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VELOCITY FIELD NEAR THE JET ORIFICE OF A ROUND JET IN A CROSSFLOW

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SUMMARY

Experimentally determined velocities at selected locations near the jet orifice are presented and analyzed for a round jet in a crossflow. Jet-to-crossflow velocity ratios of four and eight were studied experimentally for a round subsonic jet of air exhausting perpendicularly through a flat plate into a subsonic crosswind of the same temperature. Velocity measurements were made in cross sections to the jet plume located from one to four jet diameters from the orifice. Jet centerline and vortex properties are presented and utilized to extend the results of a previous study into the region close to the jet orifice.

INTRODUCTION

In the transition from hover to conventional flight, vertical take-off and landing (VTOL) aircraft supplement wing-generated lift with direct thrust from lift jets, lift fans or tilt-proprotors. Proposed configurations involve the injection of relatively high-velocity jets of air and/or exhaust gases into the crosswind caused by the forward motion of the aircraft. The interaction between these jets in a crossflow and the aerodynamic surface of the aircraft can be described in terms of an interference effect. Qualitatively, this interference effect results in a loss of lift and an increment of nose-up pitching moment, both of which tend to increase with increasing forward velocity of the aircraft. This jet/aerodynamic-surface interference effect is one of the significant problems in V/STOL aerodynamics.

In an effort to understand the basic flow phenomenon of a jet in a cross-flow, a series of wind tunnel experiments has been conducted in the V/STOL tunnel at Langley Research Center. A round subsonic jet of air 10.16cm in diameter exhausted through a flat plate into a subsonic crosswind of the same temperature. For perpendicular jet injection into the crossflow and for a range of jet to crossflow velocity ratios, the pressure distribution was measured on the flat plate (ref. 1). An extensive investigation of the flow properties in the plume of the jet was conducted. For each jet to crossflow velocity ratio studied, the velocity, static pressure and total pressure were determined at numerous locations in each of several cross sections to the jet plume (ref. 2).

Based on the results of the first wind-tunnel experiment studying the jet plume, a contrarotating pair of diffuse vortices was identified as a significant and persistent feature of the flow field. These vortices were modeled in such a way that the vortex properties could be inferred from selected velocity measurements in the jet plume (ref. 3). It has also been demonstrated that the properties of this vortex pair associated with a jet in a crossflow can be utilized to calculate the pressure distribution on the flat plate for a jet to crossflow velocity ratio of 8 (ref. 4).

Similar experiments in the jet plume and data analysis have been conducted to study the effect of jet injection on the vortex properties associated with a jet in a crossflow (Refs. 5 and 6).

The purpose of this report is to present and analyze experimental data that were acquired in a region closer to the jet orifice than that described in reference 2. Experimental velocities and pressures are presented for cross sections to the jet plume located in the region from one to four jet diameters from the jet orifice. The test conditions were perpendicular jet injection into the crossflow and jet-to-crossflow velocity ratios of four and eight. Analysis of this data provides experimental information on the vortex properties in the important region of vortex roll-up near the jet orifice.

LIST SYMBOLS

D	Diameter of the jet orifice, cm.
$\hat{e}_{\theta_1}$, $\hat{e}_{\theta_2}$, $\hat{e}_{z_v}$	Unit vectors in vortex coordinate system (see figure 3).
Γ_o	Integrated strength of a single Gaussian vortex, cm^2/s.
Γ	Effective vortex strength, cm^2/s.
γ	Effective vortex strength nondimensionalized by $2DU_\infty$.
h	Effective vortex half-spacing, cm.
h_o	Half-spacing between vortex centers, cm.
ϕ_B	Angle of rake of yaw pitch probes with the Z-axis, deg.
ϕ_v	Angle of vortex cross section with the Z-axis, deg.
R	Effective jet to crossflow velocity ratio.
r, r_1, r_2	Radii in vortex coordinate system (see figure 3), cm.
r_c	Radius of vortex core, cm.
S	Arc length along vortex curve, cm.
U_∞	Speed of the cross flow , cm/s.
$\vec{V}$	Projection of velocity vector onto cross section, cm/s.

X, Y, Z	Coordinate axes for tunnel coordinate system.
Y_B, Z_B or YB, ZB	Coordinate axes for cross section of measurement.
Y_v, Z_v or XV, ZV	Coordinate axes for cross section to vortex curve.
β	Diffusion constant for Gaussian vortex, cm^{-1}.
ω	Vorticity, s^{-1}.

APPARATUS

This experiment was conducted in the Langley V/STOL wind tunnel which is a closed return atmospheric tunnel with a test section 4.42 m by 6.63 m. Test-section airspeeds for this investigation were approximately 43 m/s for R = 4 and 21 m/s for R = 8.

The jet of air exhausted perpendicularly from a rectangular flat plat 17.7 D x 29.5 D which was mounted 3.0 D above the tunnel floor (D= 10.16 cm is the diameter of the jet). The center of the jet orifice was located 11.8 D downstream of the rounded leading edge of the plate and on the longitudinal centerline of the plate.

The jet of air was formed by using a plenum chamber and a 20:1 convergent nozzle designed to provide a flat velocity profile at the nozzle exit. Supply air for the jet was heated so that the temperature at the jet orifice would be approximately the same as that of the crossflow.

Velocity measurements were made with a rake of seven parallel yaw-pitch probes mounted 5.08 cm apart on the leading edge of an airfoil. Each probe was 20.32 cm long and 0.64 cm in diameter. Five pressure orifices were located on the hemispherical tip of each proble, and a ring of six interconnected static-pressure ports was located 5.08 cm aft of the probe tip.

All pressures were measured with pressure transducers which were calibrated with water or mercury manometers. The leads from the pressure ports on the probes were connected by plastic tubing to a pressure scanning device mounted inside the wind-tunnel sting. Each device consisted of a single pressure transducer which could be connected sequentially to each of 48 pressure tubes. The output of each pressure transducer was fed into a low pass filter to attenuate fluctuations in the transducer output signal. One second after each static-pressure port was connected to the pressure transducer, the signal from the filter was sampled and recorded on magnetic tape.

A more detailed discussion of the apparatus utilized in this series of experiments is presented in references 2 and 5.

TEST PROCEDURES AND CONDITIONS

The probe system utilized for velocity measurements in this series of experiments (refs. 2 and 5) is not well-suited for use in the region near the jet orifice. The physical size of the probes and their spacing on the rake (1/2 D) are too great for the severe velocity gradients encountered in this region. Also, there was excessive vibration in the probe support system under normal operating conditions when the rake of probes was placed in the jet plume near the jet orifice.

Selected velocity measurements in the region near the jet orifice, however, would provide useful information concerning the initial distortion of the vortex field and its roll-up into a pair of contrarotating vortices. In an attempt to acquire preliminary measurements in this important region with the existing probe system, an overlapping placement of the rake of probes was utilized to provide a measurement spacing less than 1/2 D, and probe vibration was reduced by using guy wires to stiffen the probe support system. The use of guy wires reduced the precision of probe placement and disabled two degrees of freedom in the remote control of probe location, tunnel yaw and tunnel height. Remote control of a limited range of longitudinal motion was available.

Jet to crossflow velocity ratios of 4 and 8 were studied for perpendicular jet injection into the crossflow. For each of these velocity ratios, measurements were made in one cross section approximately 1 D from the jet orifice. For a velocity ratio of 4, measurements were also made in a group of 5 closely-spaced cross sections located approximately 2 1/2 D from the jet orifice (see figure 1). For a velocity ratio of 8, velocity measurements were also made in two groups of closely spaced cross sections to the jet plume; a group of 3 cross sections located approximately 3 D and a group of 5 cross sections located approximately 4 D from the jet orifice (see figure 2). The remote control of the longitudinal motion of the probe was utilized to move the rake from one cross section to another within a group of closely-spaced cross sections. Overlapping placement of the rake of probes was utilized to obtain a measurement spacing of 1/16 D for the cross sections nearest to the jet orifice and a spacing of 1/4 D for the other cross sections (see figures 1 and 2). Lack of remote control of tunnel yaw made it excessively time consuming to achieve a fine measurement spacing out of the plane of flow symmetry. Measurements out of the plane of flow-symmetry were accomplished with two to four wind tunnel yaw locations of the rake of probes.

VORTEX MODELS

The contrarotating vortex pair associated with a jet in a crossflow can be modeled so that the vortex properties are inferred from selected velocity measurements (ref. 3). The velocity measurements presented in this report were utilized in these models to infer properties of the contrarotating vortex pair in the region near the jet orifice. A brief summary of the vortex models presented in reference 3 will serve to define the parameters used to describe the vortex properties and as a basis for evaluating the validity of the results obtained.

Filament Vortex Model. The strength and location of two infinite straight vortex filaments are determined by the measured velocities along the line of intersection of a cross section of measurement with the plane of flow symmetry (ZB axis). This two-dimensional filament vortex model is assumed to indicate the properties of the vortex pair at the location of the cross section. Although this model provides no description of the distribution of vorticity in the cross section, it has the advantage of requiring relatively few velocity measurements.

Diffuse Vortex Model. In the diffuse vortex model, the restriction that the vorticity be concentrated in a filament is relaxed, and it is assumed that each vortex is composed of a Gaussian distribution of vorticity. The strength, location, and diffuseness of the vortex pair is determined by many measured velocities in a cross section. A sketch of the geometry for the diffuse vortex model is shown in figure 3. The projection of the measured velocity onto the plane of the cross section is assumed to be the vector sum of the velocity induced by the contrarotating diffuse vortex pair and the component of the crossflow velocity in the plane of the cross section

$$\vec{V} = \frac{\Gamma_o}{2\pi}\left[\left(\frac{1 - e^{-\beta^2 r_1^2}}{r_1}\right)\hat{e}_{\theta_1} - \left(\frac{1 - e^{-\beta^2 r_2^2}}{r_2}\right)\hat{e}_{\theta_2}\right] - U_\infty \sin\phi_v \hat{e}_{z_v} \tag{1}$$

where Γ_o is strength of a single isolated diffuse vortex; β is the diffusion constant; r_1 and r_2 are distances to a point from the two vortex centers; $\hat{e}_{\theta_1}$, $\hat{e}_{\theta_2}$, $\hat{e}_{z_v}$; are unit vectors (see figure 3). The parameters describing vortex geometry and vortex strength in the velocity equation are varied to obtain the least squares best fit between the velocity data and the model.

For the presentation of results, it is convenient to define the following vortex properties: Effective vortex stength is defined as the flux of vorticity across the half plane $Y_v \leq 0$

$$\Gamma = \int_{-\pi/2}^{\pi/2}\int_o^\infty Y_v\, \omega(r_1\theta) r\, dr\, d\theta \tag{2}$$

where $\omega(r_1\theta)$ is the distribution of vorticity for the contrarotating pair of Gaussian vortices. Effective vortex spacing is defined as the centroid of vorticity in a half plane of the cross section

$$h = \frac{1}{\Gamma}\int_{-\pi/2}^{\pi/2}\int_o^\infty Y_v\, \omega(r_1\theta) r\, dr\, d\theta \tag{3}$$

Vortex core size (r_c is defined as the distance from the axis of a single Gaussian distribtuion of vorticity to the location of maximum tangential speed. The effective vortex strength, effective vortex spacing, and vortex core size are related to the diffuse vortex model parameters by

$$\Gamma = \Gamma_o \operatorname{erf}(\beta h_o), \quad h = h_o / \operatorname{erf}(\beta h_o), \quad r_c = 1.121/\beta \tag{4}$$

where

$$\operatorname{erf}(\beta h_o) = \frac{2}{\pi^{1/2}}\int_o^{\beta h_o} e^{-t^2}\, dt \tag{5}$$

is the error function.

RESULTS

Measured velocities and pressures are presented in the appendix. For each point of measurement the three velocity components, static pressure, and total pressure are presented in tabular form. Measurements are grouped according to jet to crossflow velocity ratio and cross section of measurement. Graphs representing the velocity measurements in the plane of flow symmetry serves to locate the cross sections of measurements. Graphs showing also indicate the measurement grid for each cross section.

The velocity measurements of the present study can be used in the diffuse vortex model (ref. 3) to extend the model-inferred vortex properties into the region near the jet orifice. Results of this analysis are shown in table 1. The five groups of cross sections are separated by horizontal lines in the table. The first three columns of the table serve to identify the test conditions by stating the effective jet to crossflow velocity ratio, the crossflow velocity and the angle of inclination of the cross section of measurement. The results of utilizing selected measured velocities from the cross section in the diffuse vortex model are displayed by stating the geometry of the vortex distribution and the vortex strength: vortex curve location (S/D, Z/D), effective vortex half-spacing (h/d), radius of vortex core (r_c/D), vortex curve cross section angle (ϕ_v), and effective vortex strength ($\tilde{\gamma} = \Gamma/2DU$). For use in the diffuse vortex model, it is desirable to acquire the velocity measurements in cross sections to the vortex curve ($\phi_B = \phi_v$). The model results, however, are not sensitive to relatively small changes in cross section angle. The vortex core radius for a Gaussian distribution of vorticity can be related to the parameter β in Eq. 1, $r_c = 1.121/\beta$. The number of velocity measurements from the cross section used in the diffuse vortex model (NPTS) were selected from the region near the intersection of the vortex curve and the cross section; velocities in the high axial velocity component jet core were avoided. The vortex properties are considered to be functions primarily of effective velocity ratio (R) and arc length along the vortex curve (S/D) measured from the jet orifice. Also presented in the table is an indication of the ability of the model to fit the experimental data as measured by the standard deviation expressed as a percentage of the maximum vortex induced velocity in the cross section (SIGMA).

The vortex properties listed in table 1 and the results of previous studies in the far field of the jet plume are shown graphically in figures 4 through 8. Vortex curves for R = 4 and R = 8 are shown in figures 4 and 5. Figure 6 presents the vortex half-spacing and figure 7, the vortex core size. The effective vortex strength for R = 4 and R = 8 is presented in figure 8. Note that the effective vortex strength for R = 8 reaches a higher maximum value than for R = 4, but that the initial development of the streamwise vortex is more rapid for R = 4 than for R = 8.

The diffuse vortex model is two-dimensional and describes streamwise vorticity only. In the region near the jet orifice it provides an incomplete description of the vorticity field. The numerical values for the vortex parameters presented in this report should then be considered as a rough description of the streamwise vorticity.

It is emphasized that the results presented in the report do not serve as an adequate description of the flow field in the near jet region. They are intended to be a "first look" to be used for planning more detailed experiments utilizing a probe system that is suitable for use in the extremely high velocity gradients encountered in this region. The results indicate that there is a rapid development of the streamwise vortex pair, but the measurement grid is not sufficiently small to calculate with sufficient precision the three-dimensional vorticity field.

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Velocity ratio R	Crossflow Velocity U_∞ (M/SEC)	Rake angle ϕ_B (DEG)	Vortex angle ϕ_V (DEG)	Vortex Curve location X/D	Vortex Curve location Z/D	Arc-length S/D	NPTS	Vortex Strength $\Gamma/2DU_\infty$	Half Spacing h/D	Core Size r_c/D	SIGMA
4.1	43.2	87.8	57.6	0.66	0.97	1.06	32	1.72	0.42	0.46	9.2
4.0	42.7	35.6	44.3	0.97	1.38	1.56	24	2.47	0.72	0.62	12.2
4.1	42.8	35.6	42.3	1.04	1.45	1.66	24	2.44	0.72	0.64	9.8
4.1	42.6	35.6	40.5	1.11	1.52	1.76	24	2.41	0.73	0.66	7.6
4.0	42.7	35.6	39.1	1.17	1.60	1.86	24	2.48	0.76	0.72	7.7
4.0	42.8	35.6	37.5	1.25	1.66	1.96	24	2.50	0.76	0.76	8.6
8.0	21.7	87.7	83.6	0.45	0.98	1.00	31	0.83	0.30	0.17	17.6
8.0	21.2	66.7	70.1	0.79	2.51	2.55	24	2.80	0.66	0.37	12.5
8.0	21.1	66.7	69.6	0.83	2.54	2.60	24	2.64	0.65	0.39	13.0
8.0	21.1	66.7	69.0	0.82	2.61	2.65	24	2.80	0.67	0.41	10.7
7.9	21.4	57.1	61.8	1.15	3.33	3.45	35	3.38	0.81	0.61	12.7
8.0	21.4	57.1	61.1	1.20	3.39	3.52	35	3.53	0.84	0.65	12.1
8.0	21.4	57.1	60.4	1.23	3.44	3.59	35	3.64	0.87	0.65	11.2
8.0	21.4	57.1	60.1	1.25	3.51	3.66	35	4.11	0.88	0.74	11.3
8.0	21.3	57.1	59.9	1.26	3.59	3.74	35	3.99	0.95	0.74	9.4

TABLE 1.-DIFFUSE VORTEX MODEL RESULTS

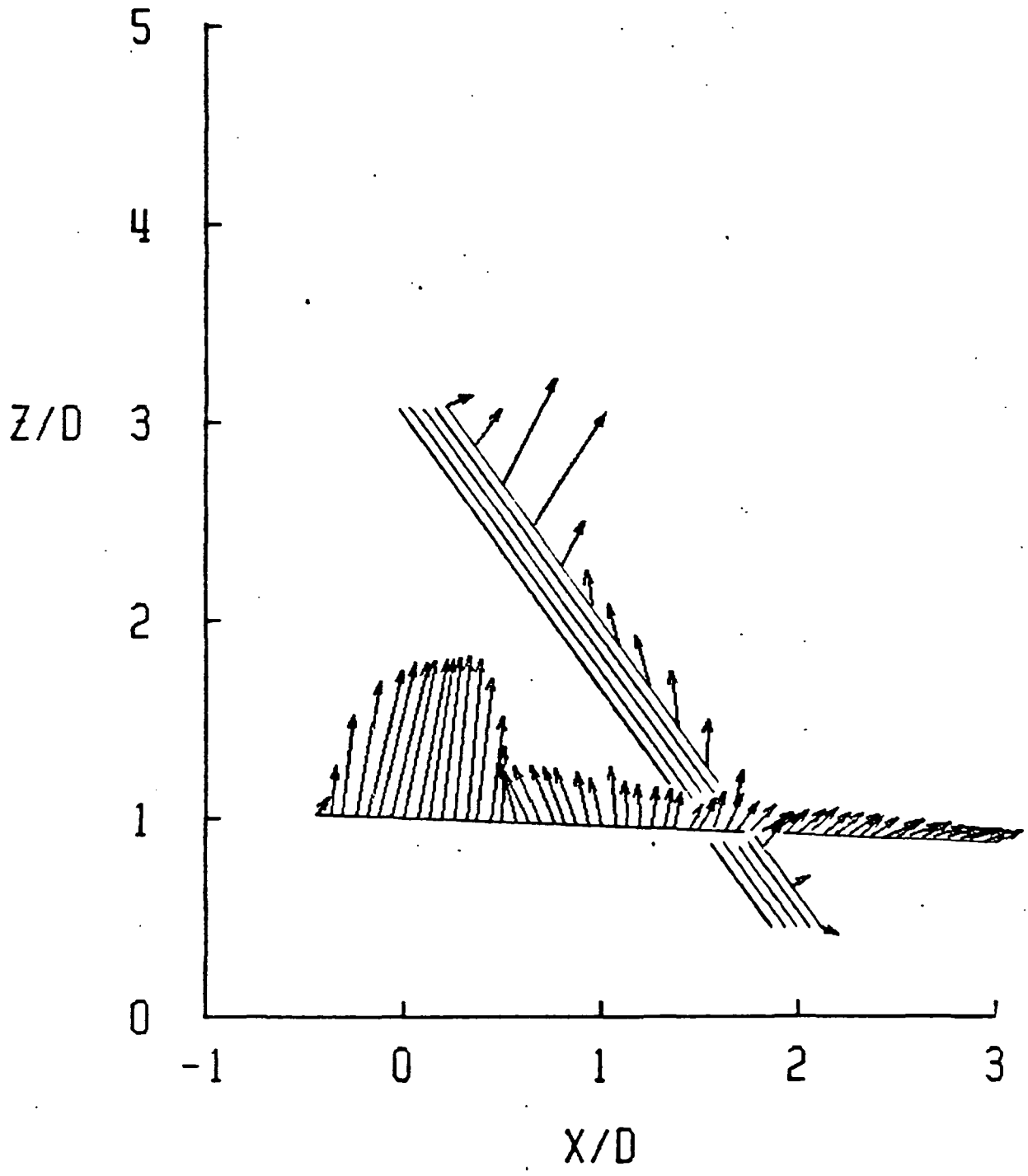


Figure 1.- Symmetry plane velocities, R=4.

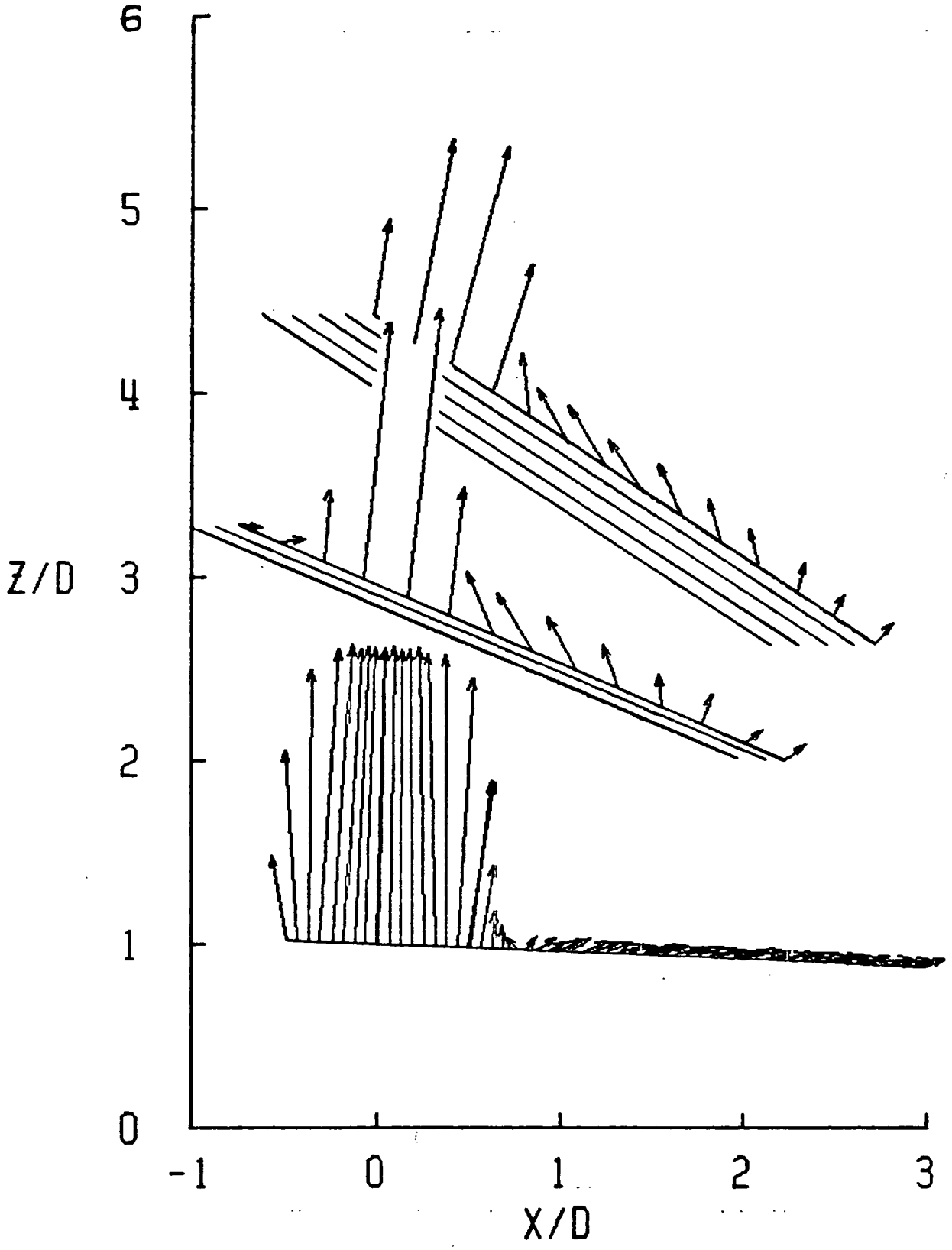


Figure 2.- Symmetry plane velocities, R=8.

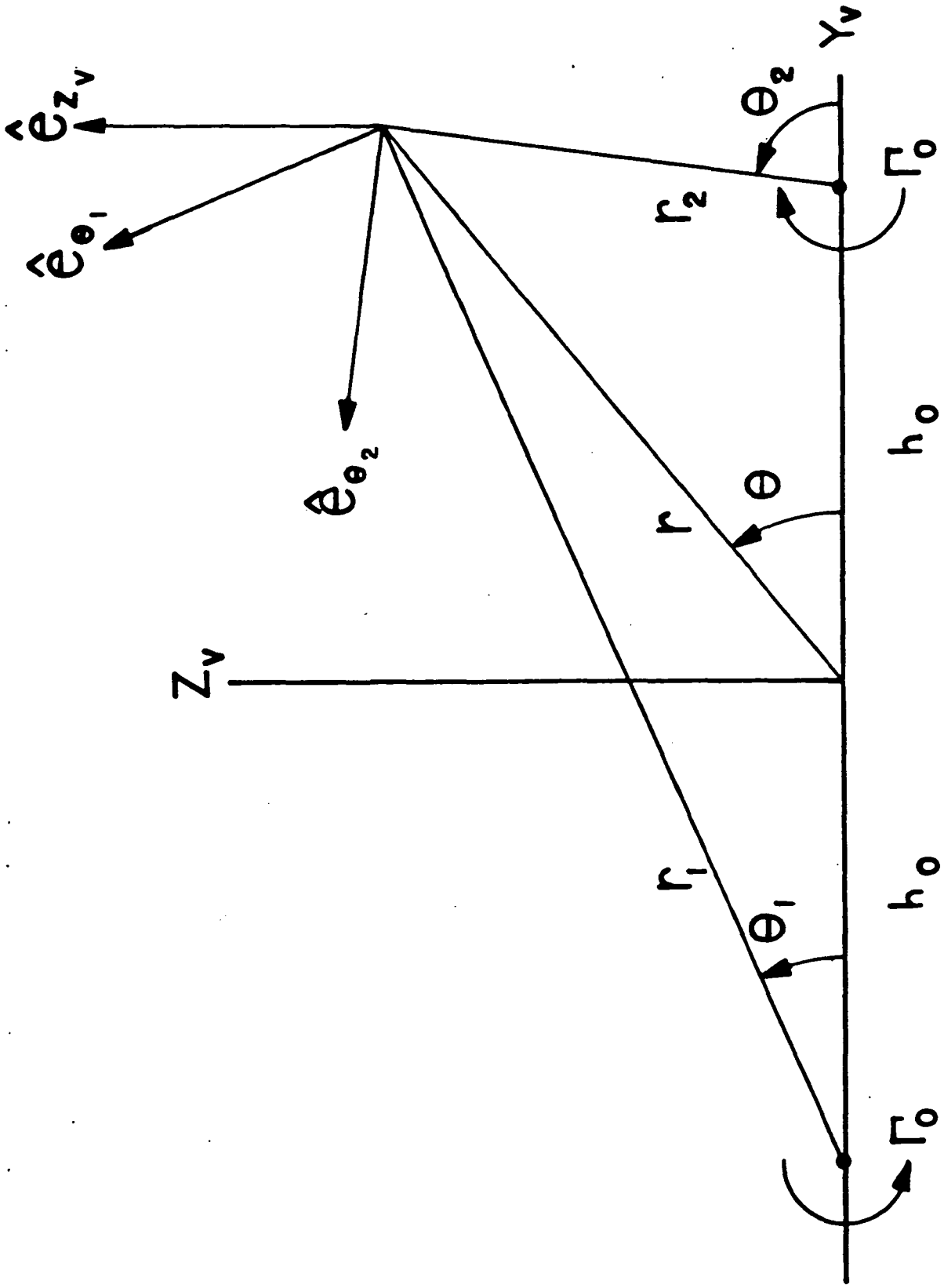


Figure 3.- Diffuse vortex model geometry.

