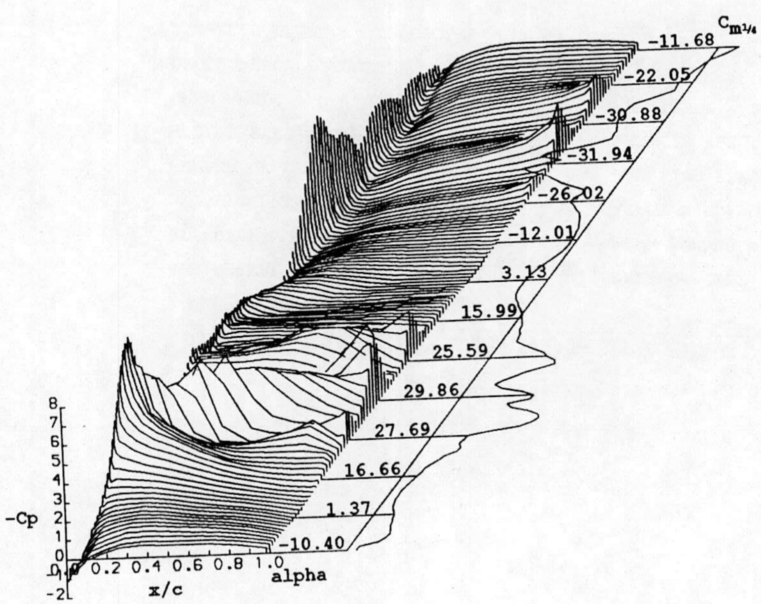
MACH NUMBER = 0.118

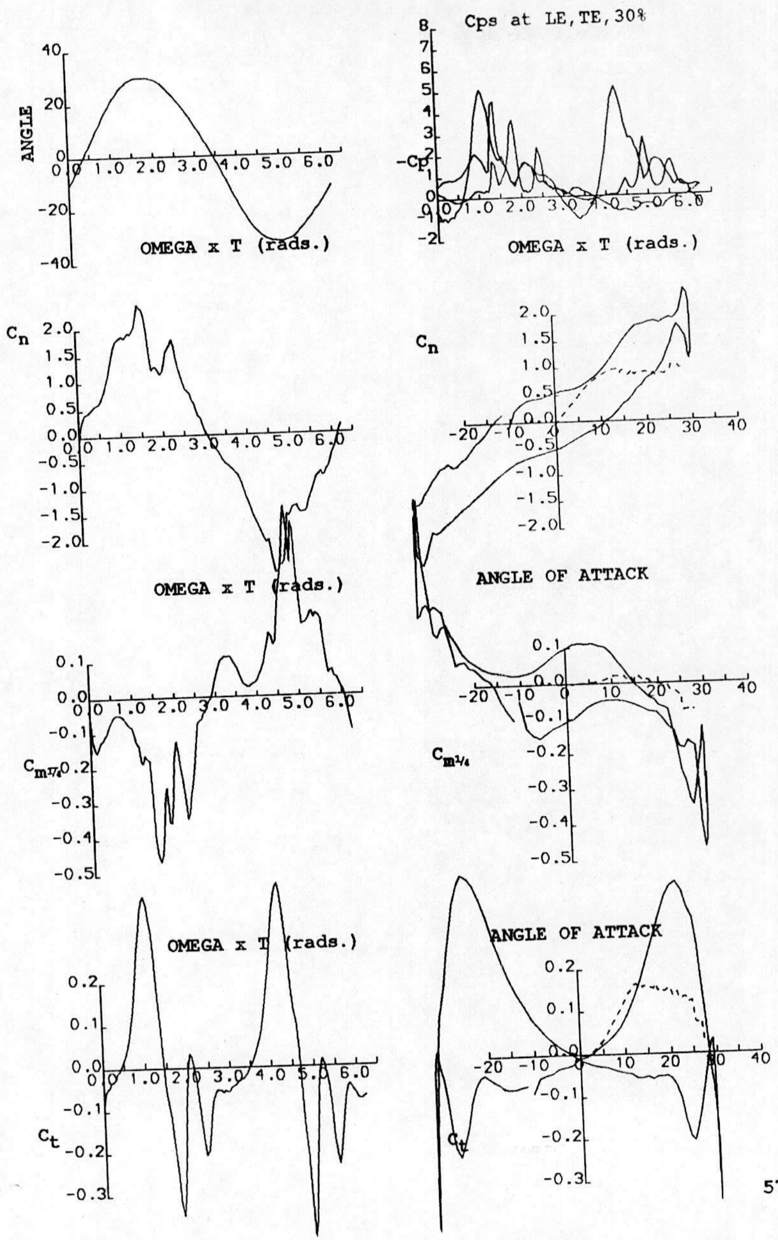
AIR TEMPERATURE = 23.0°C

SAMPLING FREQUENCY = 233.86 Hz.