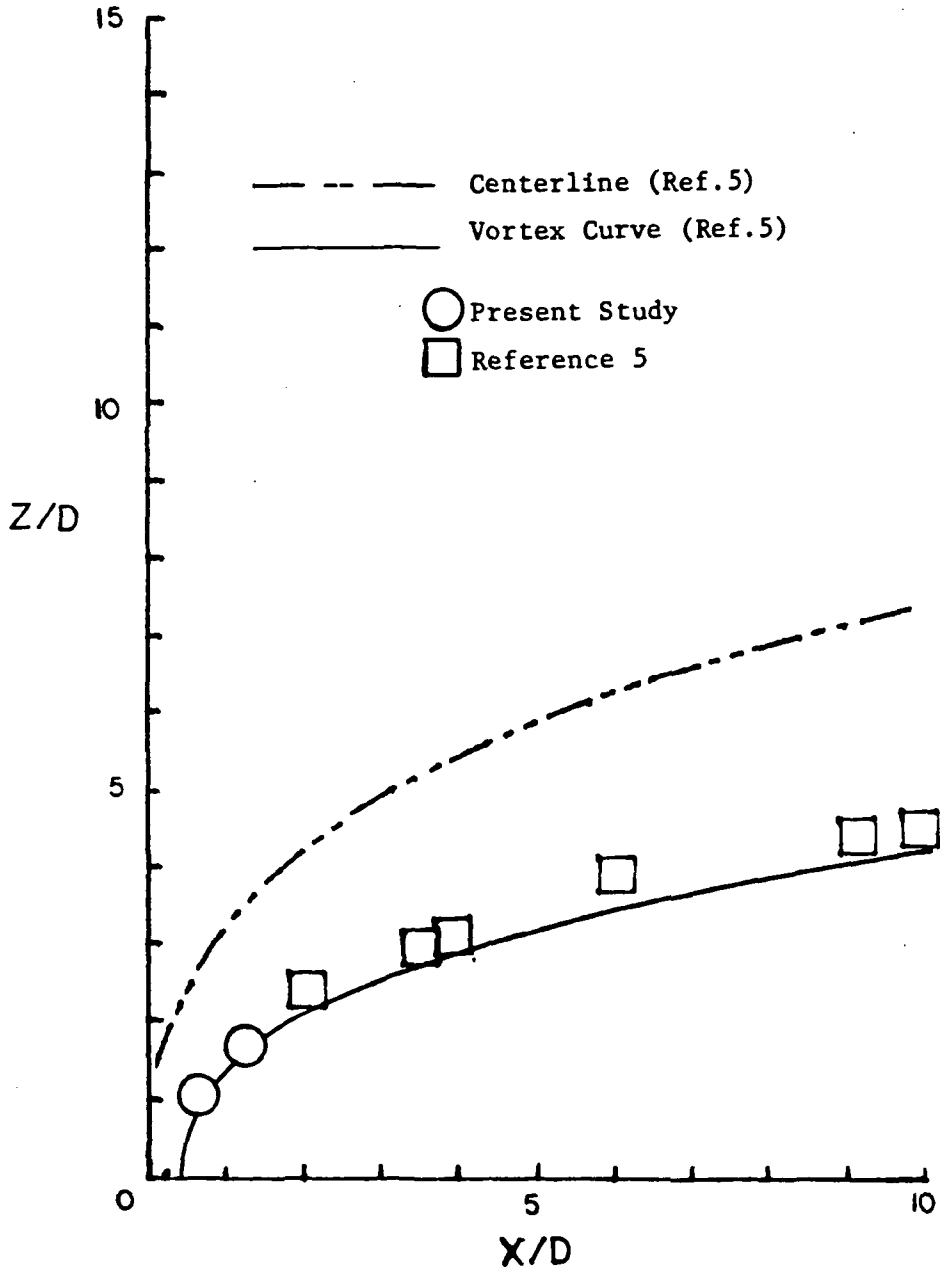


Figure 4.- Vortex curve, R=4.

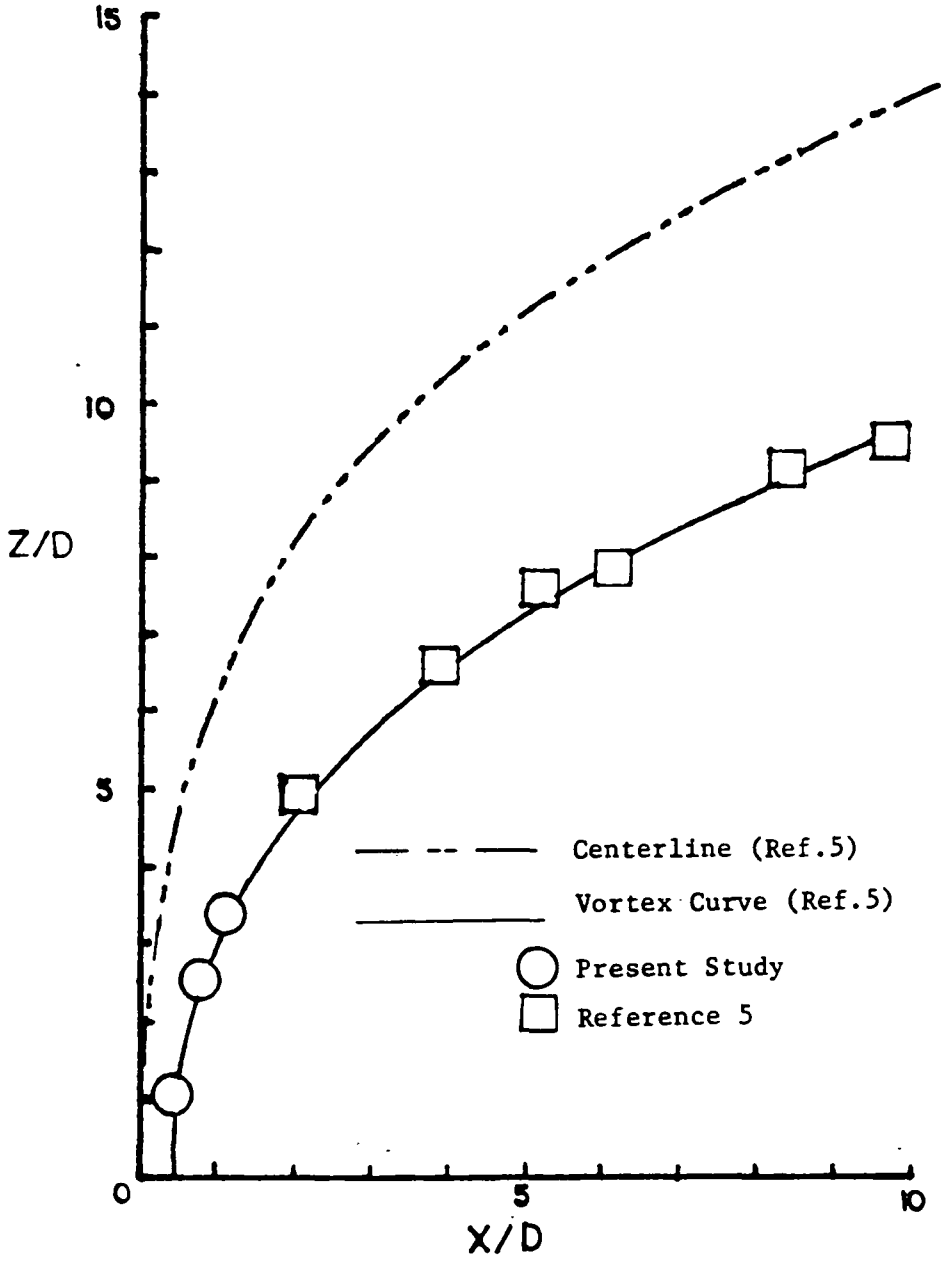


Figure 5. - Vortex curve, R=8.

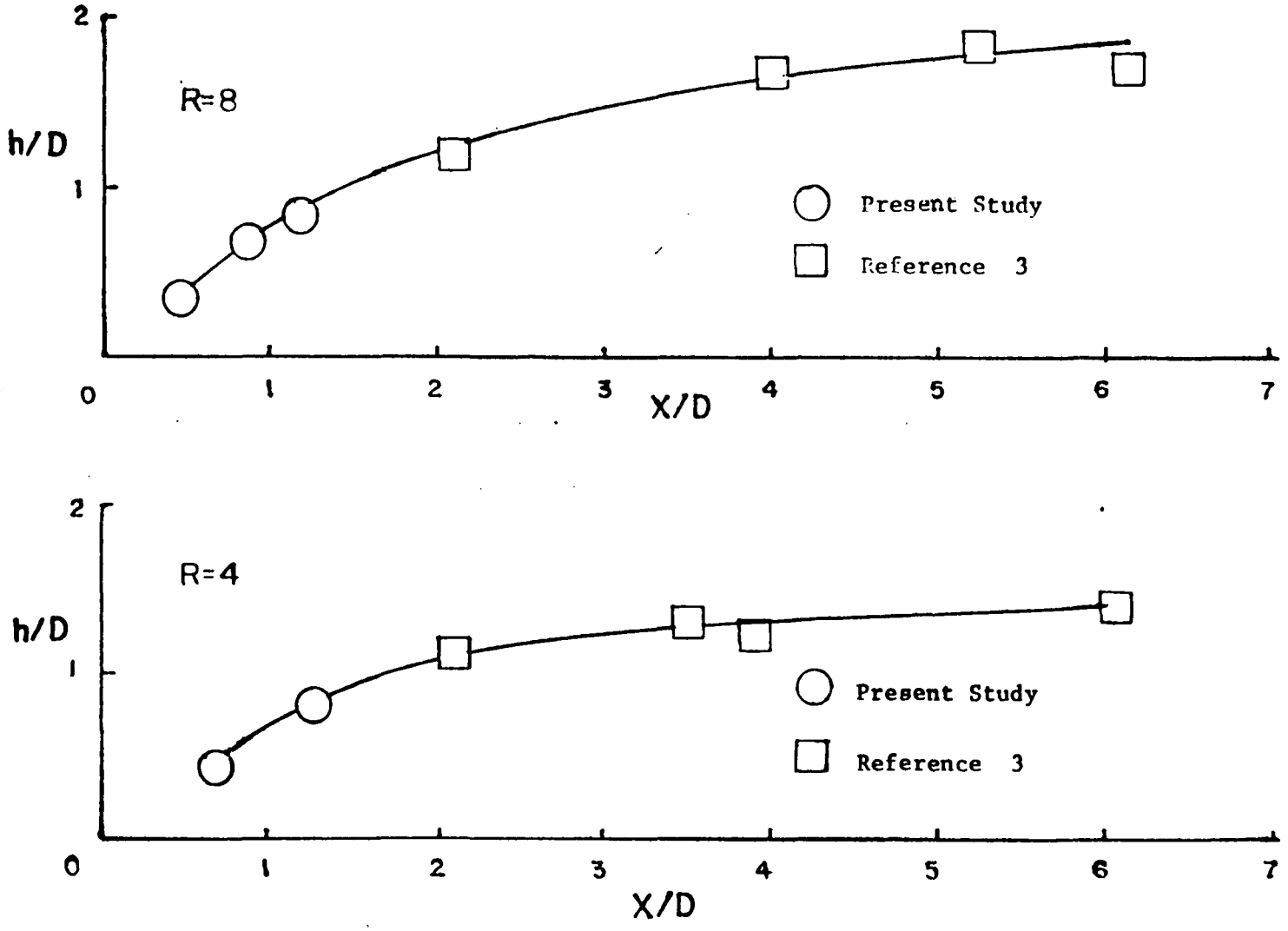


Figure 6. - Vortex half-spacing.

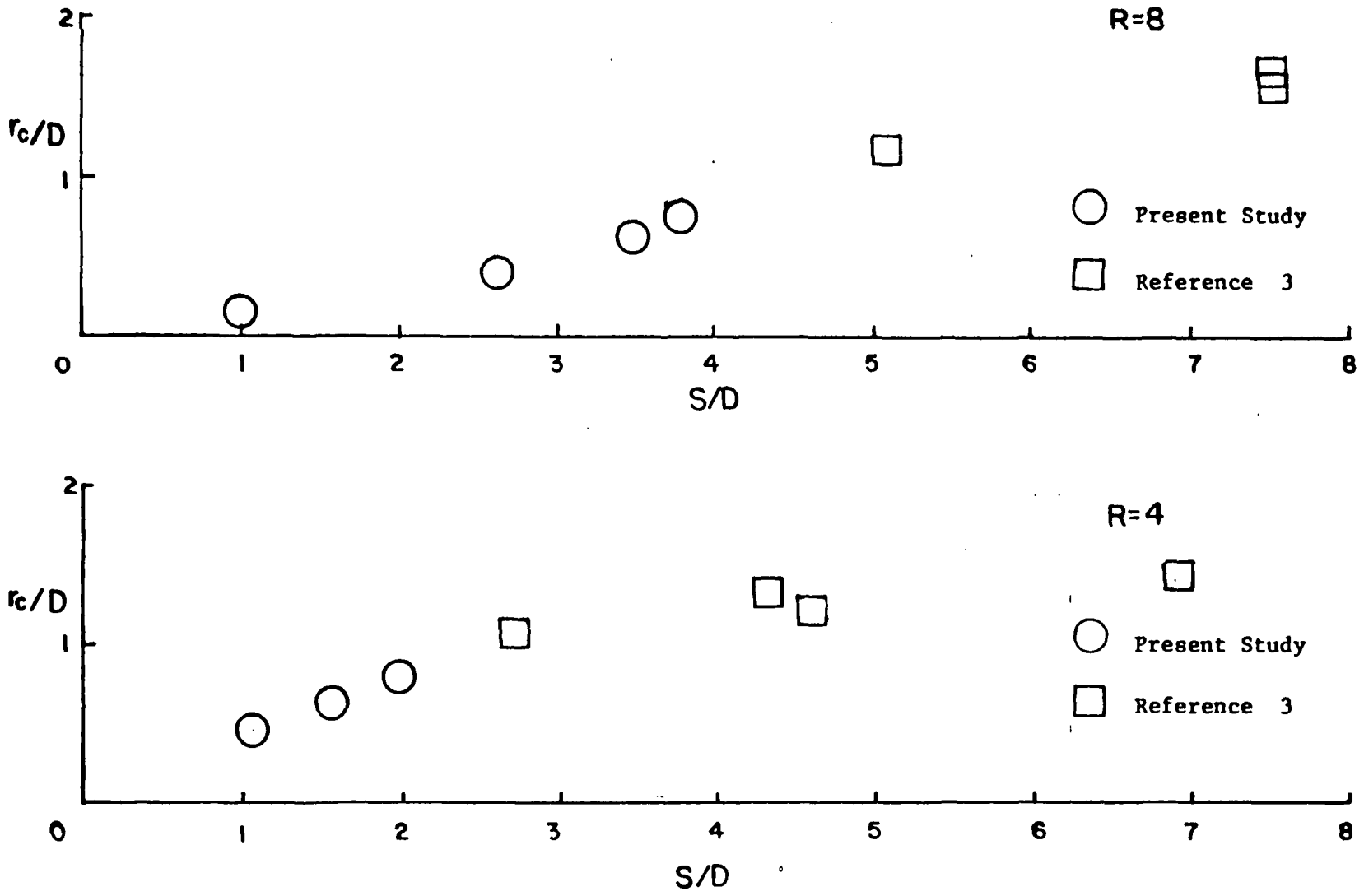


Figure 7.- Vortex core size.

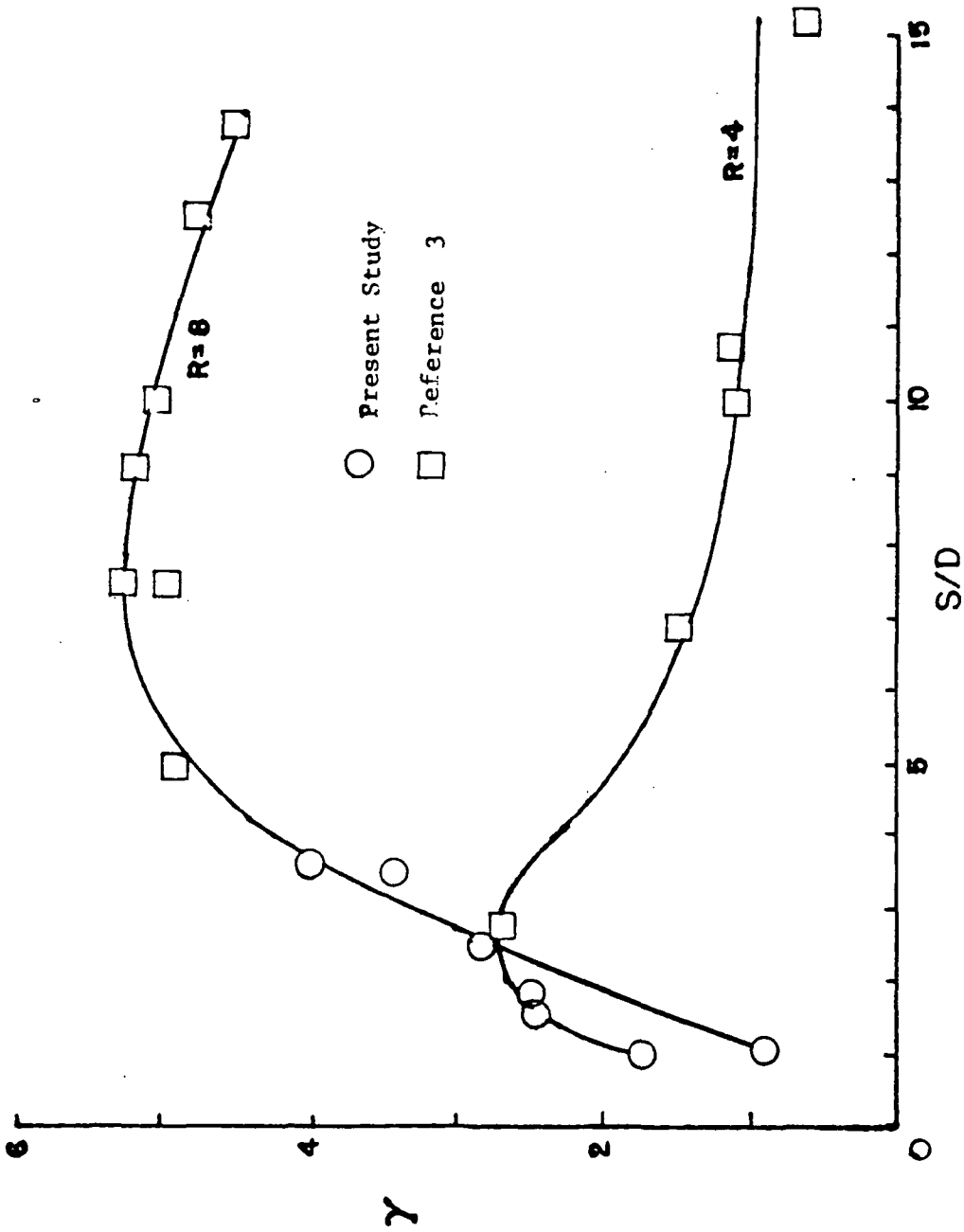


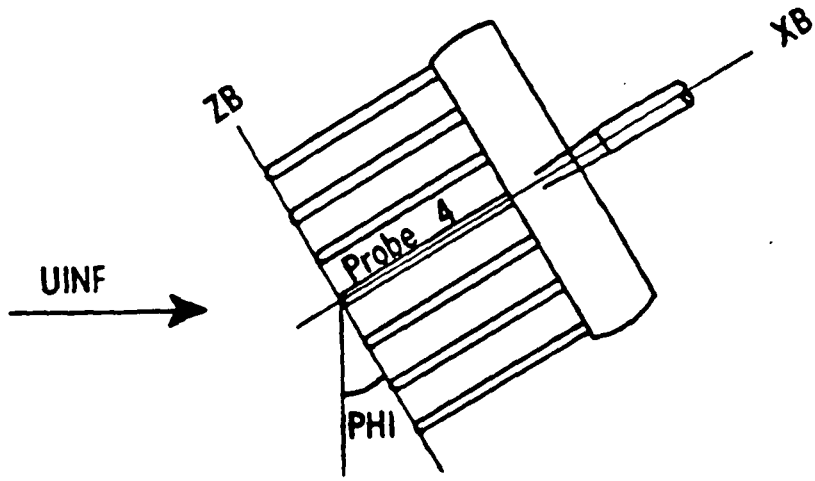
Figure 8.- Vortex strength.

APPENDIX

EXPERIMENTALLY DETERMINED VELOCITIES AND PRESSURES

Presentation of Results

The basic results of this investigation are the measured pressures and the velocities determined from them. For presentation, these measurements are grouped by cross sections of measurement. Data for R = 4 is presented first, followed by data for R = 8. For each jet to crossflow velocity ratio, cross sections are presented in order of increasing distance from the jet orifice. The results for each cross section of measurement are presented as a single figure and a correspondingly numbered table. The (a) part of the figure presents the velocity measurements in the plane of flow symmetry and serves to locate the cross section of measurement relative to the jet plume. In the (b) part of each figure are shown the projections of the measured velocities onto the cross section of measurement which serve to indicate the extent of measurement in the cross section and to illustrate the development of the contrarotating vortex pair. The correspondingly numbered table presents the numerical values for measured velocities and pressures. Multiple parts to the table, (a), (b), (c), etc. indicate overlapping placements of the rake of seven probes to provide a measurement spacing smaller than the probe spacing of the rake. The location of a cross section is given by the location of the tip of probe 4 of the rake in the wind-tunnel coordinate system (X/D,0,Z/D) and the inclination PHI of the rake with the Z-axis. The locations of points within a cross section are given by their coordinates (XB,YB,ZB) in a system obtained by rotating the wind-tunnel coordinate system through an angle PHI and locating the origin at the tip of probe 4 of the rake of seven yaw-pitch probes (See sketch). All coordinates are nondimensionalized by the jet diameter D. The velocity determined at each location in a cross section



Sketch

is specified by the three components (UB,VB,WB) relative to the coordinate system (XB,YB,ZB) and is nondimensionalized by the cross-flow speed UINF. The static and total pressures are presented as dimensionless coefficients CP and CPT.

SYMBOLS

CP	static pressure coefficient, $(p - p_\infty)/q_\infty$
CPT	total pressure coefficient, $(p_t - p_{t,\infty})/q_\infty$

Symbols (continued)

D	jet diameter, cm
PHI	angle between Z and AB axes (same as ϕ_B in main text), deg.
p	static pressure, Pa
p_t	total pressure, Pa
q	dynamic pressure, Pa
R	effective jet to crossflow velocity ratio
THETA	angle that local fluid velocity makes with probe, deg
UB,VB,WB	XB, YB and ZB components of velocity, m/zec.
UINF	cross-flow speed (same as U_∞ in main text and figures), m/s
X,Y,Z	Cartesian coordinate system; denotes wind-tunnel coordinate system when no subscript is used
XB,YB,ZB	Cartesian coordinate system fixed to rake of probes
Subscript:	
∞	refers to cross-flow condition

Index to Figures

Each figure has a corresponding table which presents the numerical values for the experimentally determined velocities and pressures.

Figure	R	PHI deg	Comments
A1	4	87.8	Cross section approximately 1 D from jet orifice
A2	4	35.6	Group of 5 closely-spaced cross sections
A3	4	35.6	
A4	4	35.6	
A5	4	35.6	
A6	4	35.6	
A7	8	87.7	Cross section approximately 1D from jet orifice
A8	8	66.7	Group of 3 closely spaced cross sections
A9	8	66.7	
A10			
A11	8	57.1	Group of 5 closely-spaced cross sections
A12	8	57.1	
A13	8	57.1	
A14	8	57.1	
A15	8	57.1	

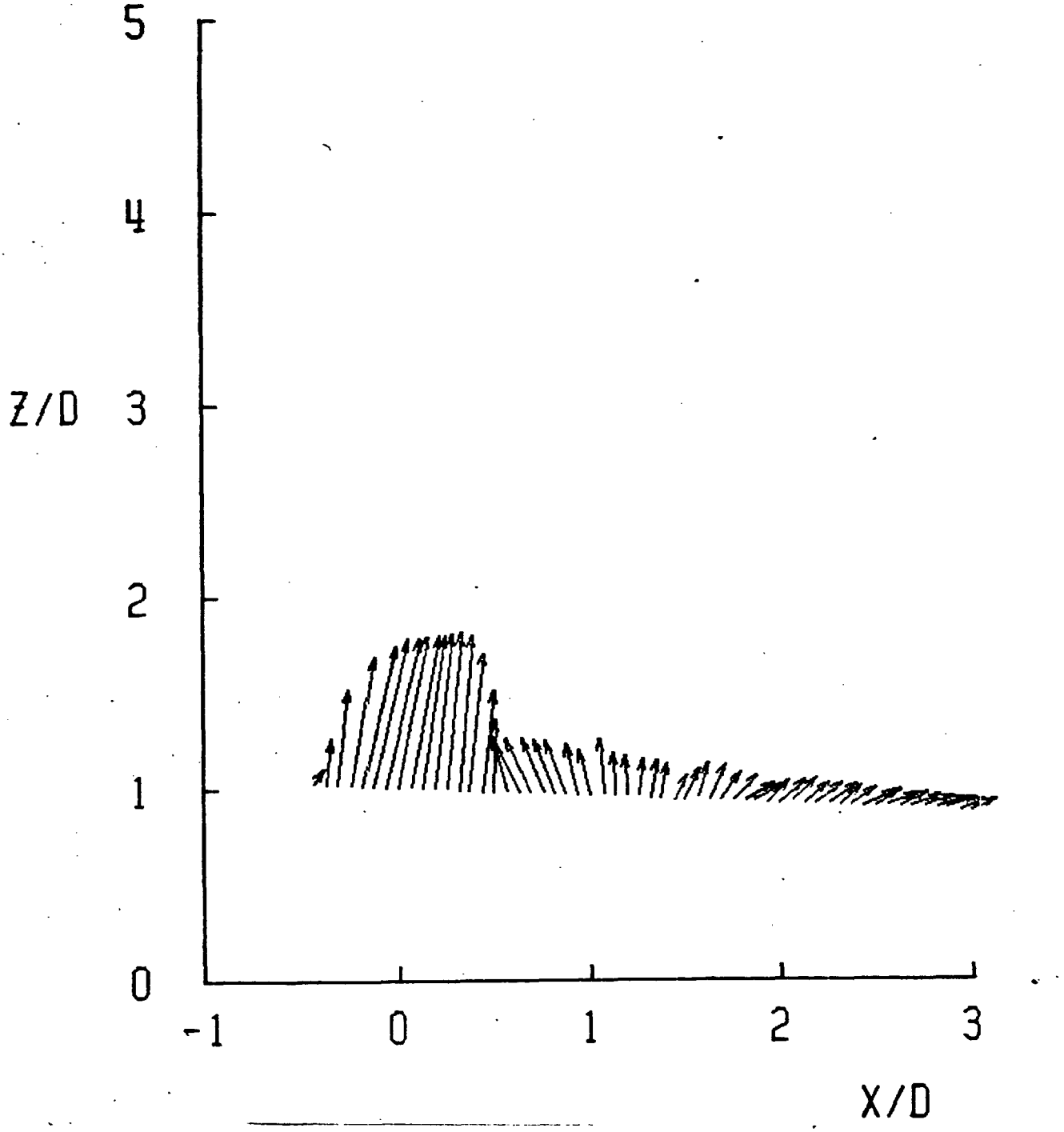


Figure Ala.-Symmetry plane velocities, R=4,
PH1 = 87.8°, cross section 1

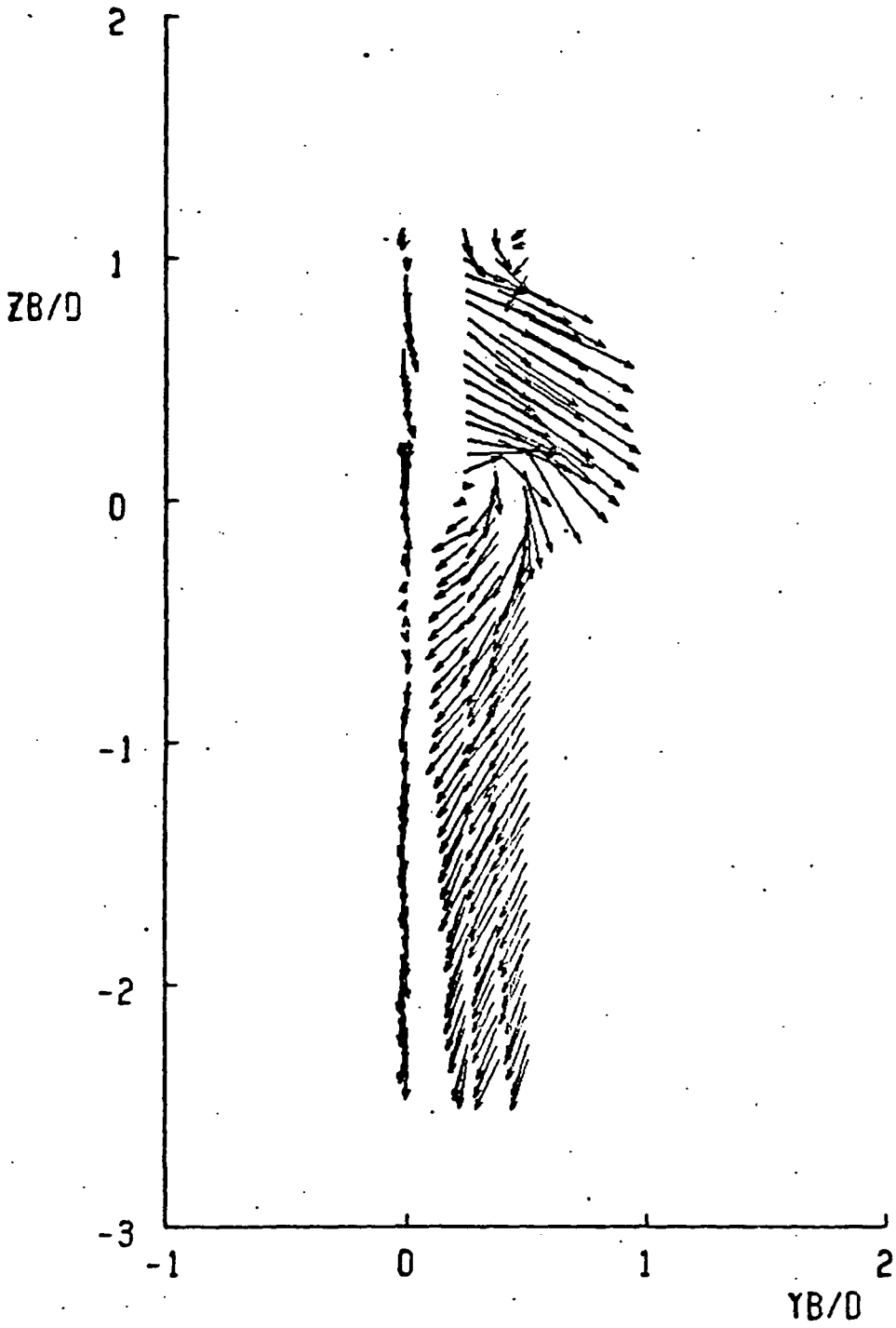


Figure A1b.- Cross-section velocities, R=4,
PH1 = 87.8°, cross-section 1

TEST CONDITIONS		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS	
R=	4.01	0.27	0.59	0.92	1.43	1.40	3.97	0.38	UB/UINF	0.28	0.44	0.59	0.80	1.19	1.91	4.02	R=	4.07
UINF=	43.2 M/S	0.10	0.03	0.0	0.05	-0.04	0.0	-0.08	VB/UINF	-0.02	-0.02	-0.14	-0.07	-0.05	0.09	0.12	UINF=	43.3 M/S
X/D=	1.07	-0.72	-0.62	-0.23	0.17	0.46	-0.58	-0.24	WB/UINF	-0.65	-0.66	-0.64	-0.35	0.34	0.03	-0.43	X/D=	1.50
Y/D=	-0.02	-0.54	-1.02	-1.74	-3.11	-4.04	-0.38	0.42	CP	-0.59	-0.83	-0.95	-1.62	-3.03	-4.14	-0.39	Y/D=	0.0
Z/D=	0.97	-0.93	-1.29	-1.83	-2.00	-2.85	15.80	-0.38	CPT	-1.07	-1.21	-1.16	-1.85	-2.48	-1.43	16.28	Z/D=	0.94
PHI=	87.8 DEG	69.4	46.2	14.2	7.0	18.3	8.3	33.5	THETA	67.4	55.9	47.9	24.3	15.9	2.7	9.1	PHI=	87.8 DEG
R=	4.01	0.36	0.52	0.92	1.13	1.28	4.03	1.23	UB/UINF									
UINF=	43.2 M/S	-0.04	-0.03	-0.04	0.04	-0.01	0.04	-0.04	VB/UINF									
X/D=	1.13	-0.71	-0.62	-0.38	0.10	-0.69	-0.44	-0.09	WB/UINF									
Y/D=	-0.02	-0.53	-0.83	-1.56	-2.57	-3.83	-0.63	-0.07	CP									
Z/D=	0.96	-0.89	-1.16	-1.57	-2.26	-3.70	15.86	0.46	CPT									
PHI=	87.8 DEG	63.4	50.1	22.4	5.4	28.3	6.3	4.7	THETA									
R=	4.01	0.29	0.50	0.71	1.06	1.39	4.07	2.53	UB/UINF									
UINF=	43.3 M/S	-0.06	-0.03	-0.02	0.0	0.04	0.02	0.02	VB/UINF									
X/D=	1.19	-0.75	-0.66	-0.50	0.07	0.71	-0.33	-0.19	WB/UINF									
Y/D=	-0.01	-0.45	-0.90	-1.26	-2.36	-3.87	-0.91	-0.66	CP									
Z/D=	0.96	-0.79	-1.20	-1.51	-2.22	-2.42	15.90	4.95	CPT									
PHI=	87.8 DEG	68.8	52.0	35.0	3.8	27.2	4.6	4.3	THETA									
R=	4.01	0.26	0.48	0.62	0.98	1.40	4.09	3.37	UB/UINF									
UINF=	43.4 M/S	-0.07	-0.03	0.0	0.02	-0.02	0.01	0.0	VB/UINF									
X/D=	1.26	-0.74	-0.71	-0.57	-0.05	0.65	-0.22	-0.47	WB/UINF									
Y/D=	-0.01	-0.40	-0.68	-1.15	-2.12	-3.78	-1.26	-0.71	CP									
Z/D=	0.96	-0.78	-0.95	-1.43	-2.16	-2.37	15.70	10.39	CPT									
PHI=	87.8 DEG	70.5	55.8	42.2	2.9	24.9	3.1	7.9	THETA									
R=	4.01	0.28	0.48	0.48	1.00	1.43	4.07	3.73	UB/UINF									
UINF=	43.5 M/S	0.0	-0.05	-0.07	0.03	-0.02	0.03	0.02	VB/UINF									
X/D=	1.32	-0.76	-0.58	-0.73	-0.12	0.62	-0.19	-0.72	WB/UINF									
Y/D=	-0.01	-0.33	-1.00	-0.77	-2.08	-3.63	-2.29	-0.12	CP									
Z/D=	0.95	-0.67	-1.47	-1.00	-2.06	-2.18	14.41	14.16	CPT									
PHI=	87.9 DEG	69.6	48.7	57.0	7.1	23.4	2.6	11.0	THETA									
R=	4.06	0.27	0.43	0.45	0.91	1.37	3.61	3.90	UB/UINF									
UINF=	43.3 M/S	-0.05	-0.04	-0.06	-0.03	-0.05	0.09	0.01	VB/UINF									
X/D=	1.37	-0.78	-0.66	-0.71	-0.14	0.57	-0.24	-0.79	WB/UINF									
Y/D=	0.0	-0.31	-0.78	-0.78	-1.89	-3.37	-3.21	0.07	CP									
Z/D=	0.95	-0.62	-1.15	-1.07	-2.03	-2.15	9.62	15.90	CPT									
PHI=	87.8 DEG	70.8	57.1	57.7	8.8	22.6	4.1	11.4	THETA									
R=	4.05	0.28	0.41	0.58	0.63	1.35	2.67	3.95	UB/UINF									
UINF=	43.3 M/S	-0.12	-0.05	-0.10	-0.04	0.01	0.01	0.08	VB/UINF									
X/D=	1.44	-0.63	-0.81	-0.53	-0.33	0.38	-0.21	-0.73	WB/UINF									
Y/D=	0.0	-0.70	-0.45	-1.11	-1.72	-3.24	-3.77	-0.16	CP									
Z/D=	0.94	-1.28	-0.61	-1.49	-2.21	-2.25	2.62	16.01	CPT									
PHI=	87.8 DEG	66.2	63.3	42.9	27.9	15.9	4.6	10.6	THETA									

TABLE A1. TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=4 AND PHI = 87.8°, CROSS-SECTION 1

(a) Y/D = 0.0

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	4.04		0.33	0.57	0.74	1.08	1.77	3.95	0.09	UB/UINF	0.20	0.38	0.54	0.81	1.20	1.92	3.91	R=	4.05	
UINF=	43.4	M/S	-0.25	-0.38	-0.56	-0.59	0.62	1.06	0.12	VB/UINF	-0.14	-0.30	-0.40	-0.59	-0.56	1.09	1.00	UINF=	43.3	M/S
X/D=	1.07		-0.83	-0.78	-0.65	-0.48	0.24	-0.83	-0.47	WB/UINF	-0.79	-0.83	-0.80	-0.66	-0.38	0.05	-0.96	X/D=	1.50	
Y/D=	0.23		-0.37	-0.89	-1.61	-3.46	-7.18	-0.65	0.12	CP	-0.38	-0.46	-0.79	-1.77	-4.23	-6.68	-0.56	Y/D=	0.25	
Z/D=	1.00		-0.51	-0.81	-1.32	-2.70	-4.55	16.96	-0.64	CPT	-0.65	-0.54	-0.70	-1.34	-3.33	-2.71	16.63	Z/D=	0.97	
PHI=	87.7	DEG	68.9	56.7	49.1	35.3	20.5	18.8	79.1	THETA	71.2	67.0	58.9	47.6	29.6	29.6	18.6	PHI=	87.7	DEG
R=	4.03		0.35	0.48	0.61	1.05	1.63	3.98	0.17	UB/UINF										
UINF=	43.4	M/S	-0.29	-0.35	-0.61	-0.58	0.16	1.15	0.32	VB/UINF										
X/D=	1.13		-0.78	-0.83	-0.78	-0.54	0.0	-0.78	-0.55	WB/UINF										
Y/D=	0.23		-0.48	-0.66	-1.09	-3.24	-7.21	-0.85	0.08	CP										
Z/D=	1.00		-0.65	-0.62	-0.75	-2.49	-5.50	17.23	-0.49	CPT										
PHI=	87.7	DEG	65.4	62.2	57.8	37.0	5.4	19.2	75.2	THETA										
R=	4.05		0.33	0.54	0.70	0.94	1.47	4.02	0.40	UB/UINF										
UINF=	43.3	M/S	-0.29	-0.30	-0.47	-0.63	-0.15	1.27	0.45	VB/UINF										
X/D=	1.19		-0.81	-0.77	-0.75	-0.62	-0.07	-0.69	-0.41	WB/UINF										
Y/D=	0.23		-0.34	-0.88	-1.28	-2.79	-6.80	-1.37	-0.29	CP										
Z/D=	0.99		-0.49	-0.90	-0.99	-2.11	-5.60	17.23	-0.55	CPT										
PHI=	87.7	DEG	69.2	56.8	51.8	43.2	6.4	19.7	62.6	THETA										
R=	4.02		0.27	0.47	0.66	0.96	1.26	3.82	1.26	UB/UINF										
UINF=	43.3	M/S	-0.31	-0.41	-0.47	-0.53	-0.33	1.39	0.95	VB/UINF										
X/D=	1.25		-0.80	-0.82	-0.71	-0.54	-0.24	-0.68	-0.30	WB/UINF										
Y/D=	0.24		-0.24	-0.52	-1.20	-2.75	-5.95	-2.11	-0.59	CP										
Z/D=	0.99		-0.43	-0.46	-1.12	-2.25	-5.18	15.03	1.01	CPT										
PHI=	87.7	DEG	72.4	63.1	52.0	38.5	18.1	21.9	38.4	THETA										
R=	4.04		0.35	0.51	0.66	0.84	1.14	3.35	2.45	UB/UINF										
UINF=	43.3	M/S	-0.23	-0.28	-0.45	-0.57	-0.55	1.49	1.11	VB/UINF										
X/D=	1.32		-0.77	-0.77	-0.71	-0.64	-0.31	-0.66	-0.45	WB/UINF										
Y/D=	0.24		-0.48	-0.77	-1.22	-2.30	-5.22	-2.90	-0.98	CP										
Z/D=	0.98		-0.71	-0.84	-1.06	-1.85	-4.59	10.61	5.64	CPT										
PHI=	87.7	DEG	66.2	58.4	51.9	45.5	29.0	25.8	25.9	THETA										
R=	4.05		0.35	0.42	0.55	0.78	1.36	2.83	3.32	UB/UINF										
UINF=	43.2	M/S	-0.25	-0.29	-0.44	-0.59	-0.49	1.57	1.07	VB/UINF										
X/D=	1.37		-0.73	-0.85	-0.85	-0.71	-0.41	-0.52	-0.58	WB/UINF										
Y/D=	0.24		-0.53	-0.51	-0.76	-1.93	-5.17	-3.44	-1.47	CP										
Z/D=	0.99		-0.90	-0.53	-0.54	-1.45	-3.89	6.79	10.67	CPT										
PHI=	87.7	DEG	66.0	64.8	60.2	50.0	25.1	30.2	20.0	THETA										
R=	4.04		0.25	0.39	0.53	0.82	1.25	2.11	3.78	UB/UINF										
UINF=	43.3	M/S	-0.22	-0.37	-0.45	-0.54	-0.50	1.48	1.01	VB/UINF										
X/D=	1.44		-0.91	-0.79	-0.81	-0.65	-0.42	-0.24	-0.76	WB/UINF										
Y/D=	0.25		0.08	-0.50	-0.75	-1.99	-4.66	-4.46	-1.12	CP										
Z/D=	0.99		0.03	-0.59	-0.60	-1.61	-3.65	1.44	14.80	CPT										
PHI=	87.7	DEG	75.4	65.9	60.3	45.8	27.9	35.3	18.4	THETA										

TABLE A1. Continued

(b) Y/D = 0.25

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	4.07		0.36	0.44	0.70	0.87	1.08	3.89	0.07	UB/UINF	0.26	0.37	0.46	0.62	0.90	1.43	3.62	R=	4.07	
UINF=	43.3	M/S	-0.36	-0.51	-0.54	-0.66	0.08	1.36	0.02	VB/UINF	-0.39	-0.39	-0.49	-0.52	-0.54	0.81	1.40	UINF=	43.1	M/S
X/D=	1.07		-0.84	-0.86	-0.67	-0.66	-0.71	-0.93	-0.31	WB/UINF	-0.82	-0.88	-0.94	-0.93	-0.78	-0.85	-0.86	X/D=	1.50	
Y/D=	0.36		-0.29	-0.62	-1.74	-3.19	-7.11	-1.39	-0.43	CP	-0.08	-0.30	-0.47	-1.50	-3.61	-6.47	-1.31	Y/D=	0.38	
Z/D=	0.97		-0.33	-0.41	-1.51	-2.55	-6.41	16.74	-1.33	CPT	-0.19	-0.23	-0.13	-0.96	-2.90	-6.38	14.52	Z/D=	0.94	
PHI=	87.7	DEG	69.3	66.4	50.9	47.0	33.5	22.9	77.3	THETA	74.3	69.0	66.8	59.8	46.7	39.4	24.3	PHI=	87.7	DEG
R=	4.04		0.37	0.46	0.63	0.75	1.12	3.95	0.11	UB/UINF										
UINF=	43.2	M/S	-0.36	-0.45	-0.57	-0.56	-0.18	1.45	0.24	VB/UINF										
X/D=	1.13		-0.80	-0.83	-0.70	-0.82	-0.85	-0.92	-0.42	WB/UINF										
Y/D=	0.36		-0.40	-0.73	-1.50	-2.81	-6.70	-1.40	-0.54	CP										
Z/D=	0.96		-0.49	-0.62	-1.27	-2.26	-5.69	17.10	-1.29	CPT										
PHI=	87.7	DEG	67.0	63.8	55.1	53.1	37.8	23.4	77.4	THETA										
R=	4.03		0.32	0.46	0.65	0.75	1.08	3.88	0.20	UB/UINF										
UINF=	43.3	M/S	-0.35	-0.41	-0.48	-0.42	-0.44	1.54	0.54	VB/UINF										
X/D=	1.19		-0.79	-0.81	-0.80	-0.79	-0.57	-0.95	-0.54	WB/UINF										
Y/D=	0.36		-0.29	-0.69	-1.33	-2.53	-6.25	-2.13	-0.59	CP										
Z/D=	0.96		-0.43	-0.65	-1.03	-2.16	-5.55	16.64	-0.96	CPT										
PHI=	87.7	DEG	69.5	62.9	55.2	50.4	33.9	24.0	74.9	THETA										
R=	4.03		0.32	0.38	0.49	0.69	1.01	3.51	0.61	UB/UINF										
UINF=	43.4	M/S	-0.37	-0.41	-0.48	-0.57	-0.46	1.62	1.01	VB/UINF										
X/D=	1.26		-0.80	-0.82	-0.87	-0.77	-0.65	-1.02	-0.51	WB/UINF										
Y/D=	0.36		-0.24	-0.32	-0.92	-2.35	-5.60	-2.81	-0.67	CP										
Z/D=	0.96		-0.39	-0.15	-0.70	-1.95	-4.94	13.23	0.0	CPT										
PHI=	87.7	DEG	70.1	69.3	64.5	54.3	38.4	29.5	61.8	THETA										
R=	4.03		0.32	0.45	0.60	0.73	0.80	3.17	1.33	UB/UINF										
UINF=	43.4	M/S	-0.39	-0.43	-0.52	-0.51	-0.50	1.56	1.20	VB/UINF										
X/D=	1.32		-0.77	-0.77	-0.69	-0.86	-0.77	-0.93	-0.56	WB/UINF										
Y/D=	0.37		-0.29	-0.66	-1.27	-2.86	-4.78	-3.75	-1.14	CP										
Z/D=	0.95		-0.43	-0.67	-1.16	-1.52	-4.29	9.32	1.42	CPT										
PHI=	87.7	DEG	69.5	63.1	55.2	54.0	48.9	29.8	44.8	THETA										
R=	4.03		0.39	0.39	0.58	0.66	0.95	2.47	2.37	UB/UINF										
UINF=	43.3	M/S	-0.32	-0.46	-0.46	-0.50	-0.59	1.52	1.37	VB/UINF										
X/D=	1.37		-0.84	-0.82	-0.77	-0.97	-0.67	-0.94	-0.63	WB/UINF										
Y/D=	0.37		-0.15	-0.43	-1.19	-1.84	-4.47	-5.41	-1.66	CP										
Z/D=	0.98		-0.25	-0.39	-1.04	-1.38	-3.75	3.34	5.47	CPT										
PHI=	87.7	DEG	72.3	67.7	57.2	56.7	43.2	36.0	32.3	THETA										
R=	4.03		0.27	0.41	0.41	0.68	0.85	1.93	3.00	UB/UINF										
UINF=	43.2	M/S	-0.36	-0.36	-0.51	-0.48	-0.51	1.23	1.48	VB/UINF										
X/D=	1.44		-0.86	-0.85	-0.95	-0.72	-0.66	-0.53	-0.84	WB/UINF										
Y/D=	0.37		-0.02	-0.41	-0.44	-2.07	-3.93	-6.50	-0.81	CP										
Z/D=	0.94		-0.08	-0.39	-0.09	-1.85	-3.49	-1.84	10.63	CPT										
PHI=	87.7	DEG	73.7	66.3	69.1	51.9	44.6	34.7	29.4	THETA										

TABLE A1. Continued

(c) Y/D = 0.4

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	4.03		0.33	0.46	0.50	0.54	0.85	2.89	0.23	UB/UINF	0.28	0.39	0.44	0.51	0.81	1.58	1.97	R=	4.07	
UINF=	43.3	M/S	-0.34	-0.51	-0.59	-0.52	0.44	1.69	-0.20	VB/UINF	-0.27	-0.41	-0.61	-0.64	-0.60	0.84	1.71	UINF=	43.1	M/S
X/D=	1.07		-0.85	-0.82	-0.95	-0.97	-1.34	-1.01	-0.15	WB/UINF	-0.81	-0.88	-0.87	-0.87	-0.98	-1.45	-0.97	X/D=	1.30	
Y/D=	0.48		-0.41	-0.89	-1.30	-3.23	-4.73	-1.81	-0.55	CP	-0.37	-0.47	-0.68	-1.79	-3.52	-4.60	-1.56	Y/D=	0.50	
Z/D=	0.98		-0.45	-0.74	-0.79	-2.72	-2.98	10.06	-1.43	CPT	-0.56	-0.37	-0.36	-1.36	-2.81	-0.17	5.44	Z/D=	0.95	
PHI=	87.7	DEG	70.3	64.9	66.1	64.0	59.0	34.1	47.2	THETA	71.7	69.2	67.6	64.5	62.3	46.6	44.9	PHI=	87.7	DEG
R=	4.03		0.30	0.44	0.47	0.54	0.93	3.22	0.26	UB/UINF										
UINF=	43.4	M/S	-0.30	-0.48	-0.55	-0.58	0.26	1.79	-0.19	VB/UINF										
X/D=	1.13		-0.89	-0.82	-0.91	-0.98	-1.36	-1.10	-0.05	WB/UINF										
Y/D=	0.48		-0.21	-0.89	-1.36	-2.99	-4.79	-1.62	-0.92	CP										
Z/D=	0.98		-0.18	-0.78	-1.00	-2.29	-2.97	13.04	-1.72	CPT										
PHI=	87.7	DEG	74.6	64.1	66.0	64.9	56.1	33.1	36.5	THETA										
R=	4.03		0.33	0.42	0.46	0.59	0.64	3.43	0.18	UB/UINF										
UINF=	43.4	M/S	-0.32	-0.41	-0.69	-0.61	0.07	1.87	-0.23	VB/UINF										
X/D=	1.19		-0.89	-0.88	-0.91	-0.90	-1.30	-1.22	-0.27	WB/UINF										
Y/D=	0.49		-0.52	-0.70	-0.96	-2.73	-4.45	-1.72	-1.09	CP										
Z/D=	0.98		-0.66	-0.58	-0.44	-2.20	-3.32	15.14	-1.93	CPT										
PHI=	87.7	DEG	68.9	66.7	69.1	61.6	64.0	33.0	62.7	THETA										
R=	4.04		0.25	0.38	0.47	0.57	0.55	3.35	0.10	UB/UINF										
UINF=	43.3	M/S	-0.32	-0.48	-0.63	-0.59	-0.13	1.84	-0.35	VB/UINF										
X/D=	1.26		-0.91	-0.93	-0.86	-0.97	-1.23	-1.23	-0.58	WB/UINF										
Y/D=	0.49		-0.08	-0.42	-1.07	-2.35	-4.39	-2.45	-1.27	CP										
Z/D=	0.97		-0.08	-0.19	-0.70	-1.72	-3.53	13.74	-1.80	CPT										
PHI=	87.7	DEG	75.4	70.0	66.2	63.4	66.1	33.4	81.8	THETA										
R=	4.03		0.33	0.41	0.43	0.49	0.55	3.21	0.20	UB/UINF										
UINF=	43.3	M/S	-0.34	-0.41	-0.55	-0.66	-0.55	1.61	1.07	VB/UINF										
X/D=	1.32		-0.79	-0.87	-0.98	-1.01	-1.09	-1.28	-0.53	WB/UINF										
Y/D=	0.49		-0.47	-0.63	-0.67	-1.75	-3.94	-4.03	-0.64	CP										
Z/D=	0.97		-0.62	-0.53	-0.21	-1.05	-3.13	10.38	-0.17	CPT										
PHI=	87.7	DEG	69.0	66.8	69.3	67.7	65.7	32.6	80.2	THETA										
R=	4.04		0.28	0.36	0.49	0.55	0.58	2.76	0.59	UB/UINF										
UINF=	43.3	M/S	-0.30	-0.44	-0.50	-0.68	-0.36	1.52	1.30	VB/UINF										
X/D=	1.38		-0.80	-1.00	-0.91	-0.91	-1.18	-1.32	-0.71	WB/UINF										
Y/D=	0.49		-0.44	-0.12	-0.90	-1.92	-3.87	-4.52	-0.85	CP										
Z/D=	0.96		-0.64	0.20	-0.58	-1.31	-2.99	6.67	0.71	CPT										
PHI=	87.7	DEG	71.9	72.0	64.9	64.3	64.8	36.0	68.3	THETA										
R=	4.03		0.31	0.40	0.46	0.53	0.57	2.31	1.27	UB/UINF										
UINF=	43.2	M/S	-0.25	-0.43	-0.48	-0.67	-0.52	1.28	1.74	VB/UINF										
X/D=	1.44		-0.80	-0.88	-0.85	-0.91	-1.06	-1.35	-0.80	WB/UINF										
Y/D=	0.50		-0.42	-0.45	-0.99	-1.79	-3.60	-4.44	-0.49	CP										
Z/D=	0.96		-0.61	-0.33	-0.82	-1.22	-2.86	3.68	3.91	CPT										
PHI=	87.7	DEG	69.8	67.8	64.7	64.9	64.1	38.7	56.3	THETA										