REDUCED FREQUENCY = 0.078

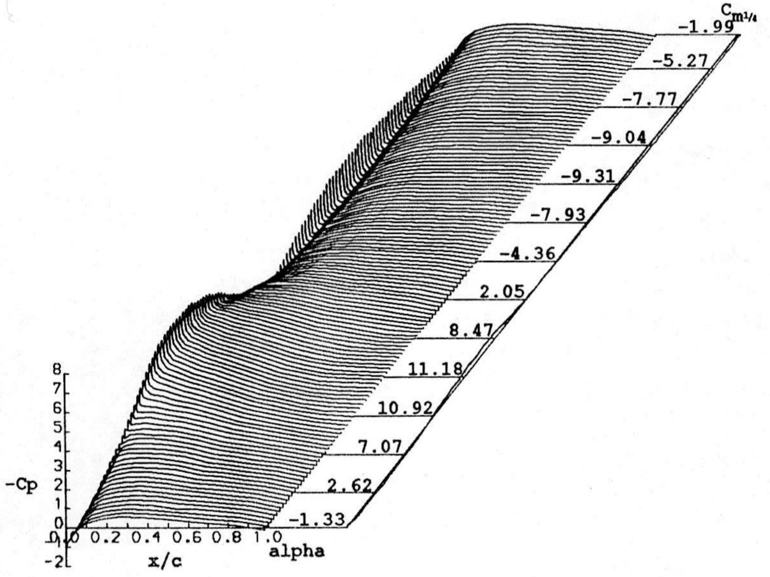
AMPLITUDE = 32.00°

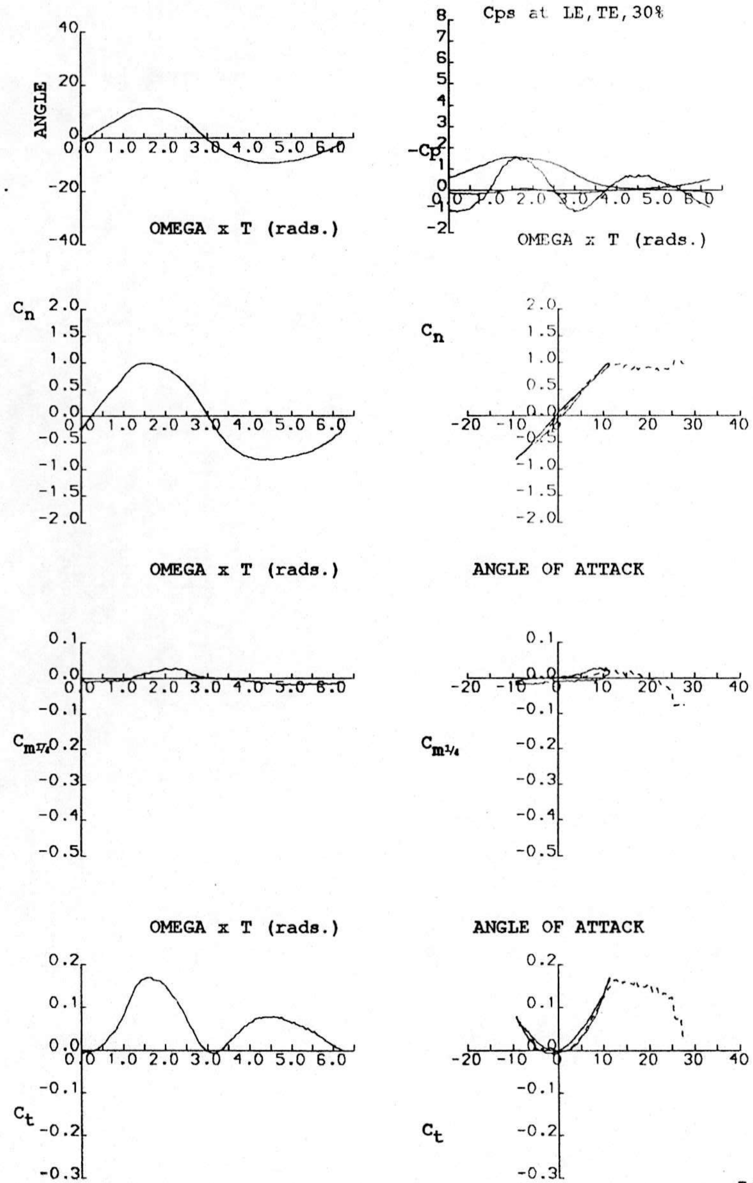




DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55482	DATE OF TEST: 10/12/91
REYNOLDS NUMBER = 2002221.	MACH NUMBER = 0.152
DYNAMIC PRESSURE = 1661.37 Nm^{-2}	AIR TEMPERATURE = 15.5°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 174.09 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.045
MEAN ANGLE = 0.00°	AMPLITUDE = 12.00°
OSCILLATION FREQUENCY = 1.360 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55492

REYNOLDS NUMBER = 1989011.

DYNAMIC PRESSURE = 1646.84 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.360 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 10/12/91