Table A1. Concluded

(d) Y/D = 0.5

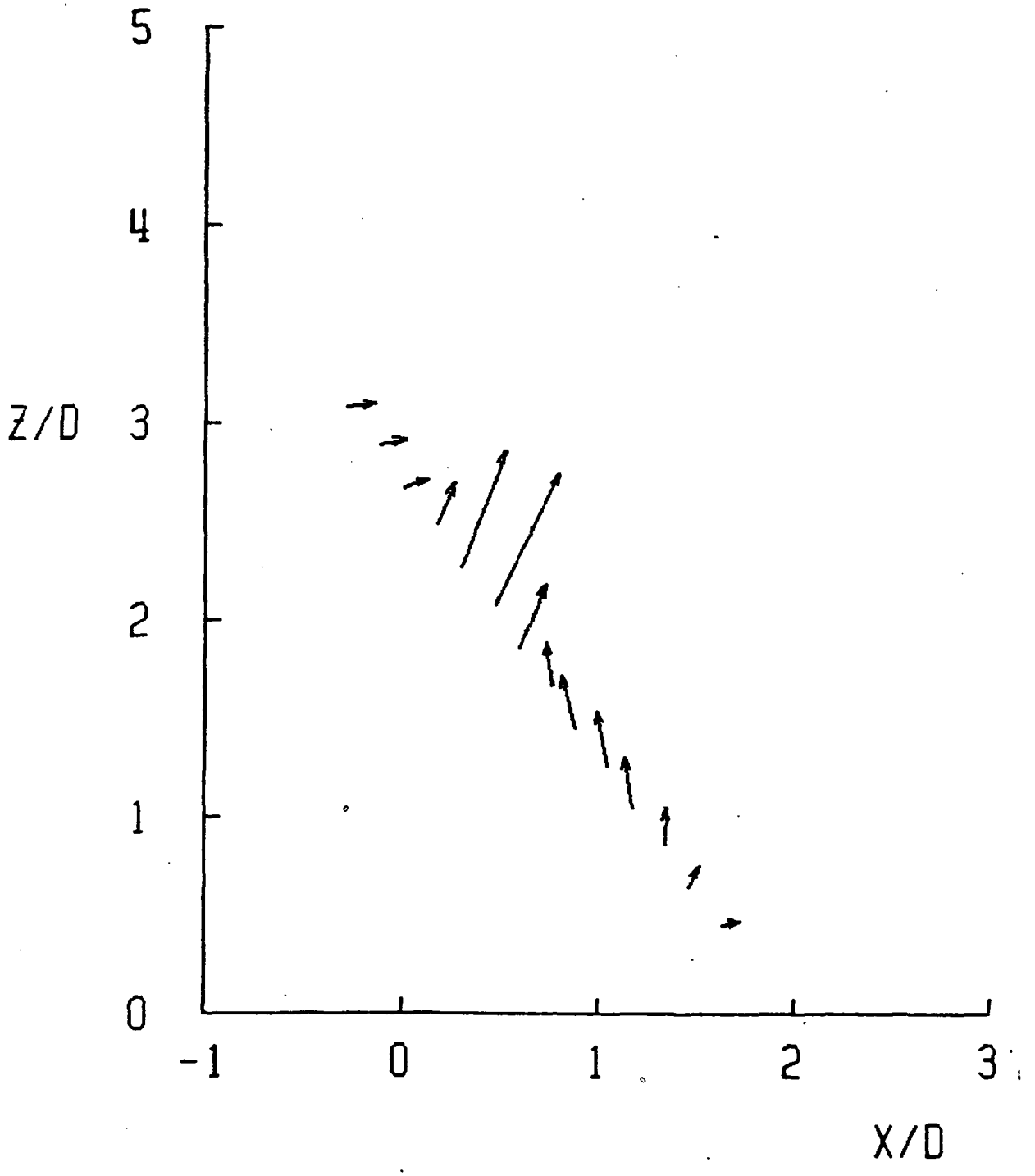


Figure A2a.- Symmetry plane velocities, R=4,
PH1 = 35.6°, cross-section 1

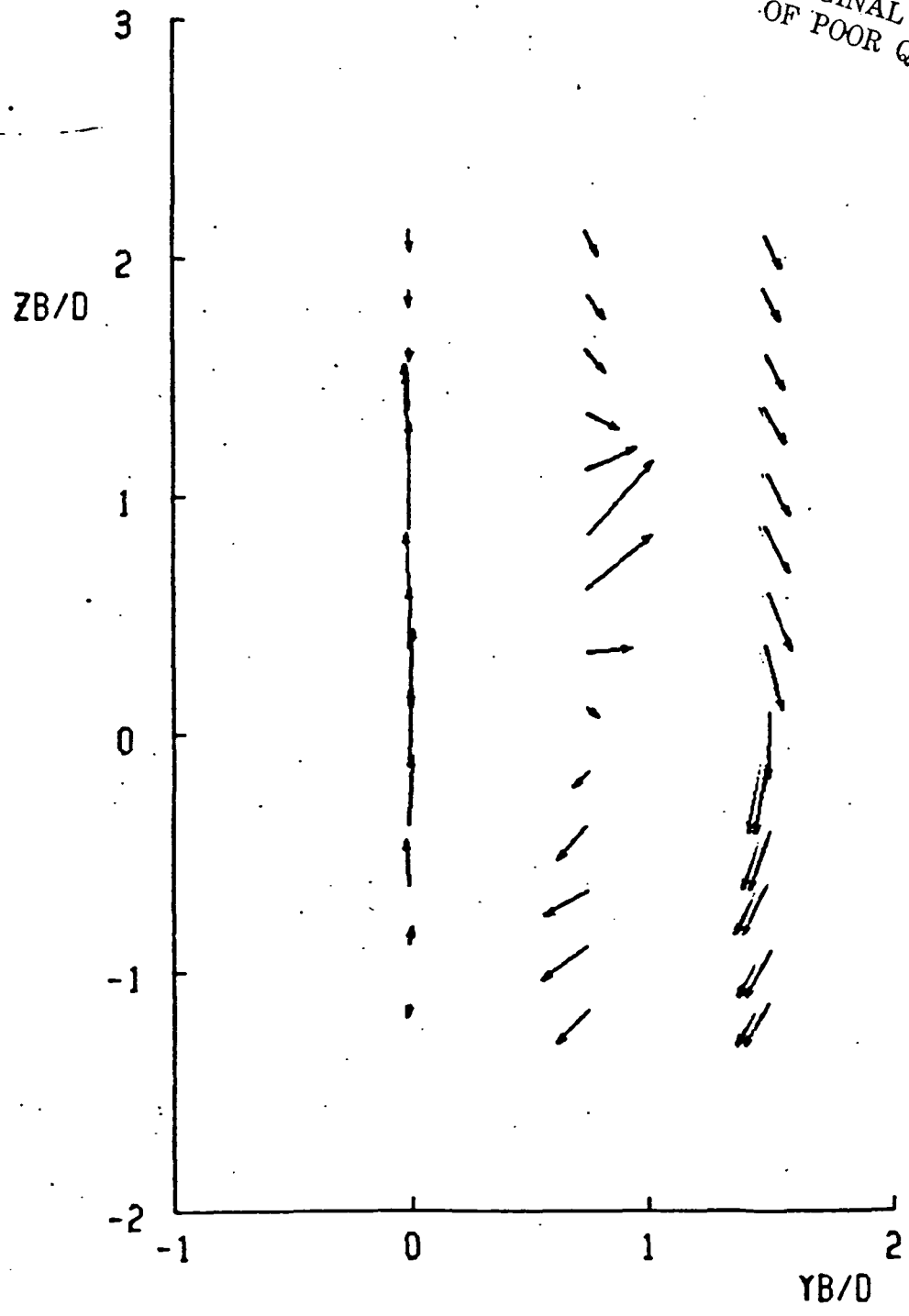


Figure A2b.- Cross-section velocities, R=4,

PHl = 35.6°, cross-section 1

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	4.03		0.58	0.61	0.49	1.50	2.64	0.62	0.64	UB/UINF
UINF=	42.5	M/S	0.05	0.03	0.07	-0.05	-0.07	-0.01	0.01	VB/UINF
X/D=	0.59		0.29	1.16	1.31	0.91	1.75	-0.20	-0.35	WB/UINF
Y/D=	-0.01		-1.19	-2.03	-2.89	-2.72	0.62	0.51	0.51	CP
Z/D=	1.86		-1.76	-1.30	-1.91	-0.60	10.04	-0.06	0.04	CPT
PHI=	35.6	DEG	26.8	62.1	69.4	31.3	33.7	18.6	28.6	THETA
R=	4.05		0.47	0.59	0.59	0.53	3.28	0.96	0.60	UB/UINF
UINF=	42.7	M/S	-0.05	-0.04	0.03	0.01	0.0	-0.05	-0.01	VB/UINF
X/D=	0.76		-0.20	0.76	1.30	0.99	1.78	0.62	-0.28	WB/UINF
Y/D=	-0.01		-1.09	-1.41	-3.02	-2.70	-1.73	-0.15	0.59	CP
Z/D=	1.67		-1.83	-1.48	-1.96	-2.43	11.98	0.17	0.03	CPT
PHI=	35.6	DEG	24.1	52.5	65.7	62.0	23.6	33.0	25.6	THETA
R=	4.01		1.00	1.25	1.09	2.79	1.22	0.67	0.66	UB/UINF
UINF=	42.3	M/S	-0.75	-0.49	0.17	1.12	0.85	0.31	0.20	VB/UINF
X/D=	0.60		-0.55	-0.54	-0.17	0.88	0.34	-0.38	-0.42	WB/UINF
Y/D=	0.74		-0.83	-3.01	-4.02	-2.62	-0.61	0.37	0.41	CP
Z/D=	1.86		0.06	-1.89	-3.75	6.59	0.75	0.06	0.06	CPT
PHI=	35.6	DEG	44.5	31.3	12.0	25.7	35.4	34.8	34.1	THETA
R=	4.03		1.00	1.18	1.18	1.36	2.86	0.73	0.62	UB/UINF
UINF=	42.4	M/S	-0.55	-0.75	-0.28	0.73	1.08	0.51	0.26	VB/UINF
X/D=	0.76		-0.53	-0.39	-0.24	0.07	1.20	-0.25	-0.39	WB/UINF
Y/D=	0.75		-0.69	-1.70	-3.93	-3.60	-1.01	-0.14	0.48	CP
Z/D=	1.64		-0.09	-0.59	-3.38	-2.18	9.24	-0.28	0.08	CPT
PHI=	35.6	DEG	38.6	37.4	18.7	26.4	28.3	36.3	35.9	THETA
R=	4.03		1.00	0.98	0.90	0.79	0.76	0.76	0.67	UB/UINF
UINF=	42.3	M/S	-0.44	-0.35	-0.03	0.37	0.36	0.29	0.23	VB/UINF
X/D=	0.61		-0.77	-0.98	-1.11	-0.97	-0.70	-0.59	-0.55	WB/UINF
Y/D=	1.49		-0.64	-0.96	-1.14	-0.62	-0.16	0.09	0.28	CP
Z/D=	1.84		0.17	0.10	-0.08	0.08	0.04	0.11	0.09	CPT
PHI=	35.6	DEG	42.2	47.0	51.1	52.2	45.5	40.2	41.1	THETA
R=	4.03		1.00	1.00	0.95	0.89	0.82	0.73	0.67	UB/UINF
UINF=	42.5	M/S	-0.42	-0.45	-0.21	0.25	0.38	0.34	0.26	VB/UINF
X/D=	0.75		-0.71	-0.85	-1.15	-1.08	-0.78	-0.61	-0.55	WB/UINF
Y/D=	1.48		-0.55	-0.88	-1.21	-1.06	-0.52	0.06	0.27	CP
Z/D=	1.67		0.14	0.08	0.07	-0.04	-0.09	0.09	0.09	CPT
PHI=	35.5	DEG	40.5	44.5	51.2	51.0	46.0	43.1	41.8	THETA

TABLE A2.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=4 AND PH1 = 35.6°, CROSS-SECTION 1

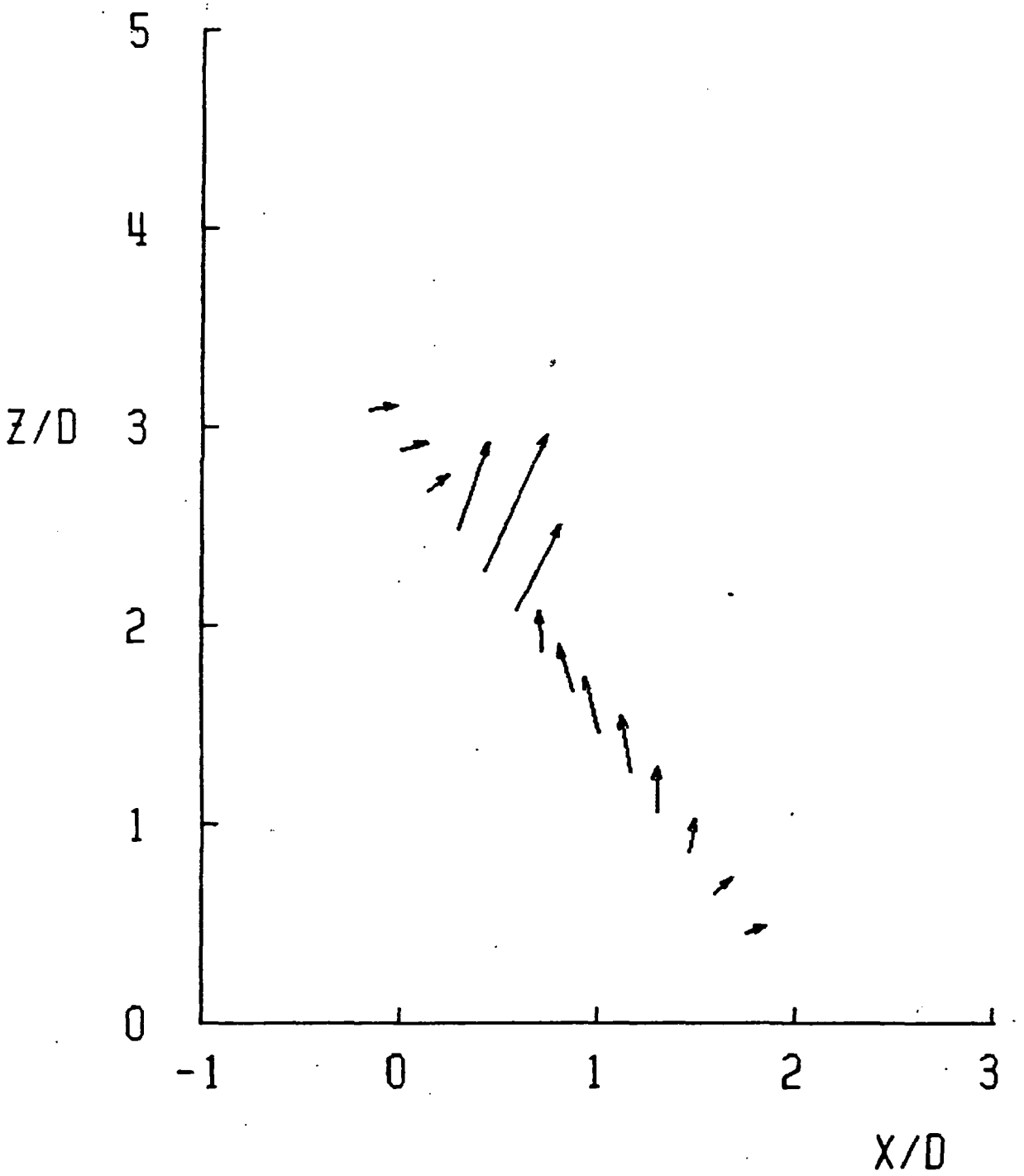


Figure A3a.- Symmetry plane velocities, R=4,

PH1 = 35.6°, cross-section 2

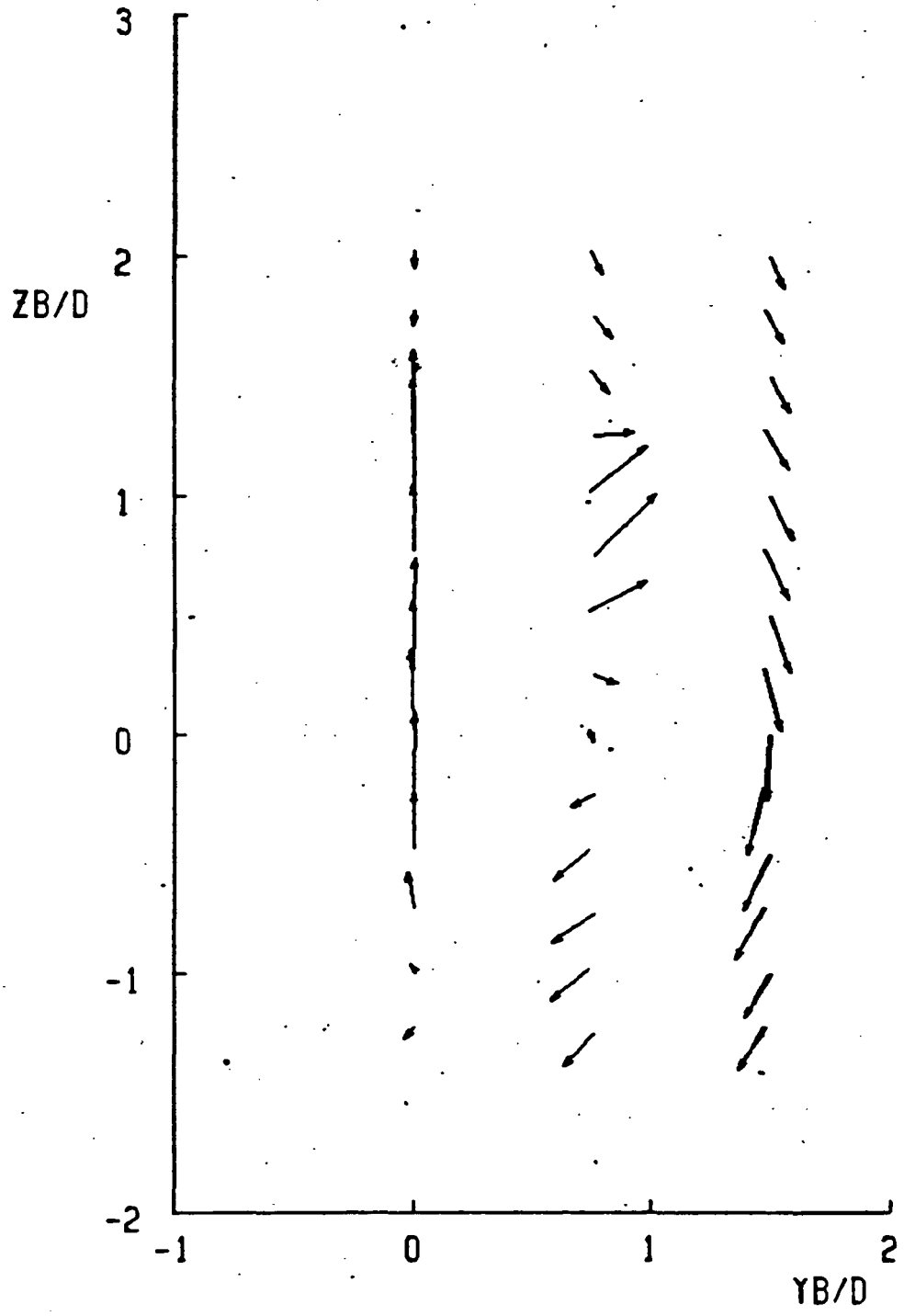


Figure A3b.- Cross-section velocities, R=4,
PH1 = 35.6°, cross-section 2

TEST CONDITIONS			ZB/D							
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	4.04		0.61	0.70	0.52	0.56	3.28	0.68	0.63	UB/UINF
UINF=	42.4	M/S	-0.04	0.02	-0.03	0.03	-0.01	-0.03	0.01	VB/UINF
X/D=	0.72		0.04	0.94	1.33	0.86	1.87	-0.03	-0.31	WB/UINF
Y/D=	0.0		-1.05	-1.96	-2.76	-2.07	-0.25	0.07	0.54	CP
Z/D=	1.87		-1.67	-1.57	-1.70	-2.03	13.83	-0.47	0.03	CPT
PHI=	35.6	DEG	6.5	53.1	68.6	56.9	29.8	5.7	26.0	THETA
R=	4.06		0.55	0.64	0.63	0.39	2.17	1.88	0.62	UB/UINF
UINF=	42.8	M/S	-0.16	-0.09	0.03	0.0	0.0	-0.01	-0.02	VB/UINF
X/D=	0.88		-0.17	0.61	1.29	1.16	1.10	1.36	-0.24	WB/UINF
Y/D=	0.0		-0.99	-1.23	-2.50	-2.47	-2.71	0.33	0.55	CP
Z/D=	1.67		-1.63	-1.44	-1.41	-1.97	2.35	4.82	0.0	CPT
PHI=	35.6	DEG	24.8	44.4	63.9	71.3	27.0	36.0	21.8	THETA
R=	4.01		1.02	1.25	1.10	2.33	1.91	0.69	0.66	UB/UINF
UINF=	42.2	M/S	-0.64	-0.60	0.06	0.98	0.96	0.32	0.21	VB/UINF
X/D=	0.72		-0.52	-0.50	-0.21	0.49	0.73	-0.37	-0.39	WB/UINF
Y/D=	0.74		-0.86	-2.55	-3.87	-2.87	-0.62	0.27	0.42	CP
Z/D=	1.86		-0.15	-1.35	-3.61	2.94	3.57	-0.02	0.05	CPT
PHI=	35.6	DEG	40.1	33.4	10.9	23.7	30.9	34.0	33.2	THETA
R=	4.03		0.91	1.04	1.09	0.86	2.99	0.94	0.65	UB/UINF
UINF=	42.5	M/S	-0.51	-0.69	-0.39	0.40	1.05	0.67	0.28	VB/UINF
X/D=	0.88		-0.54	-0.46	-0.20	-0.14	1.03	0.06	-0.36	WB/UINF
Y/D=	0.76		-0.51	-1.29	-3.56	-3.64	-1.86	-0.49	0.44	CP
Z/D=	1.64		-0.13	-0.51	-3.20	-3.71	8.74	-0.14	0.07	CPT
PHI=	35.6	DEG	40.5	40.1	23.8	24.7	24.9	33.9	34.4	THETA
R=	4.03		1.02	1.04	0.97	0.87	0.79	0.75	0.70	UB/UINF
UINF=	42.4	M/S	-0.40	-0.42	-0.05	0.34	0.38	0.33	0.23	VB/UINF
X/D=	0.73		-0.73	-0.93	-1.10	-0.95	-0.72	-0.60	-0.53	WB/UINF
Y/D=	1.50		-0.67	-1.02	-1.34	-0.99	-0.29	0.09	0.23	CP
Z/D=	1.64		0.09	0.14	-0.17	-0.22	0.0	0.14	0.07	CPT
PHI=	35.6	DEG	39.9	44.9	48.8	48.7	45.3	41.7	39.3	THETA
R=	4.03		0.96	0.97	0.98	0.95	0.84	0.73	0.70	UB/UINF
UINF=	42.5	M/S	-0.42	-0.47	-0.28	0.26	0.38	0.38	0.29	VB/UINF
X/D=	0.88		-0.70	-0.85	-1.10	-1.03	-0.82	-0.65	-0.54	WB/UINF
Y/D=	1.48		-0.47	-0.77	-1.27	-1.35	-0.68	0.03	0.21	CP
Z/D=	1.67		0.13	0.13	-0.01	-0.29	-0.14	0.13	0.07	CPT
PHI=	35.5	DEG	41.0	45.5	49.6	47.9	46.6	45.1	40.4	THETA