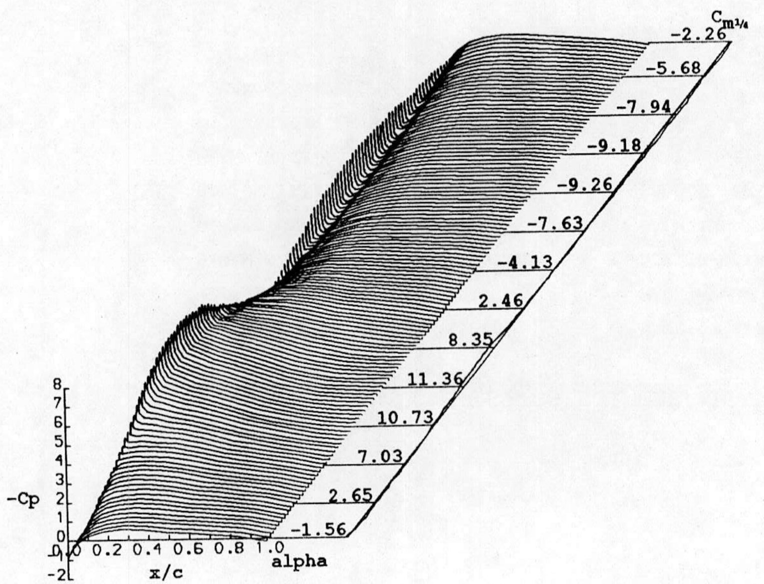
MACH NUMBER = 0.152

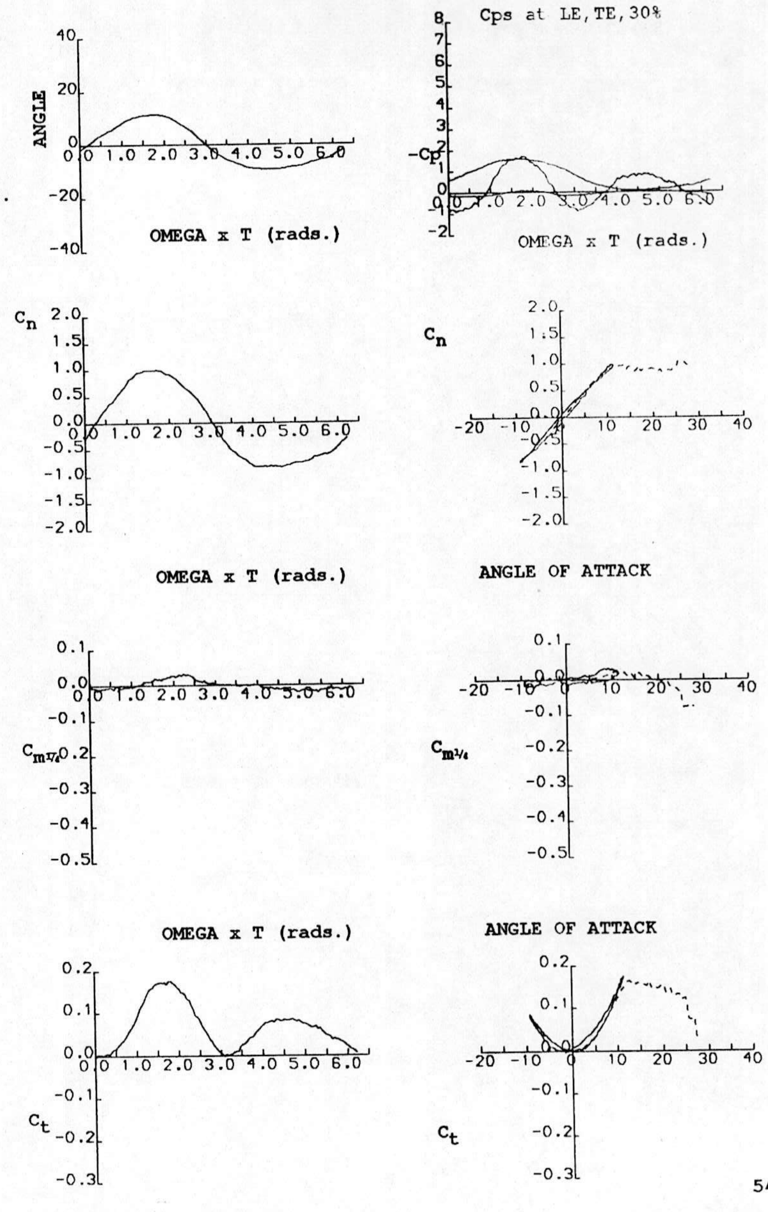
AIR TEMPERATURE = 16.0°C

SAMPLING FREQUENCY = 174.09 Hz.

REDUCED FREQUENCY = 0.045

AMPLITUDE = 12.00°





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55502

REYNOLDS NUMBER = 1976699.

DYNAMIC PRESSURE = 1648.33 Nm^{-2}

NUMBER OF CYCLES = 10

MOTION TYPE: VAWT FUNCTION

MEAN ANGLE = 0.00°

OSCILLATION FREQUENCY = 1.360 Hz.

AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 10/12/91

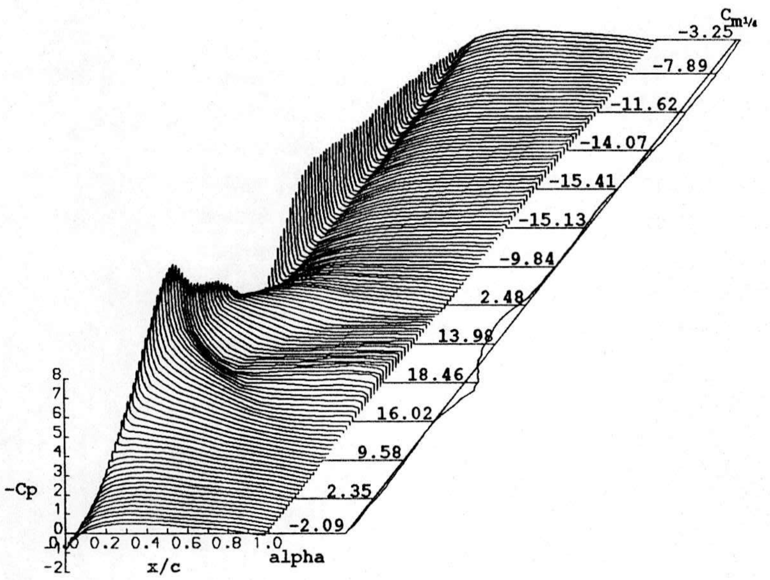
MACH NUMBER = 0.152

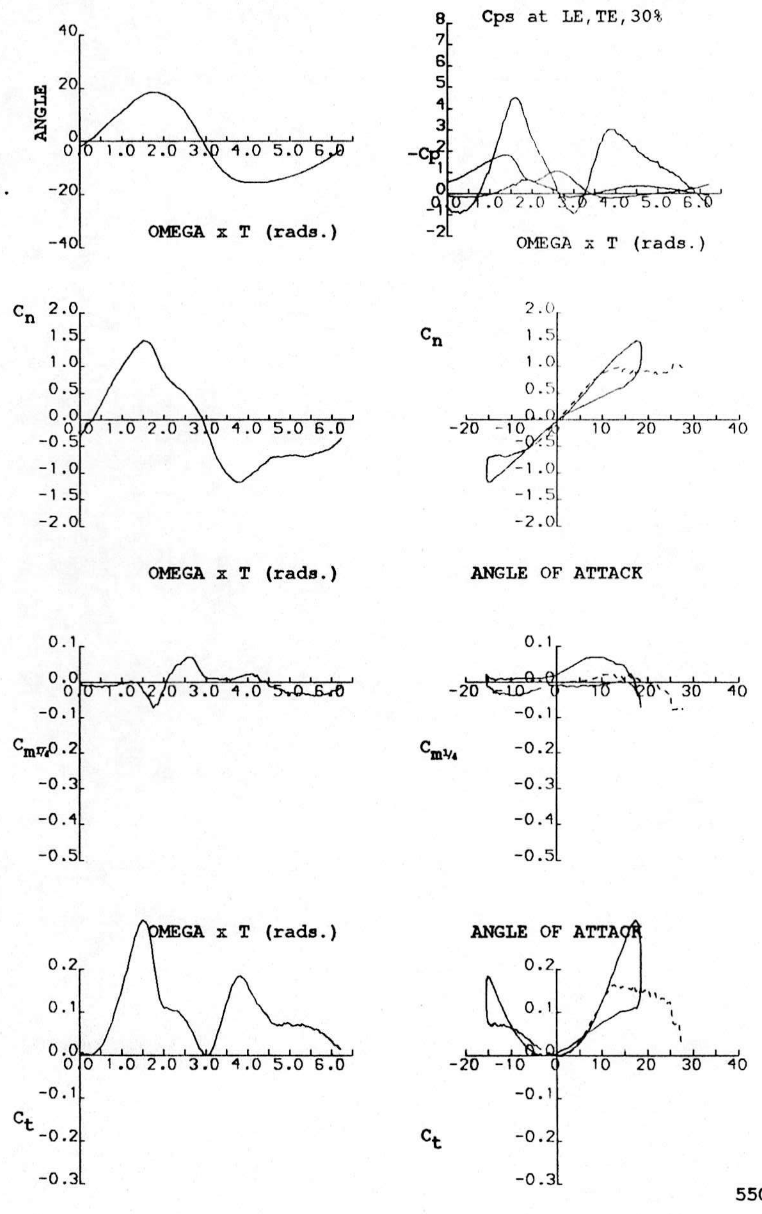
AIR TEMPERATURE = 17.5°C

SAMPLING FREQUENCY = 174.09 Hz.