TABLE A3.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=4 AND PHI = 35.6°, Cross-SECTION 2

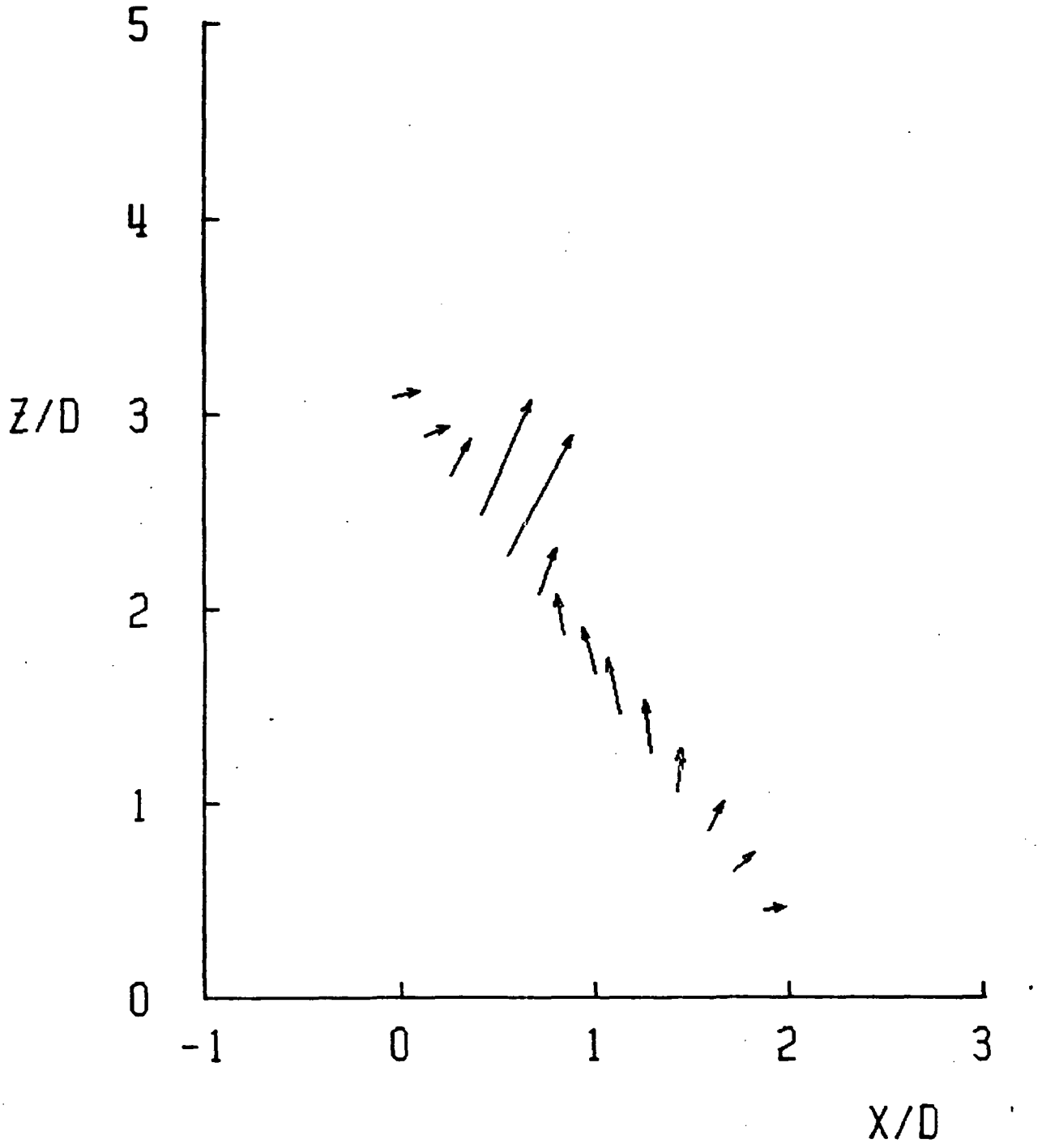


Figure A4a.- Symmetry plane velocities, R=4,
PH1 = 35.6°, cross-section 3

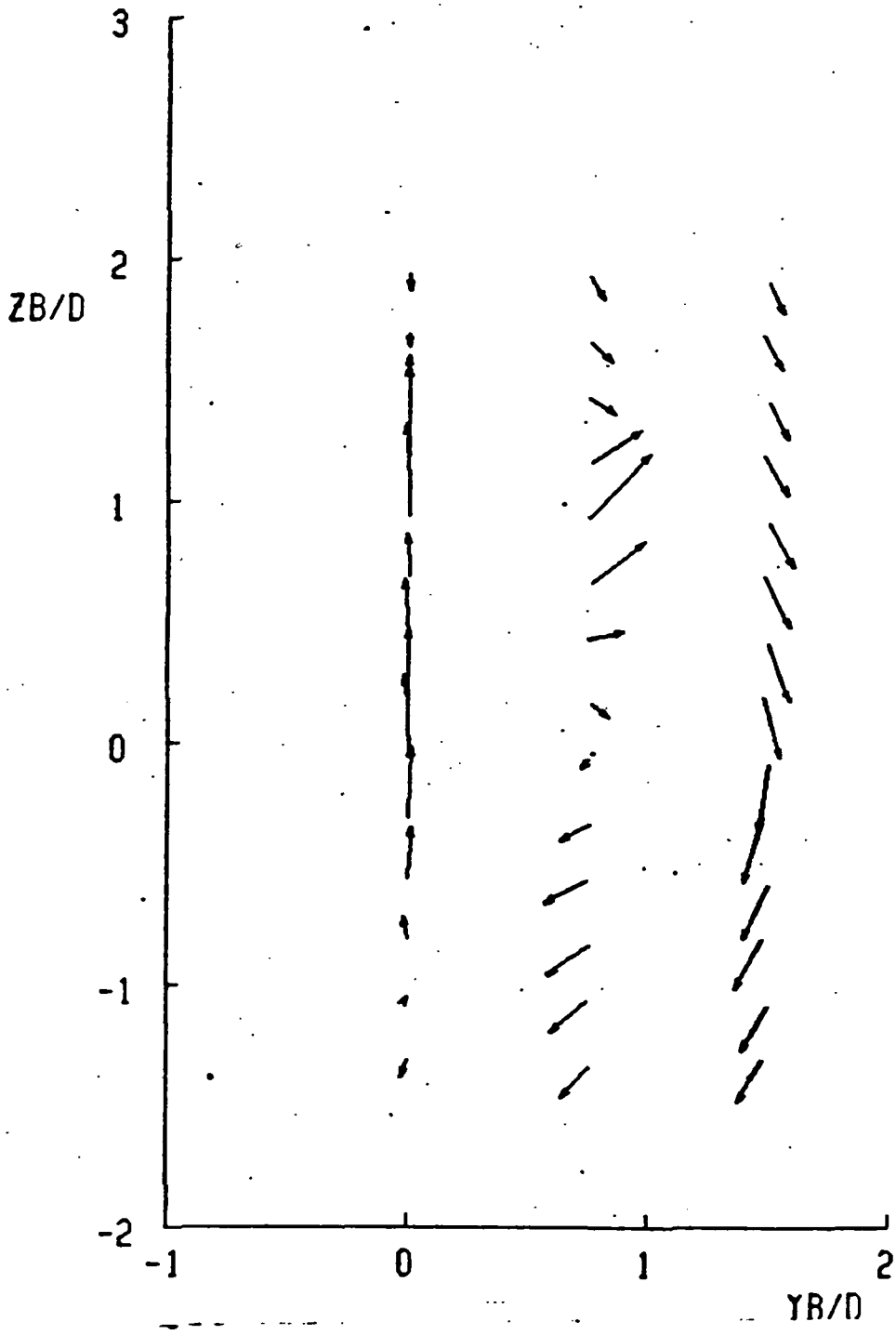


Figure A4b.- Cross-section velocities, R=4,
PH1 = 35.6°, cross-section 3

TEST CONDITIONS			ZB/D							
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	4.01		0.72	0.74	0.53	0.45	3.16	0.98	0.64	UB/UINF
UINF=	42.3	M/S	0.02	0.07	-0.04	-0.06	-0.02	0.01	0.02	VB/UINF
X/D=	0.84		0.04	0.84	1.35	0.94	1.51	0.46	-0.28	WB/UINF
Y/D=	0.0		-0.99	-1.69	-2.44	-2.07	-1.90	-0.29	0.54	CP
Z/D=	1.87		-1.47	-1.44	-1.31	-1.98	9.96	-0.12	0.02	CPT
PHI=	35.6	DEG	3.4	48.6	68.7	64.7	25.7	25.4	23.7	THETA
R=	4.07		0.52	0.79	0.66	0.45	1.07	2.75	0.65	UB/UINF
UINF=	42.6	M/S	-0.10	-0.06	0.06	0.01	-0.02	0.02	0.0	VB/UINF
X/D=	1.00		-0.29	0.38	1.19	1.15	0.72	1.66	-0.19	WB/UINF
Y/D=	0.0		-0.85	-1.37	-2.32	-2.77	-2.26	0.17	0.41	CP
Z/D=	1.67		-1.48	-1.60	-1.44	-2.24	-1.58	9.93	-0.14	CPT
PHI=	35.6	DEG	31.6	26.4	60.9	68.8	34.2	31.1	16.6	THETA
R=	4.05		0.91	1.11	1.08	1.67	2.71	0.74	0.63	UB/UINF
UINF=	42.4	M/S	-0.61	-0.71	-0.13	0.60	1.02	0.42	0.24	VB/UINF
X/D=	0.84		-0.51	-0.38	-0.16	0.11	1.05	-0.28	-0.39	WB/UINF
Y/D=	0.75		-0.58	-1.95	-3.86	-3.46	-1.18	-0.08	0.45	CP
Z/D=	1.86		-0.11	-1.05	-3.63	-1.26	7.63	-0.29	0.07	CPT
PHI=	35.6	DEG	42.5	37.5	12.0	18.4	27.2	32.9	35.1	THETA
R=	4.04		0.94	1.12	1.13	0.66	2.85	1.55	0.64	UB/UINF
UINF=	42.6	M/S	-0.47	-0.69	-0.50	0.29	0.89	0.83	0.33	VB/UINF
X/D=	1.00		-0.51	-0.48	-0.27	-0.23	0.68	0.53	-0.34	WB/UINF
Y/D=	0.76		-0.56	-1.23	-3.05	-3.63	-3.04	-0.72	0.39	CP
Z/D=	1.64		-0.18	-0.24	-2.45	-4.06	5.70	1.71	0.03	CPT
PHI=	35.6	DEG	37.6	38.3	29.4	27.6	20.0	30.8	35.0	THETA
R=	4.00		0.97	1.03	0.94	0.95	0.84	0.77	0.71	UB/UINF
UINF=	42.2	M/S	-0.42	-0.41	-0.16	0.34	0.40	0.33	0.25	VB/UINF
X/D=	0.85		-0.73	-0.88	-1.11	-0.95	-0.73	-0.61	-0.53	WB/UINF
Y/D=	1.50		-0.53	-1.01	-1.23	-1.16	-0.49	0.03	0.22	CP
Z/D=	1.84		0.13	0.02	-0.06	-0.23	-0.09	0.11	0.07	CPT
PHI=	35.6	DEG	41.7	43.8	50.1	46.2	44.0	41.2	39.1	THETA
R=	4.00		0.97	1.01	0.99	1.05	0.89	0.77	0.68	UB/UINF
UINF=	42.4	M/S	-0.40	-0.45	-0.32	0.27	0.44	0.39	0.31	VB/UINF
X/D=	1.00		-0.67	-0.81	-1.06	-0.99	-0.84	-0.64	-0.56	WB/UINF
Y/D=	1.48		-0.47	-0.79	-1.22	-1.59	-0.84	-0.12	0.24	CP
Z/D=	1.67		0.09	0.08	0.0	-0.40	-0.15	0.05	0.11	CPT
PHI=	35.5	DEG	39.6	43.1	48.7	44.0	46.1	43.4	42.6	THETA

TABLE A4.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=4, AND PHI = 35.6°, cross-section 3

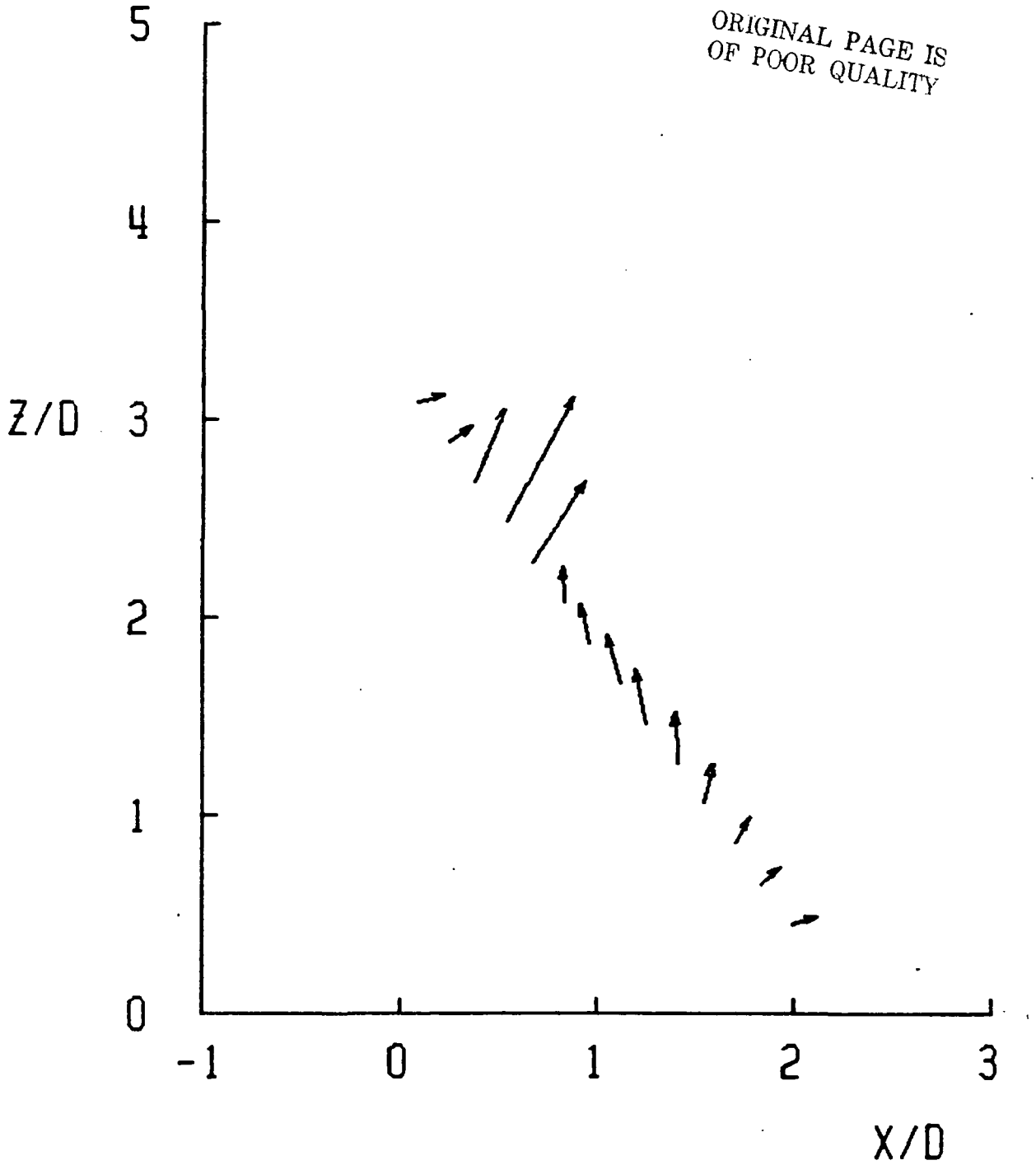


Figure A5a.- Symmetry plane velocities, R=4,
PH1 = 35.6°, cross-section 4

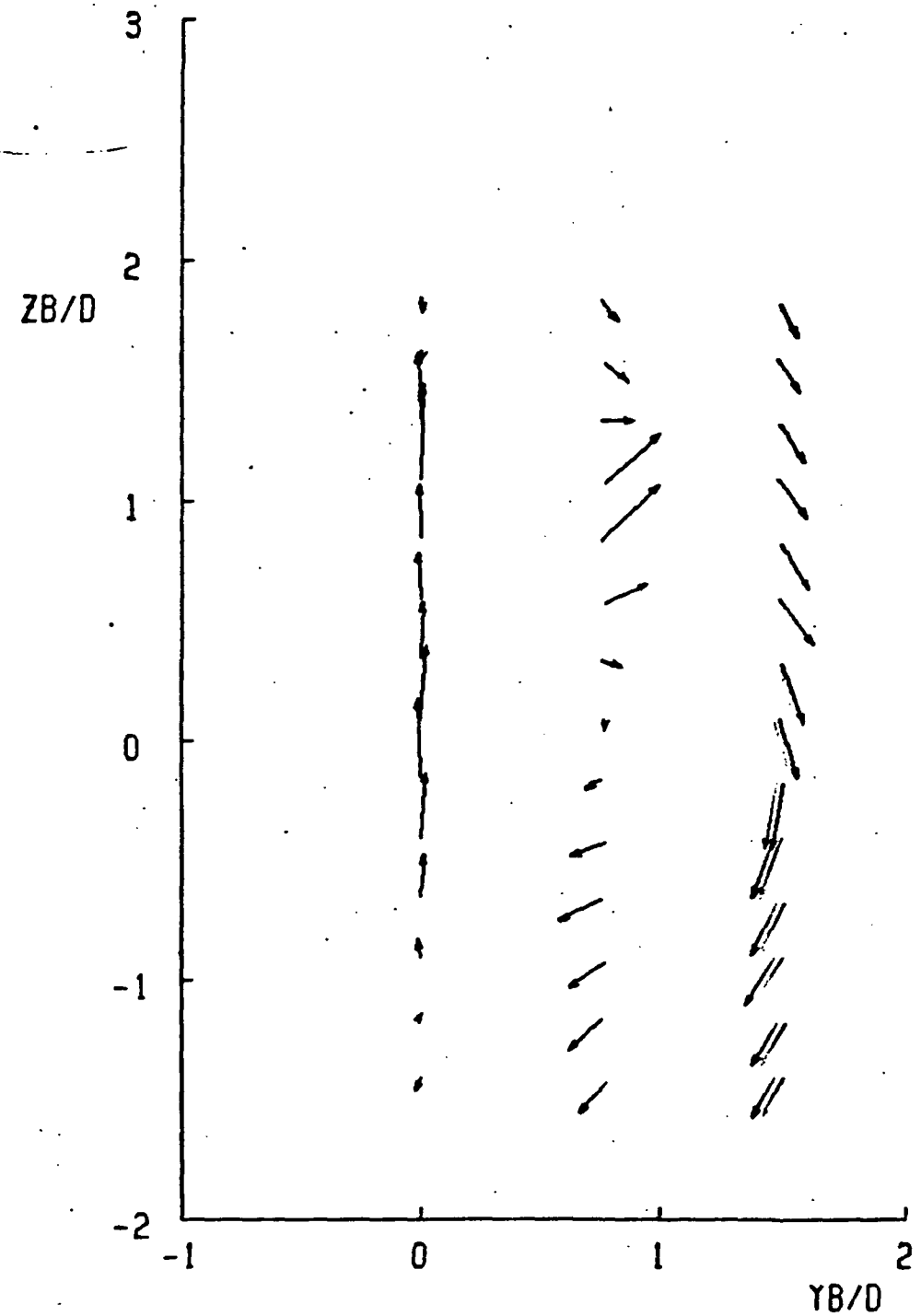


Figure A5b.- Cross-section velocities, R=4,
PH1 = 35.6°, cross-section 4

TEST CONDITIONS			ZB/D							
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	4.02		0.69	0.78	0.59	0.41	2.30	1.67	0.64	UB/UINF
UINF=	42.3	M/S	0.02	0.06	-0.04	0.03	-0.02	-0.04	0.02	VB/UINF
X/D=	0.96		0.04	0.69	1.30	0.93	0.89	1.07	-0.26	WB/UINF
Y/D=	0.0		-0.89	-1.63	-2.42	-2.32	-2.95	-0.07	0.53	CP
Z/D=	1.87		-1.43	-1.53	-1.35	-2.28	2.30	2.92	0.0	CPT
PHI=	35.6	DEG	3.0	41.3	65.6	66.4	21.2	32.9	21.9	THETA
R=	4.04		0.65	0.70	0.69	0.43	0.53	3.21	0.68	UB/UINF
UINF=	42.8	M/S	-0.10	-0.04	0.09	0.09	-0.05	0.03	-0.01	VB/UINF
X/D=	1.12		-0.24	0.30	1.09	1.22	0.76	1.57	-0.03	WB/UINF
Y/D=	0.0		-0.85	-1.33	-2.06	-2.45	-1.83	-1.12	0.10	CP
Z/D=	1.67		-1.36	-1.75	-1.37	-1.76	-1.97	11.35	-0.44	CPT
PHI=	35.6	DEG	23.1	23.8	57.8	70.3	55.3	26.1	3.9	THETA
R=	4.06		1.01	1.09	0.96	1.27	2.95	0.94	0.64	UB/UINF
UINF=	42.4	M/S	-0.55	-0.71	-0.26	0.36	0.99	0.56	0.28	VB/UINF
X/D=	0.97		-0.52	-0.36	-0.15	-0.12	0.90	-0.01	-0.35	WB/UINF
Y/D=	0.75		-0.69	-1.71	-3.47	-3.58	-2.15	-0.53	0.44	CP
Z/D=	1.86		-0.09	-0.88	-3.45	-2.80	7.78	-0.32	0.06	CPT
PHI=	35.6	DEG	38.2	37.8	18.8	14.9	23.3	29.1	34.0	THETA
R=	4.04		0.92	1.04	1.08	0.71	2.08	2.27	0.65	UB/UINF
UINF=	42.6	M/S	-0.45	-0.62	-0.59	-0.02	0.71	0.92	0.37	VB/UINF
X/D=	1.12		-0.50	-0.41	-0.21	-0.11	0.33	0.82	-0.30	WB/UINF
Y/D=	0.77		-0.47	-1.05	-2.68	-3.58	-3.15	-0.94	0.24	CP
Z/D=	1.64		-0.17	-0.40	-2.10	-4.06	0.91	4.92	-0.10	CPT
PHI=	35.6	DEG	37.5	37.0	31.8	9.7	19.1	27.3	35.0	THETA
R=	4.05		0.95	0.99	0.97	0.99	0.85	0.76	0.70	UB/UINF
UINF=	42.3	M/S	-0.44	-0.45	-0.22	0.33	0.43	0.37	0.26	VB/UINF
X/D=	0.97		-0.70	-0.86	-1.09	-0.99	-0.75	-0.63	-0.54	WB/UINF
Y/D=	1.50		-0.47	-0.84	-1.28	-1.31	-0.70	-0.01	0.22	CP
Z/D=	1.84		0.14	0.10	-0.09	-0.21	-0.22	0.11	0.07	CPT
PHI=	35.6	DEG	41.7	45.0	48.9	46.2	44.9	43.1	40.3	THETA
R=	4.04		0.93	0.92	0.99	1.07	0.99	0.77	0.67	UB/UINF
UINF=	42.4	M/S	-0.39	-0.52	-0.39	0.27	0.54	0.44	0.33	VB/UINF
X/D=	1.12		-0.67	-0.79	-1.00	-1.00	-0.77	-0.66	-0.56	WB/UINF
Y/D=	1.49		-0.37	-0.53	-1.20	-1.57	-1.23	-0.22	0.22	CP
Z/D=	1.67		0.10	0.23	-0.07	-0.32	-0.33	0.01	0.10	CPT
PHI=	35.5	DEG	40.3	46.6	47.7	43.6	42.8	45.3	43.2	THETA

TABLE A5.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=4 and PH1 = 35.6°, cross-section 4