REDUCED FREQUENCY = 0.045

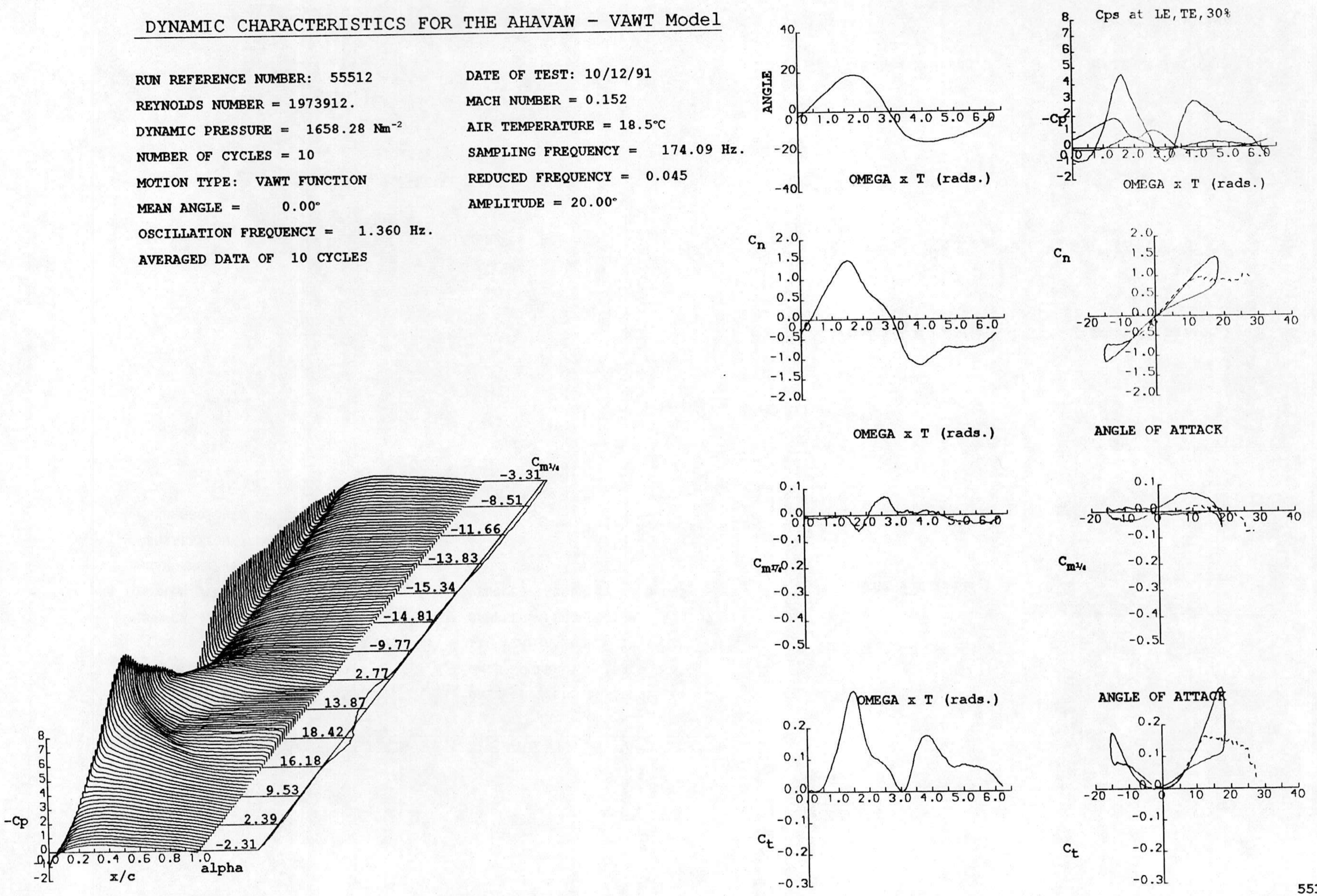
AMPLITUDE = 20.00°