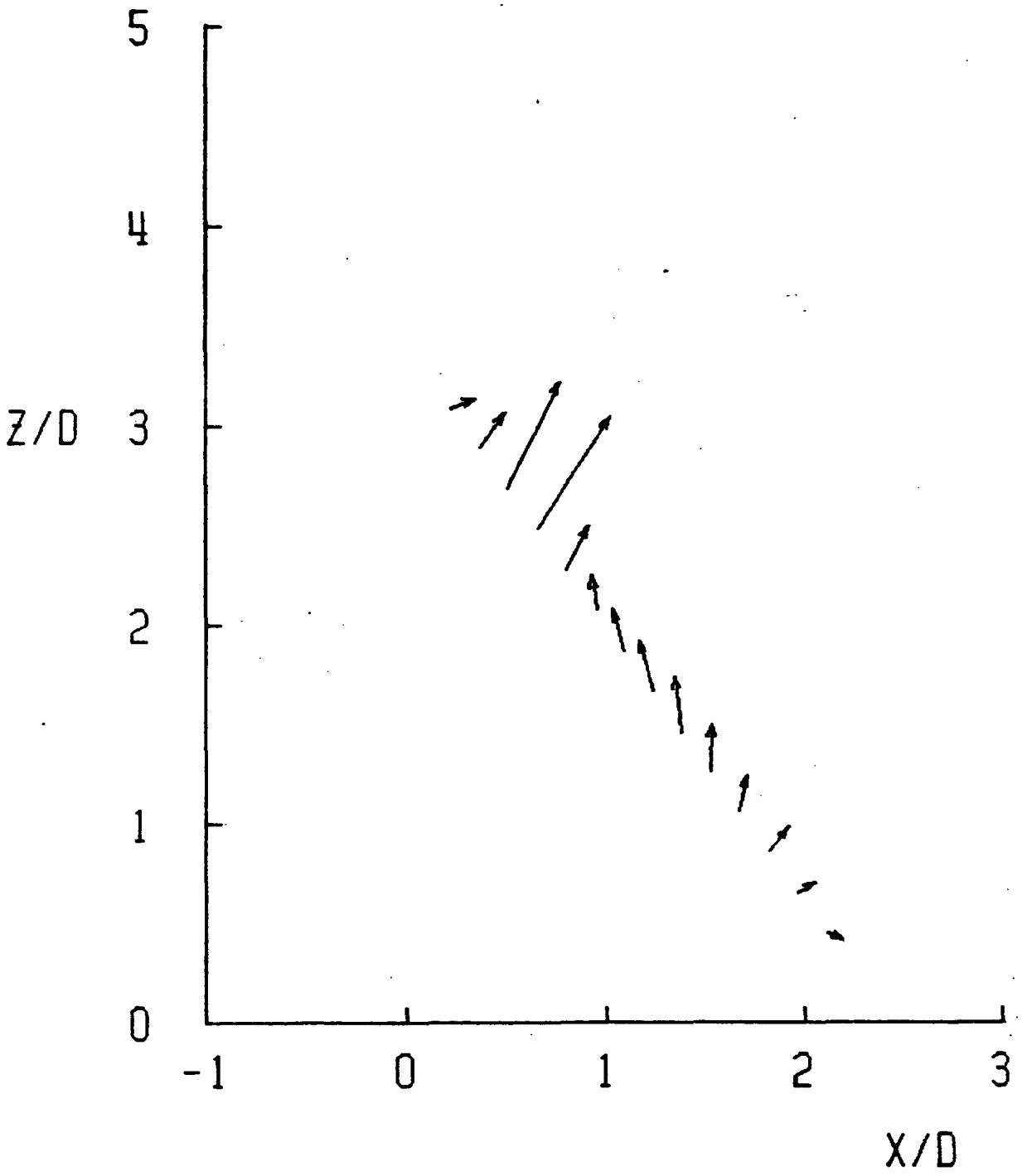


Figure A6a.- Symmetry plane velocities, R=4,
PH1 = 35.6°, cross-section 5

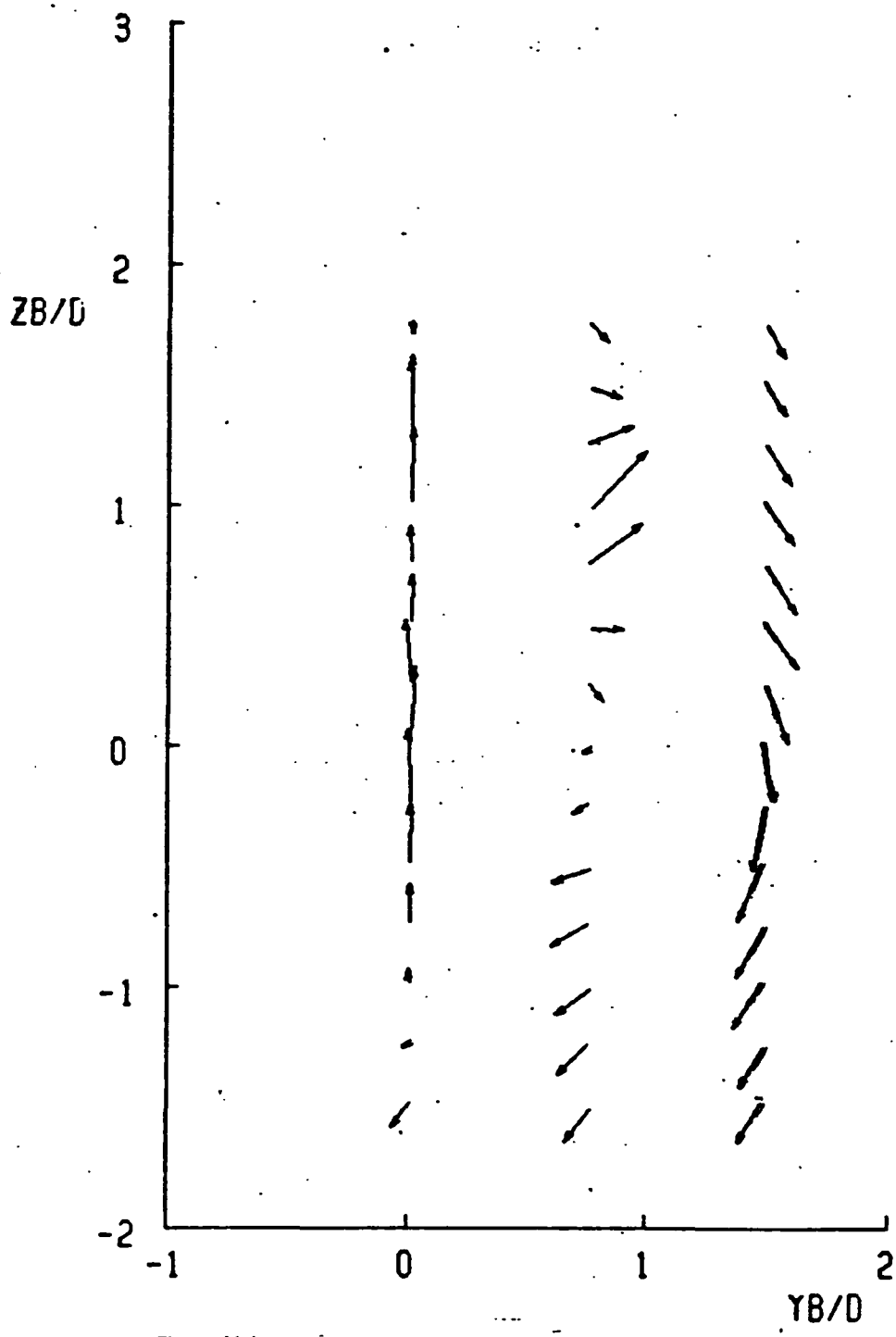


Figure A6b.- Cross-section velocities, R=4,
PHl = 35.6°, cross-section 5

TEST CONDITIONS			ZB/D						
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	4.04		0.54	0.72	0.69	0.39	1.10	2.61	0.66	UB/UINF
UINF=	42.4	M/S	-0.12	0.01	-0.03	-0.10	-0.02	0.0	0.01	VB/UINF
X/D=	1.09		-0.06	0.65	1.22	1.03	0.59	1.43	-0.20	WB/UINF
Y/D=	0.01		-0.84	-1.29	-2.34	-2.25	-2.32	-0.21	0.39	CP
Z/D=	1.87		-1.53	-1.35	-1.37	-2.02	-1.76	7.93	-0.13	CPT
PHI=	35.6	DEG	15.7	42.3	60.6	69.3	28.2	28.8	16.9	THETA
R=	4.02		0.22	0.78	0.71	0.45	0.41	3.10	1.02	UB/UINF
UINF=	42.8	M/S	-0.29	-0.02	0.02	0.06	0.02	0.03	-0.02	VB/UINF
X/D=	1.24		-0.39	0.22	0.95	1.25	0.77	1.23	0.34	WB/UINF
Y/D=	0.01		-0.40	-1.20	-2.01	-2.30	-1.92	-2.54	-0.32	CP
Z/D=	1.67		-1.11	-1.55	-1.59	-1.52	-2.15	8.08	-0.17	CPT
PHI=	35.6	DEG	66.6	16.0	53.0	70.2	61.6	21.8	18.6	THETA
R=	4.03		0.95	1.11	1.00	0.65	2.83	1.43	0.65	UB/UINF
UINF=	42.4	M/S	-0.51	-0.63	-0.26	0.22	0.86	0.71	0.30	VB/UINF
X/D=	1.09		-0.49	-0.35	-0.15	-0.30	0.65	0.27	-0.33	WB/UINF
Y/D=	0.76		-0.54	-1.62	-3.24	-3.26	-2.79	-0.94	0.40	CP
Z/D=	1.86		-0.14	-0.86	-3.15	-3.71	5.74	0.71	0.03	CPT
PHI=	35.6	DEG	38.1	34.6	18.5	28.8	19.5	26.5	33.4	THETA
R=	4.05		0.92	1.03	1.05	0.59	1.52	2.73	0.76	UB/UINF
UINF=	42.6	M/S	-0.42	-0.58	-0.63	-0.15	0.51	0.90	0.47	VB/UINF
X/D=	1.25		-0.51	-0.40	-0.21	-0.05	-0.02	0.94	-0.16	WB/UINF
Y/D=	0.77		-0.41	-0.92	-2.30	-3.45	-3.26	-1.49	-0.07	CP
Z/D=	1.64		-0.12	-0.37	-1.74	-4.07	-1.67	6.97	-0.24	CPT
PHI=	35.6	DEG	36.8	35.9	34.0	16.3	16.7	24.2	31.3	THETA
R=	4.05		0.97	0.97	1.00	1.08	0.87	0.75	0.69	UB/UINF
UINF=	42.4	M/S	-0.42	-0.48	-0.22	0.33	0.46	0.38	0.29	VB/UINF
X/D=	1.09		-0.66	-0.83	-1.07	-0.96	-0.79	-0.64	-0.55	WB/UINF
Y/D=	1.50		-0.49	-0.76	-1.29	-1.52	-0.80	-0.06	0.22	CP
Z/D=	1.85		0.06	0.12	-0.08	-0.31	-0.19	0.07	0.10	CPT
PHI=	35.6	DEG	39.9	45.5	48.0	42.8	45.9	44.0	41.3	THETA
R=	4.02		0.93	0.95	0.99	1.17	1.13	0.80	0.68	UB/UINF
UINF=	42.6	M/S	-0.40	-0.49	-0.42	0.16	0.52	0.47	0.34	VB/UINF
X/D=	1.24		-0.64	-0.74	-0.98	-0.98	-0.77	-0.71	-0.56	WB/UINF
Y/D=	1.49		-0.36	-0.62	-1.09	-1.70	-1.45	-0.34	0.17	CP
Z/D=	1.67		0.08	0.10	0.04	-0.34	-0.30	0.03	0.07	CPT
PHI=	35.5	DEG	39.9	43.7	47.7	40.1	38.7	46.1	43.0	THETA

TABLE A6.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=4, AND PHI = 35.6°, cross-section 5

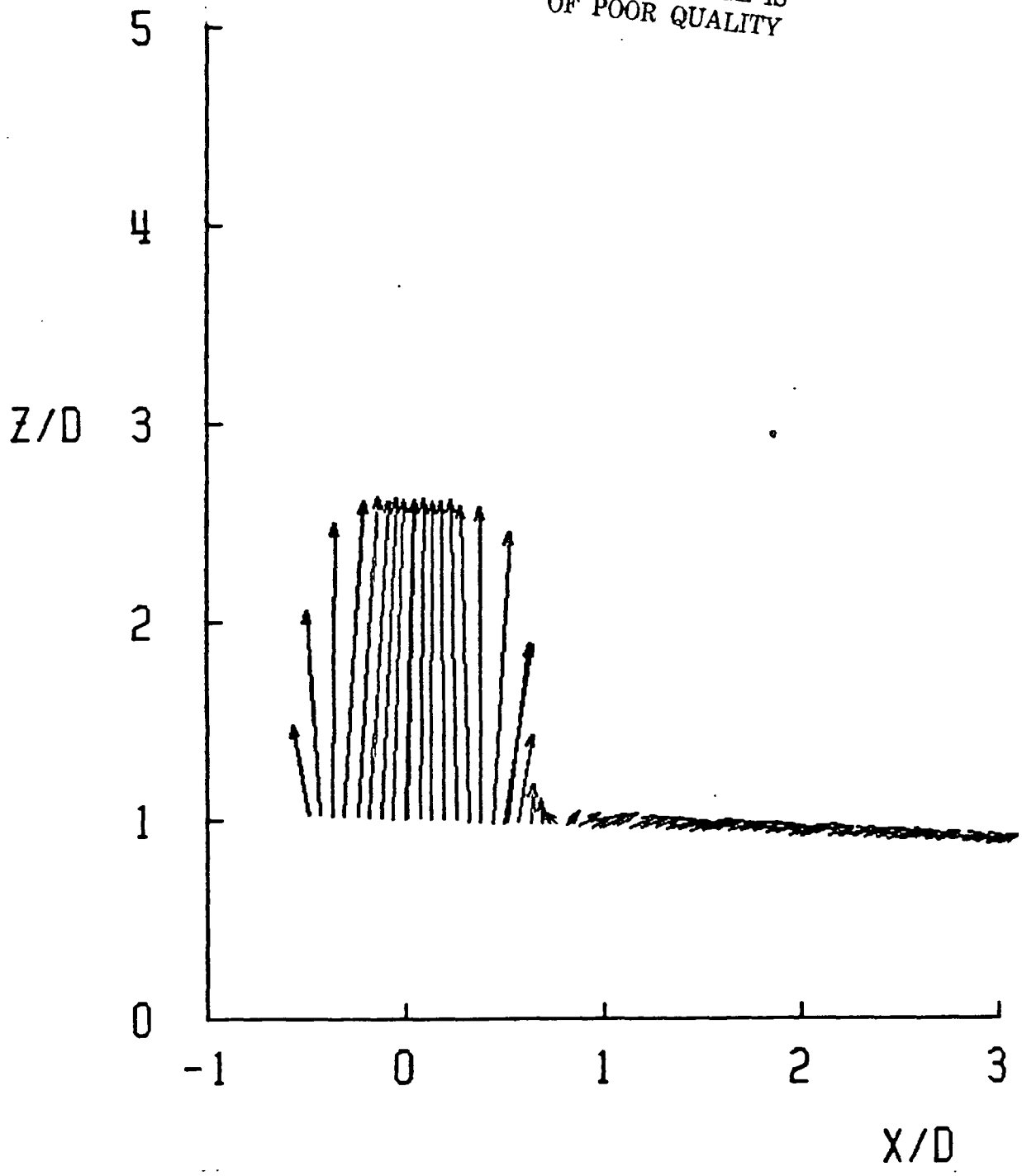


Figure A7a.- Symmetry plane velocities, R=8,
PHl = 87.7°, cross-section 1

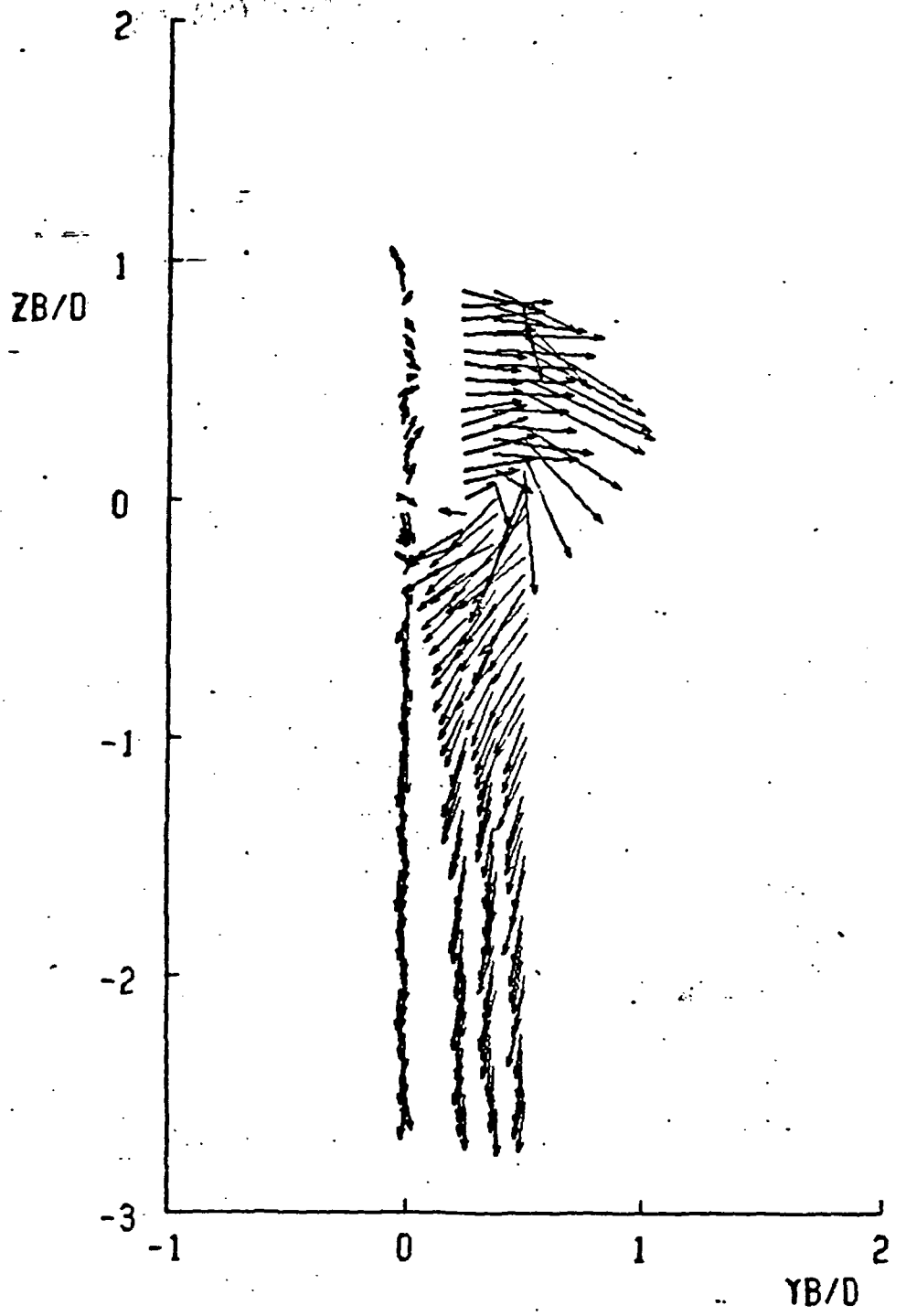


Figure A7b.- Cross-section velocities, R=8, PH1=87.7°, cross-section 1

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	8.04		0.17	0.18	0.23	0.28	4.52	8.03	2.27	UB/UINF	0.15	0.19	0.20	0.23	0.24	7.38	8.12	R=	8.06	
UINF=	21.7	M/S	-0.08	-0.05	0.02	0.07	0.09	0.06	-0.21	VB/UINF	0.08	-0.05	-0.03	-0.08	-0.19	0.14	0.15	UINF=	21.7	M/S
X/D=	1.01		-0.65	-0.65	-0.66	-0.54	-0.41	0.10	0.48	WB/UINF	-0.54	-0.73	-0.69	-0.61	-0.43	-0.14	0.04	X/D=	1.44	
Y/D=	-0.02		-0.15	-0.22	-0.26	-0.38	-1.89	-0.27	-0.55	CP	-0.13	-0.04	-0.18	-0.31	-0.49	-4.14	-1.09	Y/D=	0.0	
Z/D=	0.97		-0.70	-0.76	-0.77	-1.00	18.11	67.33	3.93	CPT	-0.69	-0.48	-0.67	-0.88	-1.21	58.37	68.34	Z/D=	0.94	
PHI=	87.8	DEG	75.4	74.8	70.6	62.5	5.2	0.8	12.9	THETA	77.2	75.6	73.6	69.3	62.1	1.5	1.0	PHI=	87.8	DEG
R=	8.05		0.13	0.19	0.22	0.31	2.21	5.08	5.13	UB/UINF	0.17	0.17	0.19	0.23	0.30	4.54	8.08	R=	7.99	
UINF=	21.7	M/S	0.03	0.03	-0.05	0.07	0.10	0.05	-0.07	VB/UINF	-0.10	-0.07	-0.06	0.01	-0.05	0.10	0.17	UINF=	21.5	M/S
X/D=	1.07		-0.66	-0.71	-0.65	-0.50	-0.26	0.19	0.53	WB/UINF	-0.52	-3.69	-0.68	-0.71	-0.48	-0.51	0.10	X/D=	1.50	
Y/D=	-0.02		-0.09	-0.12	-0.20	-0.42	-1.64	-0.80	-1.25	CP	-0.36	-0.09	-0.17	-0.16	-0.45	-2.00	-1.95	Y/D=	0.0	
Z/D=	0.97		-0.64	-0.59	-0.71	-1.07	2.36	67.78	25.01	CPT	-1.05	-0.58	-0.87	-0.60	-1.11	18.29	66.69	Z/D=	0.94	
PHI=	87.8	DEG	78.5	75.1	71.8	68.8	7.1	1.4	6.0	THETA	78.8	76.3	74.1	70.1	64.3	6.8	1.8	PHI=	87.8	DEG
R=	8.01		0.11	0.19	0.23	0.27	0.99	8.04	7.40	UB/UINF										
UINF=	21.8	M/S	-0.01	-0.03	0.03	0.13	0.04	0.08	0.13	VB/UINF										
X/D=	1.13		-0.64	-0.67	-0.72	-0.64	-0.04	0.28	0.20	WB/UINF										
Y/D=	-0.02		-0.12	-0.18	-0.18	-0.26	-1.64	-0.85	-2.17	CP										
Z/D=	0.96		-0.70	-0.69	-0.57	-0.77	-1.66	67.04	54.69	CPT										
PHI=	87.8	DEG	79.9	73.9	72.0	67.6	3.3	2.0	1.8	THETA										
R=	8.03		0.19	0.15	0.23	0.26	0.64	8.04	7.96	UB/UINF										
UINF=	21.8	M/S	0.03	-0.07	-0.05	0.03	-0.15	0.17	0.13	VB/UINF										
X/D=	1.19		-0.59	-0.75	-0.71	-0.68	0.07	0.36	-0.21	WB/UINF										
Y/D=	-0.01		-0.28	0.03	-0.15	-0.16	-1.35	-1.18	-0.67	CP										
Z/D=	0.96		-0.90	-0.38	-0.59	-0.63	-1.91	66.93	65.84	CPT										
PHI=	87.8	DEG	73.3	78.5	72.3	68.8	14.5	2.8	1.7	THETA										
R=	8.13		0.12	0.17	0.20	0.24	0.30	8.10	8.08	UB/UINF										
UINF=	21.7	M/S	0.04	0.0	-0.02	-0.05	0.12	0.28	0.12	VB/UINF										
X/D=	1.26		-0.74	-0.72	-0.69	-0.67	0.31	0.46	-0.22	WB/UINF										
Y/D=	-0.01		0.15	-0.06	-0.16	-0.20	-0.94	-0.79	0.17	CP										
Z/D=	0.96		-0.29	-0.51	-0.65	-0.68	-1.74	68.47	68.85	CPT										
PHI=	87.8	DEG	80.5	76.5	73.7	70.2	47.7	3.8	1.7	THETA										
R=	8.03		0.12	0.21	0.22	0.24	0.35	7.98	8.04	UB/UINF										
UINF=	21.7	M/S	-0.05	0.0	0.04	0.0	0.11	0.09	0.12	VB/UINF										
X/D=	1.32		-0.66	-0.69	-0.73	-0.69	-0.26	0.52	-0.18	WB/UINF										
Y/D=	-0.01		-0.06	-0.23	-0.11	-0.18	-0.82	-0.59	-0.63	CP										
Z/D=	0.95		-0.61	-0.76	-0.53	-0.64	-1.62	66.49	67.28	CPT										
PHI=	87.8	DEG	79.7	72.2	73.3	71.0	39.4	3.8	1.5	THETA										
R=	8.07		0.13	0.20	0.19	0.23	0.31	7.96	8.09	UB/UINF										
UINF=	21.6	M/S	-0.04	-0.02	-0.02	-0.03	-0.03	0.11	0.19	VB/UINF										
X/D=	1.38		-0.67	-0.72	-0.69	-0.72	-0.50	0.33	-0.08	WB/UINF										
Y/D=	0.0		-0.04	-0.12	-0.19	-0.16	-0.42	-1.97	-0.53	CP										
Z/D=	0.95		-0.57	-0.56	-0.68	-0.59	-1.08	64.53	68.38	CPT										
PHI=	87.8	DEG	79.1	74.4	74.8	72.2	58.4	2.8	1.4	THETA										

TABLE A7.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PHI = 87.7°, Cross-section 1

(a) Y/D = 0.0

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	7.99		0.15	0.23	0.33	0.58	1.41	7.98	0.90	UB/UINF	0.14	0.20	0.23	0.29	0.59	1.99	8.06	R=	8.01	
UINF=	21.7	M/S	-0.12	-0.08	-0.30	-0.49	-0.79	1.01	1.25	VB/UINF	0.0	-0.04	-0.13	-0.27	-0.56	-0.44	0.92	UINF=	21.8	M/S
X/D=	1.07		-0.74	-0.89	-0.82	-0.66	-0.50	0.15	-0.30	WB/UINF	-0.70	-0.79	-0.80	-0.83	-0.71	0.04	0.03	X/D=	1.50	
Y/D=	0.23		-0.05	0.16	0.07	-0.38	-2.33	-2.86	-0.58	CP	-0.06	-0.02	0.0	0.07	-0.12	-3.05	-3.17	Y/D=	0.25	
Z/D=	1.00		-0.46	0.01	-0.07	-0.38	-0.46	65.04	0.87	CPT	-0.55	-0.35	-0.30	-0.07	0.04	1.14	66.12	Z/D=	0.97	
PHI=	87.7	DEG	79.0	75.5	69.4	55.0	33.9	7.2	54.9	THETA	78.5	76.1	74.4	71.9	56.6	12.6	6.4	PHI=	87.7	DEG
R=	7.98		0.19	0.21	0.35	0.49	1.19	8.05	2.71	UB/UINF										
UINF=	21.7	M/S	-0.03	-0.16	-0.25	-0.47	-0.90	1.09	1.51	VB/UINF										
X/D=	1.13		-0.72	-0.86	-0.80	-0.82	-0.36	0.33	0.06	WB/UINF										
Y/D=	0.23		-0.13	0.15	-0.03	0.01	-2.13	-4.24	-0.80	CP										
Z/D=	1.00		-0.57	-0.04	-0.21	0.15	-0.78	65.36	7.92	CPT										
PHI=	87.7	DEG	76.0	76.6	67.3	62.5	39.1	7.9	29.1	THETA										
R=	7.97		0.15	0.24	0.30	0.46	0.73	7.87	8.12	UB/UINF										
UINF=	21.7	M/S	-0.05	-0.12	-0.29	-0.35	-0.99	1.10	1.39	VB/UINF										
X/D=	1.19		-0.75	-0.80	-0.79	-0.80	-0.58	0.35	0.15	WB/UINF										
Y/D=	0.23		0.01	-0.02	0.07	-0.16	-0.62	-4.65	-1.65	CP										
Z/D=	0.99		-0.40	-0.32	-0.12	-0.18	0.24	61.64	25.32	CPT										
PHI=	87.7	DEG	78.8	73.7	70.4	62.4	57.8	8.3	15.2	THETA										
R=	7.98		0.17	0.19	0.25	0.42	0.72	7.24	7.05	UB/UINF										
UINF=	21.7	M/S	-0.04	-0.08	-0.14	-0.42	-0.78	1.21	1.18	VB/UINF										
X/D=	1.25		-0.66	-0.87	-0.90	-0.81	-0.64	0.31	0.07	WB/UINF										
Y/D=	0.24		-0.23	0.17	0.24	0.07	-0.66	-4.90	-2.53	CP										
Z/D=	0.99		-0.76	-0.03	0.13	0.08	-0.12	50.96	50.23	CPT										
PHI=	87.7	DEG	75.4	77.5	74.5	65.5	54.5	9.6	9.4	THETA										
R=	7.98		0.19	0.19	0.27	0.42	0.71	6.45	7.83	UB/UINF										
UINF=	21.7	M/S	-0.14	-0.11	-0.19	-0.38	-0.71	1.17	1.05	VB/UINF										
X/D=	1.32		-0.66	-0.86	-0.77	-0.80	-0.68	0.19	-0.12	WB/UINF										
Y/D=	0.24		-0.23	0.17	-0.08	0.0	-0.59	-6.58	-3.06	CP										
Z/D=	0.98		-0.74	-0.03	-0.39	-0.04	-0.13	37.26	62.35	CPT										
PHI=	87.7	DEG	74.7	77.5	71.2	64.5	54.3	10.3	7.6	THETA										
R=	7.98		0.12	0.19	0.28	0.39	0.65	4.95	7.97	UB/UINF										
UINF=	21.7	M/S	-0.07	-0.01	-0.22	-0.31	-0.68	0.91	0.94	VB/UINF										
X/D=	1.37		-0.73	-0.85	-0.69	-0.79	-0.70	0.20	-0.14	WB/UINF										
Y/D=	0.24		-0.02	0.12	-0.28	-0.09	-0.36	-6.90	-2.83	CP										
Z/D=	0.99		-0.46	-0.13	-0.69	-0.22	0.02	18.11	64.79	CPT										
PHI=	87.7	DEG	80.7	77.2	68.9	65.6	56.4	10.6	6.7	THETA										
R=	8.06		0.13	0.21	0.22	0.32	0.66	2.96	8.04	UB/UINF										
UINF=	21.7	M/S	-0.10	-0.03	-0.12	-0.23	-0.62	0.49	0.91	VB/UINF										
X/D=	1.44		-0.71	-0.78	-0.88	-0.92	-0.62	0.28	-0.07	WB/UINF										
Y/D=	0.25		-0.06	-0.12	0.19	0.02	-0.43	-4.44	-1.90	CP										
Z/D=	0.98		-0.53	-0.47	0.03	-0.15	-0.23	3.70	66.92	CPT										
PHI=	87.7	DEG	80.1	74.7	75.9	69.5	53.3	10.7	6.4	THETA										

TABLE A7.- Continued

(b) Y/D = 0.25

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZO/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	8.04		0.16	0.23	0.31	0.52	1.00	7.67	0.83	UB/UINF	0.13	0.22	0.23	0.32	0.62	1.66	7.61	R=	8.02	
UINF=	21.6	M/S	-0.19	-0.19	-0.22	-0.42	-1.12	1.30	1.42	VB/UINF	0.01	-0.19	-0.07	-0.29	-0.41	-1.14	1.31	UINF=	21.7	M/S
X/D=	1.07		-0.72	-0.86	-0.81	-0.84	-1.08	-0.02	-0.66	WB/UINF	-0.79	-0.81	-0.84	-0.80	-0.84	-0.90	-0.03	X/D=	1.50	
Y/D=	0.36		-0.12	0.01	-0.12	-0.47	-2.61	-6.34	-0.07	CP	0.08	-0.10	-0.01	-0.19	-0.49	-4.10	-3.95	Y/D=	0.38	
Z/D=	0.97		-0.54	-0.19	-0.31	-0.32	-0.18	56.96	1.80	CPT	-0.29	-0.35	-0.24	-0.38	-0.23	-0.21	58.33	Z/D=	0.94	
PHI=	87.7	DEG	78.1	75.0	69.8	61.0	57.4	9.5	68.1	THETA	80.6	75.3	74.9	69.3	56.7	41.3	9.6	PHI=	87.7	DEG
R=	8.01		0.20	0.19	0.29	0.47	0.97	7.62	2.23	UB/UINF										
UINF=	21.6	M/S	-0.15	-0.03	-0.17	-0.41	-1.08	1.42	0.89	VB/UINF										
X/D=	1.13		-0.66	-0.80	-0.82	-0.78	-0.53	-0.11	-0.33	WB/UINF										
Y/D=	0.36		-0.33	0.15	-0.13	-0.20	-2.69	-7.33	-4.24	CP										
Z/D=	0.96		-0.82	0.0	-0.35	-0.01	-1.30	58.49	0.69	CPT										
PHI=	87.7	DEG	73.3	77.9	70.7	64.8	51.1	10.8	23.0	THETA										
R=	8.01		0.16	0.28	0.27	0.33	0.98	6.32	3.06	UB/UINF										
UINF=	21.6	M/S	-0.15	-0.13	-0.22	-0.43	-1.04	1.71	1.60	VB/UINF										
X/D=	1.19		-0.72	-0.72	-0.81	-0.87	-0.75	-0.24	-0.20	WB/UINF										
Y/D=	0.36		-0.15	-0.31	-0.10	0.03	-2.12	-4.49	-2.05	CP										
Z/D=	0.94		-0.59	-0.69	-0.32	0.08	-0.49	39.43	9.05	CPT										
PHI=	87.7	DEG	78.1	69.8	71.9	71.2	52.6	15.2	27.7	THETA										
R=	8.02		0.14	0.22	0.25	0.42	0.62	5.37	4.74	UB/UINF										
UINF=	21.7	M/S	-0.36	-0.18	-0.24	-0.34	-0.78	1.45	1.89	VB/UINF										
X/D=	1.23		-0.78	-0.86	-0.84	-0.90	-0.66	-0.11	-0.06	WB/UINF										
Y/D=	0.35		0.02	0.04	0.0	-0.14	-1.33	-6.30	-0.77	CP										
Z/D=	0.96		-0.35	-0.14	-0.18	-0.05	-0.89	24.65	24.93	CPT										
PHI=	87.7	DEG	79.5	75.8	73.9	66.6	58.9	15.0	21.6	THETA										
R=	8.01		0.17	0.23	0.28	0.35	0.72	3.42	6.61	UB/UINF										
UINF=	21.8	M/S	-0.03	-0.25	-0.17	-0.37	-0.59	0.60	1.71	VB/UINF										
X/D=	1.32		-0.72	-0.79	-0.83	-0.86	-0.93	-0.37	-0.09	WB/UINF										
Y/D=	0.37		-0.18	-0.12	-0.12	-0.08	-0.78	-6.14	-3.18	CP										
Z/D=	0.95		-0.64	-0.38	-0.32	-0.08	-0.04	5.18	44.61	CPT										
PHI=	87.7	DEG	76.5	74.3	71.4	69.5	56.9	11.6	14.4	THETA										
R=	8.03		0.16	0.22	0.26	0.34	0.53	2.61	7.26	UB/UINF										
UINF=	21.7	M/S	-0.04	-0.14	-0.09	-0.31	-0.67	0.25	1.45	VB/UINF										
X/D=	1.38		-0.71	-0.81	-0.86	-0.86	-0.92	-0.71	-0.05	WB/UINF										
Y/D=	0.37		-0.16	-0.03	-0.05	-0.08	-0.29	-6.05	-2.91	CP										
Z/D=	0.95		-0.64	-0.31	-0.23	-0.13	0.29	0.38	53.88	CPT										
PHI=	87.7	DEG	77.5	75.2	73.2	69.7	65.3	15.9	11.2	THETA										
R=	8.09		0.19	0.19	0.24	0.35	0.60	1.82	7.78	UB/UINF										
UINF=	21.7	M/S	-0.05	-0.15	-0.15	-0.30	-0.56	-0.77	1.36	VB/UINF										
X/D=	1.44		-0.63	-0.80	-0.87	-0.85	-0.87	-0.82	-0.03	WB/UINF										
Y/D=	0.37		-0.39	-0.04	0.10	-0.10	-0.56	-4.57	-4.40	CP										
Z/D=	0.94		-0.95	-0.34	-0.06	-0.16	-0.12	-0.98	60.98	CPT										
PHI=	87.7	DEG	73.6	76.9	74.8	69.0	59.9	31.9	9.8	THETA										

TABLE A7.- Continued

(c) Y/D = 0.4

TEST CONDITIONS			ZB/D						
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	7.96		0.13	0.20	0.35	0.47	0.66	4.51	0.25	UB/UINF
UINF=	21.7	M/S	-0.20	-0.28	-0.37	-0.53	-0.84	1.70	0.33	VB/UINF
X/D=	1.13		-0.79	-0.90	-0.78	-0.94	-1.00	-1.07	-1.24	WB/UINF
Y/D=	0.48		0.07	0.22	-0.18	-0.28	-3.35	-3.95	-2.66	CP
Z/D=	0.98		-0.25	0.15	-0.31	0.10	-2.21	20.03	-1.96	CPT
PHI=	87.7	DEG	80.9	77.8	67.7	66.6	63.2	23.9	78.9	THETA
R=	7.96		0.17	0.26	0.28	0.44	0.71	4.33	0.59	UB/UINF
UINF=	21.8	M/S	-0.10	-0.15	-0.24	-0.49	-1.08	1.35	1.12	VB/UINF
X/D=	1.19		-0.72	-0.83	-0.89	-0.83	-0.83	-1.41	-1.15	WB/UINF
Y/D=	0.49		-0.17	-0.12	-0.04	-0.52	-1.80	-6.99	-2.64	CP
Z/D=	0.98		-0.61	-0.34	-0.11	-0.39	-0.42	15.05	-0.70	CPT
PHI=	87.7	DEG	77.0	73.1	73.0	65.4	62.5	24.2	69.8	THETA
R=	7.95		0.13	0.22	0.26	0.36	0.50	3.18	1.24	UB/UINF
UINF=	21.9	M/S	-0.06	-0.21	-0.27	-0.48	-0.99	0.79	1.84	VB/UINF
X/D=	1.26		-0.81	-0.91	-0.86	-0.97	-1.16	-1.71	-1.07	WB/UINF
Y/D=	0.49		0.06	0.15	-0.03	0.10	-0.24	-6.21	-1.51	CP
Z/D=	0.97		-0.26	0.08	-0.15	0.41	1.35	6.64	3.61	CPT
PHI=	87.7	DEG	80.7	76.5	74.1	71.6	71.8	30.6	59.6	THETA
R=	8.01		0.15	0.21	0.27	0.42	0.62	2.30	2.40	UB/UINF
UINF=	21.8	M/S	0.01	-0.19	-0.28	-0.44	-0.58	0.17	2.07	VB/UINF
X/D=	1.32		-0.79	-0.94	-0.00	-0.79	-0.93	-2.08	-1.08	WB/UINF
Y/D=	0.49		0.06	0.28	-0.18	-0.41	-1.62	-5.84	-2.12	CP
Z/D=	0.97		-0.29	0.25	-0.39	-0.42	-1.04	2.86	8.24	CPT
PHI=	87.7	DEG	79.6	77.7	72.2	65.3	50.7	42.2	44.1	THETA
R=	8.00		0.12	0.23	0.27	0.40	0.60	1.48	3.52	UB/UINF
UINF=	21.8	M/S	-0.13	-0.14	-0.24	-0.30	-0.75	-0.77	2.18	VB/UINF
X/D=	1.38		-0.75	-0.87	-0.87	-0.86	-0.85	-2.18	-1.10	WB/UINF
Y/D=	0.49		-0.03	0.01	0.01	-0.40	-1.05	-3.80	-1.72	CP
Z/D=	0.96		-0.42	-0.17	-0.10	-0.41	-0.39	2.80	15.95	CPT
PHI=	87.7	DEG	80.9	75.5	73.3	66.2	62.3	57.4	34.7	THETA
R=	8.00		0.13	0.23	0.25	0.33	0.51	1.07	4.26	UB/UINF
UINF=	21.9	M/S	-0.19	-0.13	-0.17	-0.38	-0.62	-0.96	2.20	VB/UINF
X/D=	1.44		-0.74	-0.89	-0.91	-0.93	-0.87	-2.06	-0.99	WB/UINF
Y/D=	0.50		-0.05	0.10	0.12	0.07	-0.76	-3.39	-2.36	CP
Z/D=	0.96		-0.45	-0.04	0.04	0.21	-0.37	1.94	21.18	CPT
PHI=	87.7	DEG	80.0	75.9	74.7	72.0	64.5	64.8	29.4	THETA
R=	8.04		0.14	0.24	0.22	0.29	0.57	0.72	5.01	UB/UINF
UINF=	21.8	M/S	-0.11	-0.18	-0.22	-0.35	-0.55	-1.26	2.02	VB/UINF
X/D=	1.50		-0.73	-0.80	-0.94	-0.93	-0.84	-1.46	-0.99	WB/UINF
Y/D=	0.50		-0.13	-0.15	0.26	0.12	-0.84	-3.14	-3.82	CP
Z/D=	0.95		-0.56	-0.43	0.25	0.20	-0.49	0.09	26.29	CPT
PHI=	87.7	DEG	79.1	73.8	77.0	73.5	60.3	69.6	24.1	THETA

TABLE A7. - Concluded

(d) Y/D = 0.5

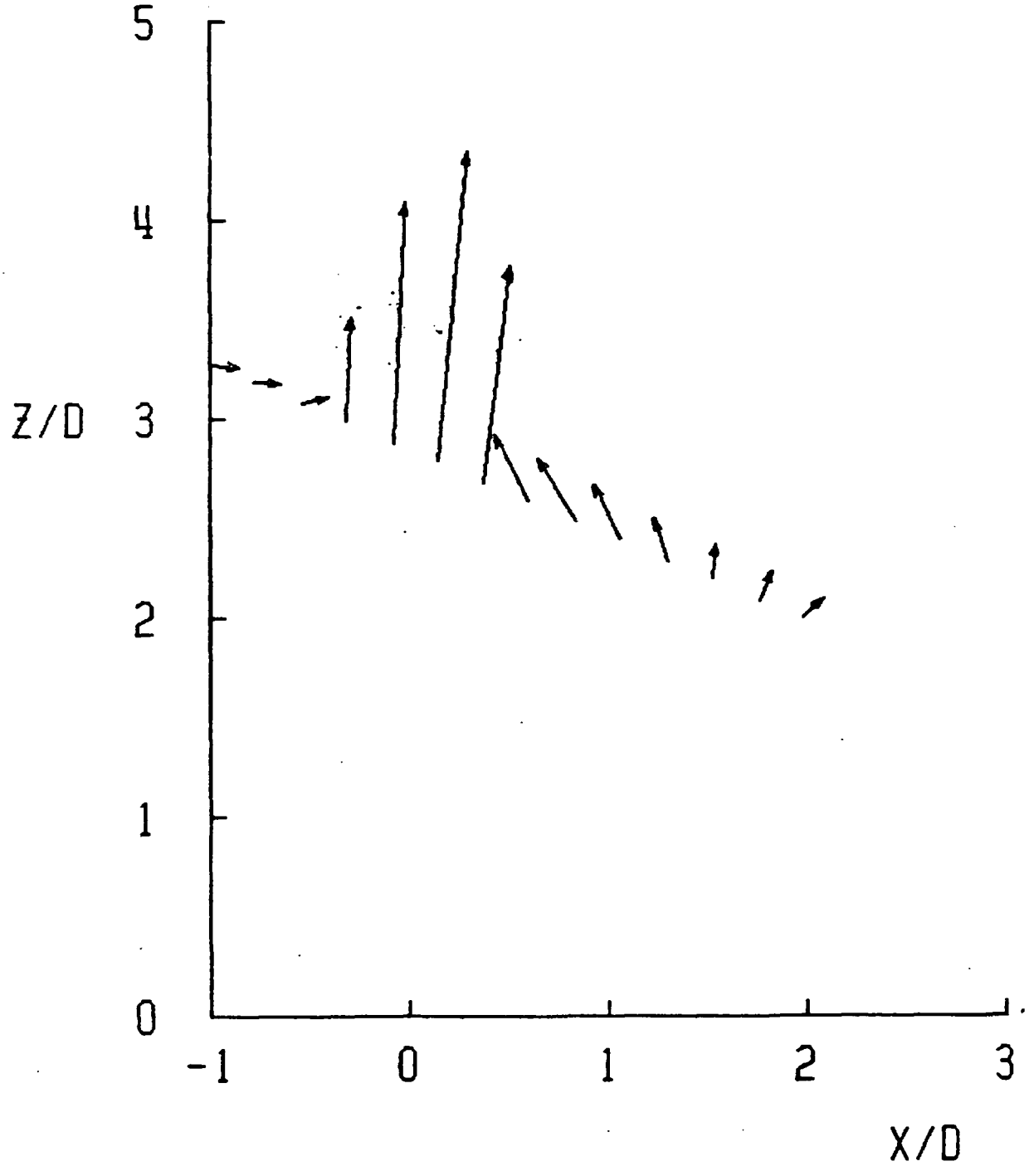


Figure A8a.- Symmetry plane velocity, R=8,
PH1 = 66.7°, cross-section 1

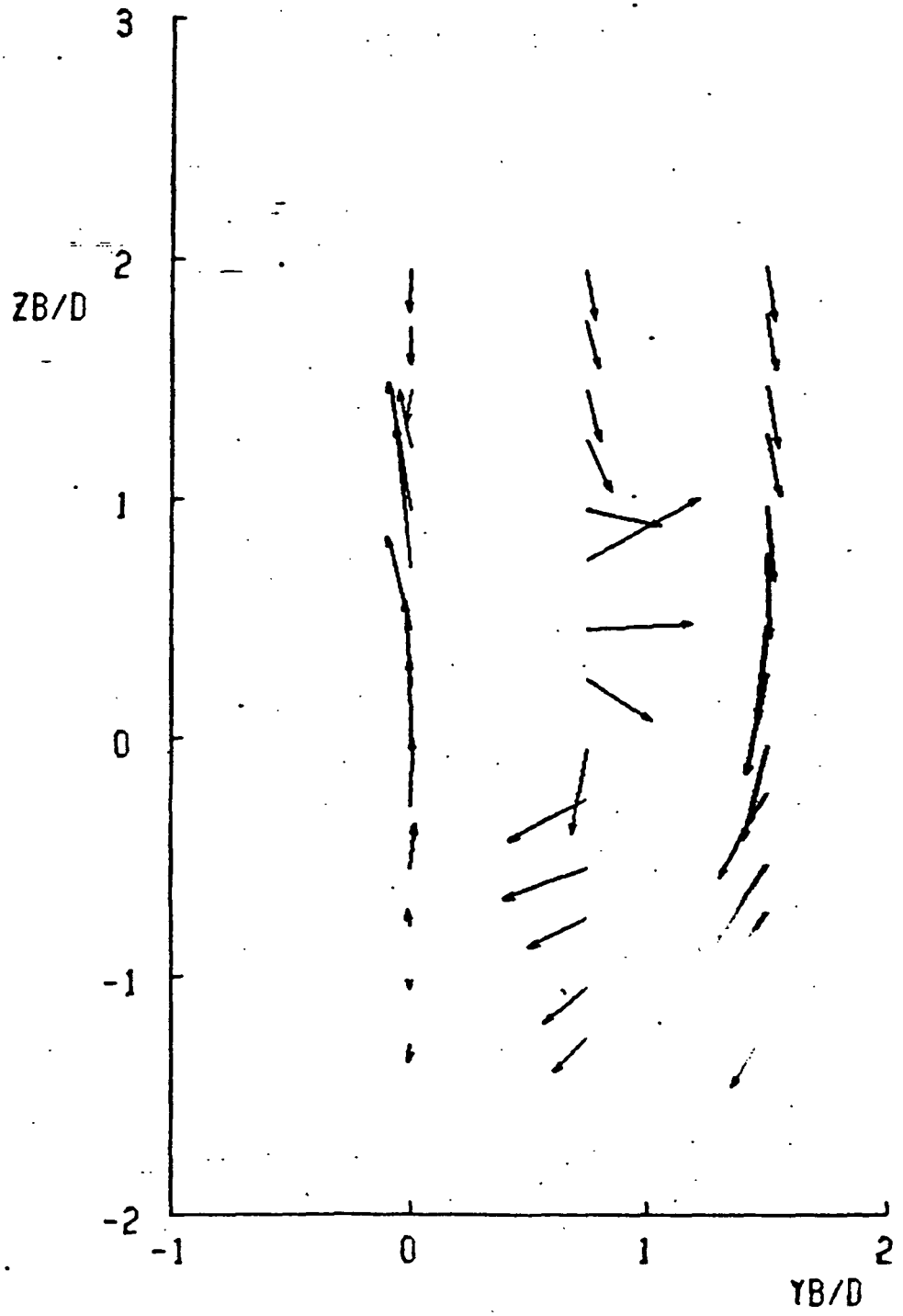


Figure A8b.- Cross-section velocities, R=8
PH1 = 66.7°, cross-section 1

TEST CONDITIONS			ZB/D							
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	8.00		0.82	0.86	1.11	5.29	5.68	0.42	0.19	UB/UINF
UINF=	21.2	M/S	0.0	0.09	-0.02	-0.39	-0.37	-0.08	-0.02	VB/UINF
X/D=	0.38		-0.03	0.74	1.50	1.55	2.11	-0.55	-0.71	WB/UINF
Y/D=	0.0		-0.68	-1.65	-3.83	-8.62	0.14	-0.19	0.34	CP
Z/D=	2.68		-1.00	-1.34	-1.34	21.88	37.30	-0.72	-0.12	CPT
PHI=	66.6	DEG	2.3	40.8	53.5	17.1	20.9	53.0	75.0	THETA
R=	7.99		0.66	0.86	1.03	1.19	7.46	2.49	0.23	UB/UINF
UINF=	21.2	M/S	-0.03	-0.04	0.03	-0.09	-0.24	-0.20	0.0	VB/UINF
X/D=	0.60		-0.30	0.26	1.13	1.42	2.35	0.94	-0.62	WB/UINF
Y/D=	0.0		-0.39	-1.04	-2.65	-3.72	-3.15	-3.06	0.31	CP
Z/D=	2.59		-0.86	-1.22	-1.29	-1.27	60.92	3.11	-0.25	CPT
PHI=	66.7	DEG	24.4	17.3	47.6	50.3	17.6	21.3	70.1	THETA
R=	7.99		0.74	1.10	3.03	5.48	1.61	0.35	0.20	UB/UINF
UINF=	21.2	M/S	-0.72	-1.37	-0.26	1.80	1.29	0.23	0.16	VB/UINF
X/D=	0.38		-0.58	-0.50	-1.41	0.10	-0.26	-0.84	-0.81	WB/UINF
Y/D=	0.74		-0.28	-2.20	-9.57	-9.45	-3.61	-0.35	0.13	CP
Z/D=	2.68		0.12	0.15	0.81	23.93	-0.28	-0.46	-0.15	CPT
PHI=	66.7	DEG	51.9	53.8	25.5	17.4	38.4	67.8	76.3	THETA
R=	8.00		0.71	0.86	2.08	3.76	5.19	0.52	0.20	UB/UINF
UINF=	21.3	M/S	-0.54	-0.94	-1.28	1.11	1.91	0.42	0.21	VB/UINF
X/D=	0.57		-0.56	-0.47	-0.68	-0.68	1.02	-0.84	-0.78	WB/UINF
Y/D=	0.74		-0.16	-0.85	-6.49	*****	-3.34	-1.52	0.07	CP
Z/D=	2.59		-0.05	0.01	-1.02	4.18	28.31	-1.37	-0.24	CPT
PHI=	66.7	DEG	48.5	51.4	35.6	18.4	21.9	60.6	75.6	THETA
R=	7.98		0.70	0.61	0.70	0.76	0.44	0.35	0.23	UB/UINF
UINF=	21.1	M/S	-0.52	-0.80	-0.37	-0.15	0.11	0.18	0.13	VB/UINF
X/D=	0.38		-0.88	-1.29	-1.58	-1.55	-1.25	-1.01	-0.91	WB/UINF
Y/D=	1.50		-0.99	-0.97	-3.44	-3.49	-1.58	-0.60	-0.09	CP
Z/D=	2.72		-0.46	0.71	-1.30	-1.48	-0.82	-0.41	-0.19	CPT
PHI=	66.6	DEG	56.0	68.3	66.7	64.1	70.8	71.3	76.0	THETA
R=	8.06		0.62	0.61	0.73	0.60	0.48	0.39	0.22	UB/UINF
UINF=	21.2	M/S	-0.55	-0.69	-0.77	-0.34	0.04	0.22	0.15	VB/UINF
X/D=	0.54		-0.91	-1.10	-1.42	-1.69	-1.41	-1.03	-0.91	WB/UINF
Y/D=	1.50		-0.30	-0.69	-2.21	-3.03	-2.19	-1.04	-0.30	CP
Z/D=	2.59		0.22	0.38	-0.08	-0.67	-0.96	-0.77	-0.39	CPT
PHI=	66.7	DEG	60.2	65.0	66.0	70.9	71.2	69.9	76.6	THETA

TABLE A8.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PH1 = 66.7°, CROSS-SECTION 1