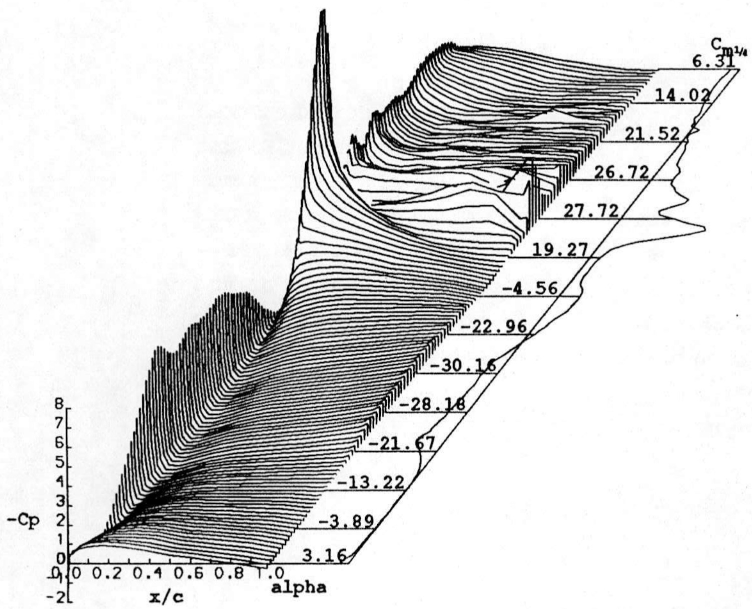
DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

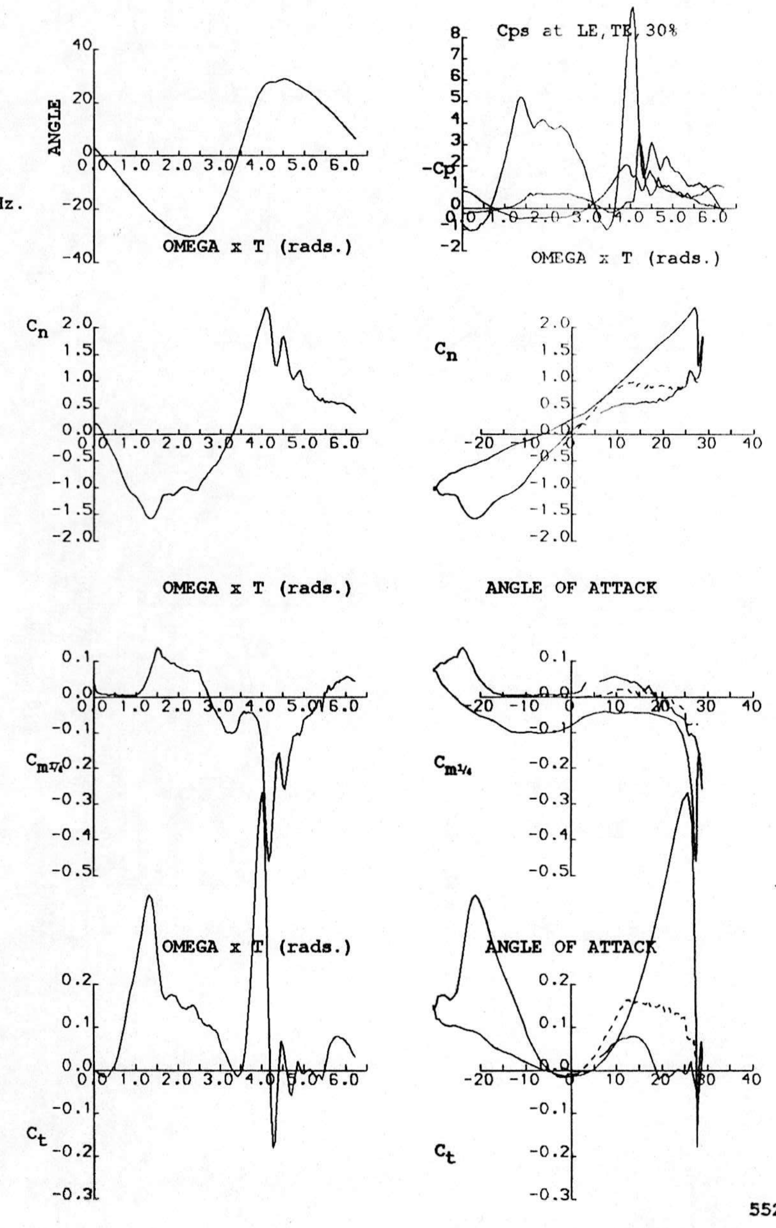
RUN REFERENCE NUMBER: 55512	DATE OF TEST: 10/12/91
REYNOLDS NUMBER = 1973912.	MACH NUMBER = 0.152
DYNAMIC PRESSURE = 1658.28 Nm^{-2}	AIR TEMPERATURE = 18.5°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 174.09 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.045
MEAN ANGLE = 0.00°	AMPLITUDE = 20.00°
OSCILLATION FREQUENCY = 1.360 Hz.	
AVERAGED DATA OF 10 CYCLES	



DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55521	DATE OF TEST: 29/1/92
REYNOLDS NUMBER = 1959005.	MACH NUMBER = 0.149
DYNAMIC PRESSURE = 1614.41 Nm^{-2}	AIR TEMPERATURE = 18.5°C
NUMBER OF CYCLES = 10	SAMPLING FREQUENCY = 174.09 Hz.
MOTION TYPE: VAWT FUNCTION	REDUCED FREQUENCY = 0.046
MEAN ANGLE = 0.00°	AMPLITUDE = 30.00°
OSCILLATION FREQUENCY = 1.360 Hz.	
AVERAGED DATA OF 10 CYCLES	





DYNAMIC CHARACTERISTICS FOR THE AHAVAW - VAWT Model

RUN REFERENCE NUMBER: 55531
REYNOLDS NUMBER = 1944123.
DYNAMIC PRESSURE = 1604.03 Nm^{-2}
NUMBER OF CYCLES = 10
MOTION TYPE: VAWT FUNCTION
MEAN ANGLE = 0.00°
OSCILLATION FREQUENCY = 1.360 Hz.
AVERAGED DATA OF 10 CYCLES

DATE OF TEST: 29/1/92
MACH NUMBER = 0.149
AIR TEMPERATURE = 19.5°C
SAMPLING FREQUENCY = 174.09 Hz.
REDUCED FREQUENCY = 0.046
AMPLITUDE = 30.00°