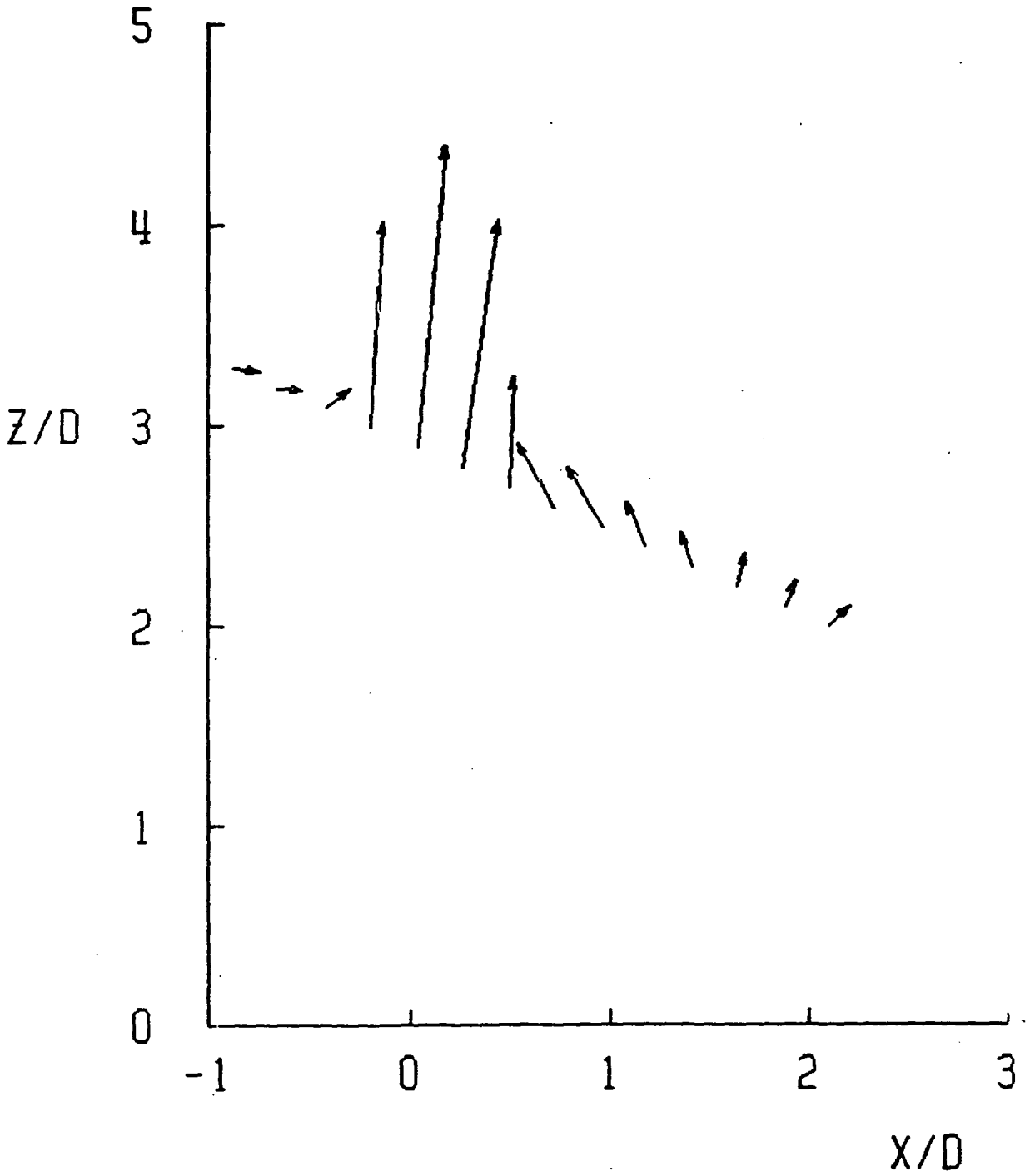


Figure A9a.- Symmetry plane velocities, R=8, PHl = 66.7°, cross-section 2

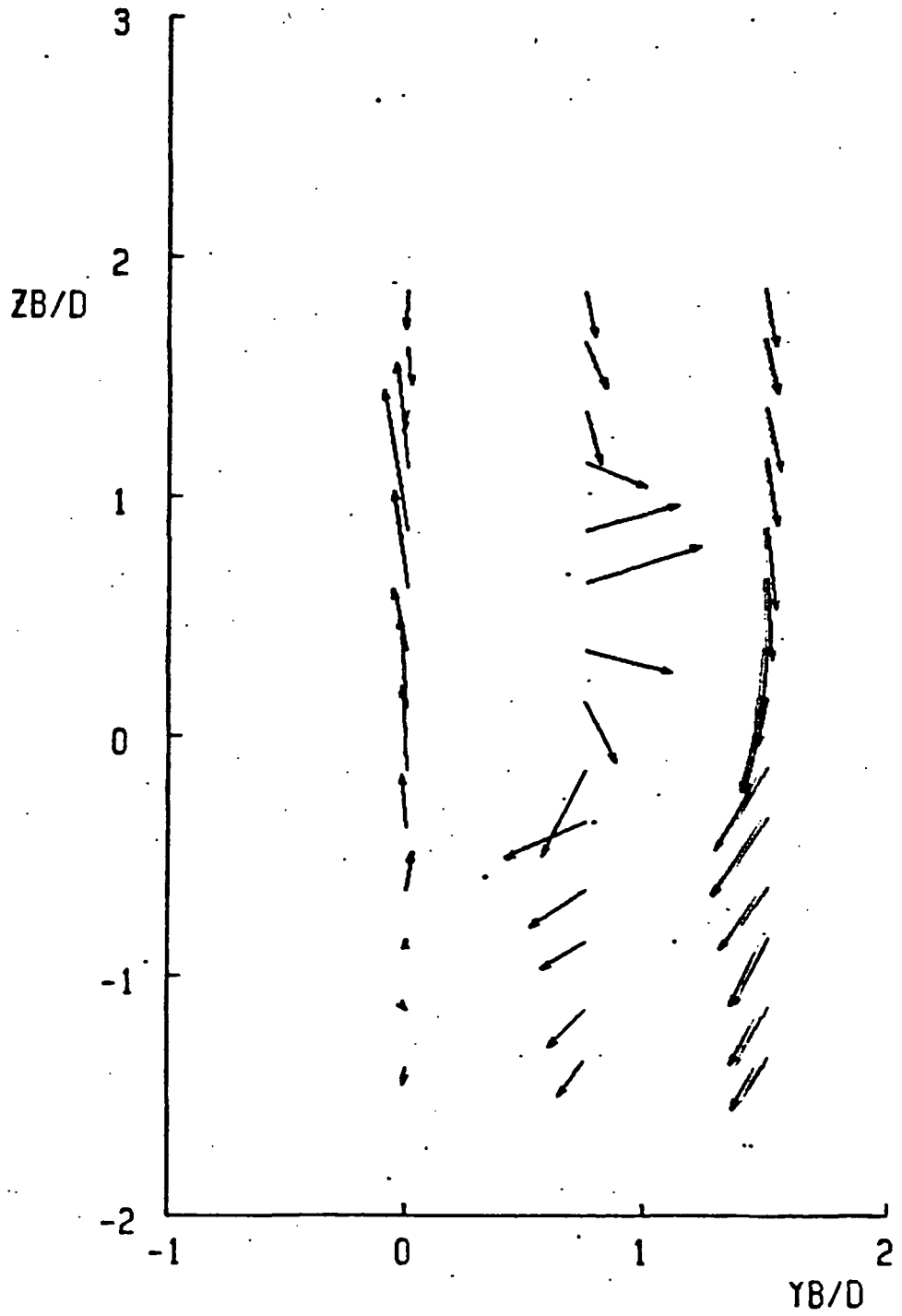


Figure A9b.- Cross-section velocities, R=8, φ_{h1} = 66.7°, cross-section 2

TEST CONDITIONS			ZB/D							
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	8.04		0.70	0.70	1.06	2.58	7.20	0.69	0.19	UB/UINF
UINF=	21.1	M/S	0.01	0.10	-0.08	-0.24	-0.40	-0.09	-0.04	VB/UINF
X/D=	0.50		-0.01	0.62	1.39	1.02	2.34	-0.36	-0.65	WB/UINF
Y/D=	0.0		-0.56	-1.04	-3.56	-6.19	0.52	-1.45	0.30	CP
Z/D=	2.69		-1.07	-1.14	-1.49	0.60	60.26	-1.84	-0.24	CPT
PHI=	66.6	DEG	1.0	41.6	52.9	22.3	18.4	28.3	74.2	THETA
R=	8.00		0.66	0.87	0.87	1.14	6.04	4.89	0.22	UB/UINF
UINF=	21.1	M/S	-0.06	0.01	-0.09	-0.13	-0.23	-0.19	0.04	VB/UINF
X/D=	0.72		-0.29	0.13	0.89	1.49	1.62	1.76	-0.61	WB/UINF
Y/D=	0.0		-0.43	-0.86	-2.15	-4.01	-8.19	-2.14	0.16	CP
Z/D=	2.59		-0.90	-1.09	-1.57	-1.47	31.53	24.59	-0.42	CPT
PHI=	66.7	DEG	24.5	8.5	45.9	52.8	15.3	20.0	70.4	THETA
R=	8.04		0.72	0.97	2.39	4.46	3.48	0.39	0.22	UB/UINF
UINF=	21.1	M/S	-0.61	-0.93	-0.74	1.44	1.54	0.23	0.15	VB/UINF
X/D=	0.50		-0.61	-0.61	-1.43	-0.37	0.43	-0.89	-0.76	WB/UINF
Y/D=	0.75		-0.11	-1.65	-7.98	-9.60	-4.51	-0.72	-0.05	CP
Z/D=	2.69		0.14	-0.47	-0.59	12.02	9.39	-0.72	-0.40	CPT
PHI=	66.7	DEG	50.8	49.6	34.3	17.6	23.9	67.0	74.0	THETA
R=	8.10		0.75	0.90	1.39	3.34	5.98	1.09	0.22	UB/UINF
UINF=	21.0	M/S	-0.44	-0.73	-1.35	0.49	1.91	1.00	0.32	VB/UINF
X/D=	0.69		-0.58	-0.45	-0.61	-1.02	0.59	-0.41	-0.76	WB/UINF
Y/D=	0.75		-0.21	-0.81	-3.99	*****	-7.09	-2.99	-0.02	CP
Z/D=	2.59		-0.12	-0.27	-0.85	0.95	33.26	-1.63	-0.29	CPT
PHI=	66.7	DEG	44.5	44.3	47.5	18.4	17.7	43.9	75.0	THETA
R=	8.08		0.65	0.77	0.81	0.65	0.44	0.36	0.23	UB/UINF
UINF=	21.1	M/S	-0.56	-0.74	-0.82	-0.17	0.13	0.21	0.16	VB/UINF
X/D=	0.50		-0.95	-1.03	-1.37	-1.63	-1.36	-1.05	-0.95	WB/UINF
Y/D=	1.50		-0.42	-1.49	-2.70	-3.45	-1.88	-0.80	-0.10	CP
Z/D=	2.72		0.22	-0.29	-0.48	-1.35	-0.81	-0.51	-0.13	CPT
PHI=	66.6	DEG	59.5	59.0	63.6	68.3	72.1	71.5	76.6	THETA
R=	8.05		0.66	0.57	0.64	0.74	0.56	0.38	0.22	UB/UINF
UINF=	21.3	M/S	-0.53	-0.57	-0.87	-0.39	0.07	0.16	0.17	VB/UINF
X/D=	0.67		-0.87	-1.13	-1.30	-1.57	-1.37	-1.12	-0.92	WB/UINF
Y/D=	1.50		-0.36	-0.55	-1.67	-3.72	-3.04	-1.14	-0.35	CP
Z/D=	2.59		0.10	0.39	0.19	-1.53	-1.85	-0.71	-0.41	CPT
PHI=	66.7	DEG	57.4	66.0	68.0	65.6	67.7	71.4	76.5	THETA

TABLE A9.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PHI = 66.7°, CROSS-SECTION 2

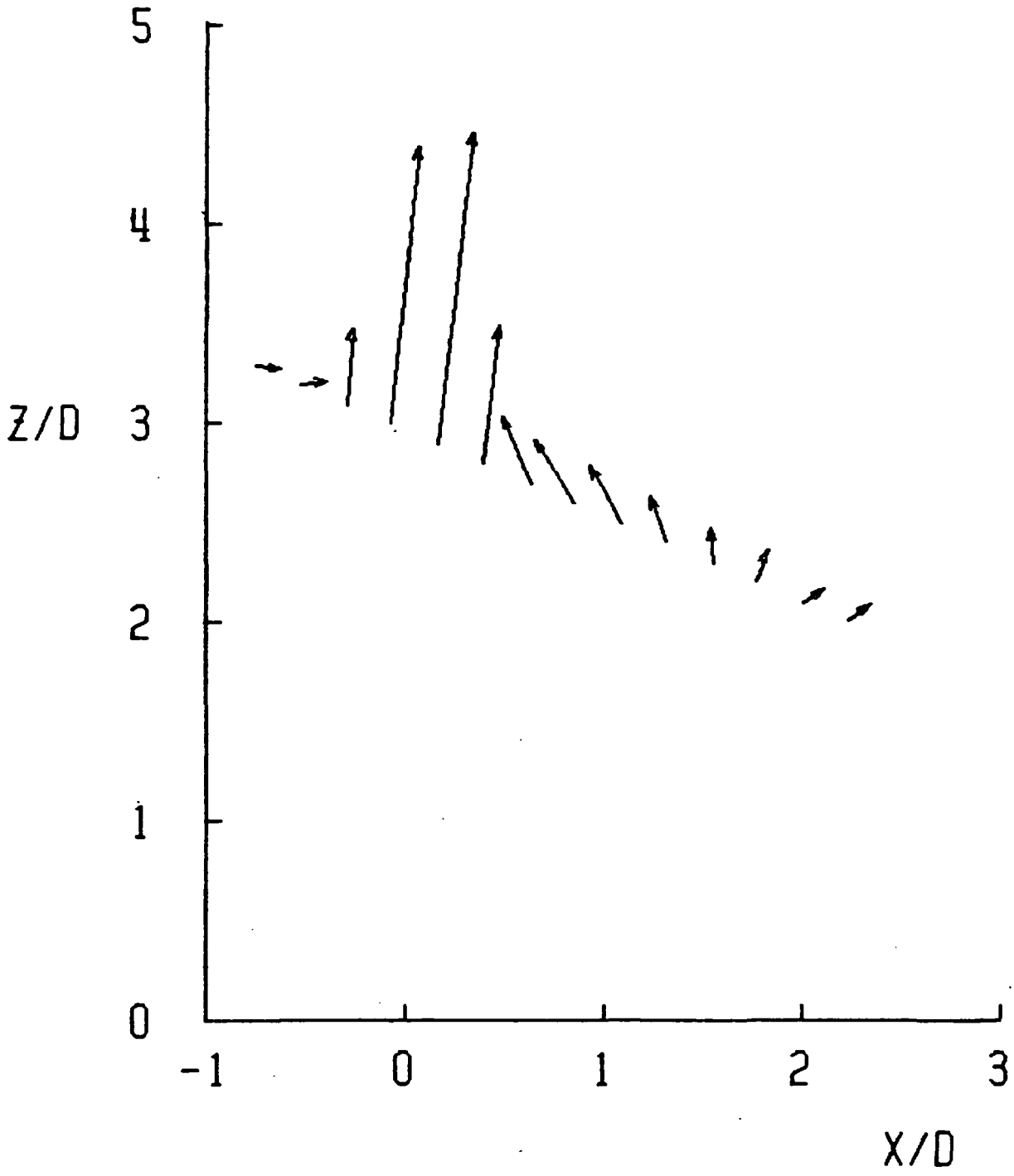


Figure A10a.-- Symmetry plane velocities, R=8, PHI = 66.7°, cross-section 3

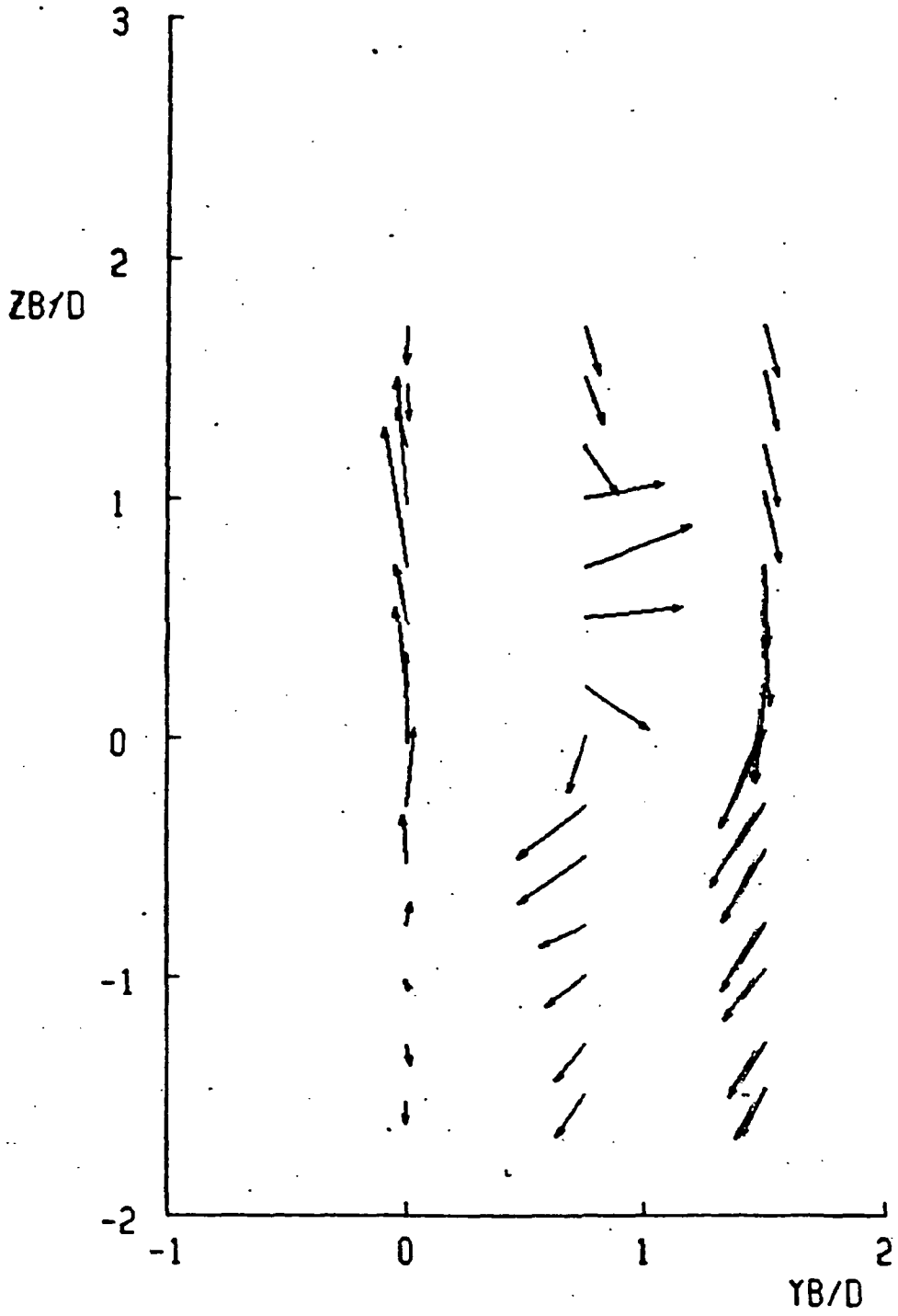


Figure A10b.- Cross-section velocities, R=8, PH1 = 66.7°, cross-section 3

TEST CONDITIONS			ZB/D							
			-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	
R=	8.07		0.52	0.82	1.03	1.31	7.57	1.86	0.19	UB/UINF
UINF=	21.2	M/S	0.06	0.06	0.11	-0.20	-0.38	-0.19	-0.03	VB/UINF
X/D=	0.63		-0.33	0.40	1.32	1.33	2.33	0.64	-0.61	WB/UINF
Y/D=	0.0		-0.35	-1.03	-2.65	-4.08	-2.02	-2.99	0.29	CP
Z/D=	2.69		-0.97	-1.20	-0.82	-1.55	63.88	-0.05	-0.31	CPT
PHI=	66.6	DEG	32.7	26.4	51.9	46.0	17.5	20.0	72.5	THETA
R=	7.99		0.59	0.85	0.91	1.06	3.34	6.67	0.33	UB/UINF
UINF=	21.1	M/S	-0.02	-0.02	-0.06	-0.03	-0.20	-0.19	0.01	VB/UINF
X/D=	0.95		-0.37	0.04	0.80	1.53	0.99	2.11	-0.60	WB/UINF
Y/D=	0.0		-0.35	-0.75	-1.56	-3.84	-7.07	-1.17	-0.51	CP
Z/D=	2.60		-0.87	-1.03	-1.10	-1.35	4.25	49.25	-1.03	CPT
PHI=	66.7	DEG	32.?	3.4	41.4	55.3	17.0	17.7	61.0	THETA
R=	8.08		0.77	1.03	1.91	3.92	5.18	0.55	0.20	UB/UINF
UINF=	21.1	M/S	-0.50	-0.77	-1.14	1.06	1.78	0.53	0.21	VB/UINF
X/D=	0.63		-0.58	-0.34	-0.85	-0.71	0.69	-0.78	-0.78	WB/UINF
Y/D=	0.75		-0.21	-1.48	-6.98	*****	-5.78	-1.70	0.04	CP
Z/D=	2.69		-0.04	-0.72	-2.29	5.70	24.64	-1.50	-0.26	CPT
PHI=	66.7	DEG	45.5	40.1	37.4	17.4	19.5	59.2	75.7	THETA
R=	8.06		0.65	0.79	1.37	3.37	5.56	2.33	0.28	UB/UINF
UINF=	21.2	M/S	-0.48	-0.67	-1.13	-0.30	1.64	1.33	0.28	VB/UINF
X/D=	0.82		-0.68	-0.50	-0.78	-0.93	0.17	0.24	-0.76	WB/UINF
Y/D=	0.75		0.13	-0.38	-3.58	*****	-8.90	-3.53	-0.28	CP
Z/D=	2.60		0.23	-0.04	-0.81	-0.32	24.86	2.80	-0.55	CPT
PHI=	66.7	DEG	52.4	47.4	45.8	16.4	15.8	29.4	70.3	THETA
R=	7.97		0.64	0.56	0.67	0.73	0.56	0.40	0.26	UB/UINF
UINF=	21.1	M/S	-0.55	-0.68	-0.88	-0.17	0.03	0.21	0.21	VB/UINF
X/D=	0.63		-0.91	-1.12	-1.39	-1.64	-1.37	-1.02	-0.86	WB/UINF
Y/D=	1.50		-0.37	-0.83	-2.04	-3.83	-2.84	-1.18	-0.50	CP
Z/D=	2.72		0.18	0.21	0.14	-1.56	-1.65	-0.94	-0.65	CPT
PHI=	66.6	DEG	59.1	67.3	68.2	66.3	67.6	69.0	73.6	THETA
R=	8.07		0.74	0.63	0.69	0.69	0.54	0.43	0.23	UB/UINF
UINF=	21.2	M/S	-0.42	-0.64	-0.67	-0.70	0.07	0.23	0.20	VB/UINF
X/D=	0.79		-0.82	-0.84	-1.20	-1.62	-1.57	-1.18	-0.97	WB/UINF
Y/D=	1.50		-0.53	-0.92	-1.87	-2.71	-3.06	-1.61	-0.41	CP
Z/D=	2.60		-0.13	-0.40	-0.50	-0.09	-1.29	-0.99	-0.37	CPT
PHI=	66.7	DEG	51.5	59.3	63.8	68.8	70.9	70.2	76.6	THETA

TABLE A10.-TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PHI = 66.7°, CROSS-SECTION 3

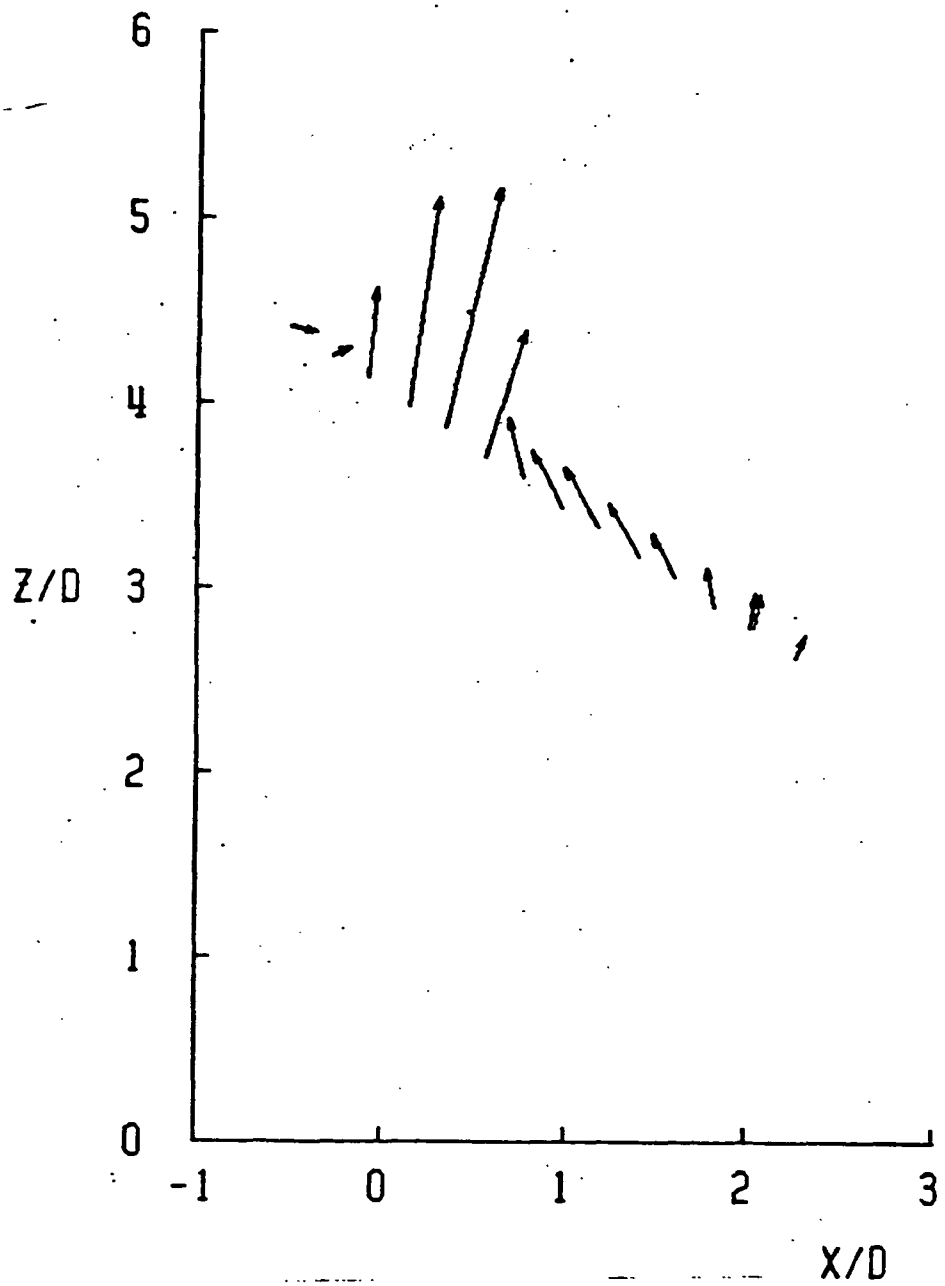


Figure 11a.- Symmetry plane velocities, R=8,
PH1 = 57.1°, cross-section 1

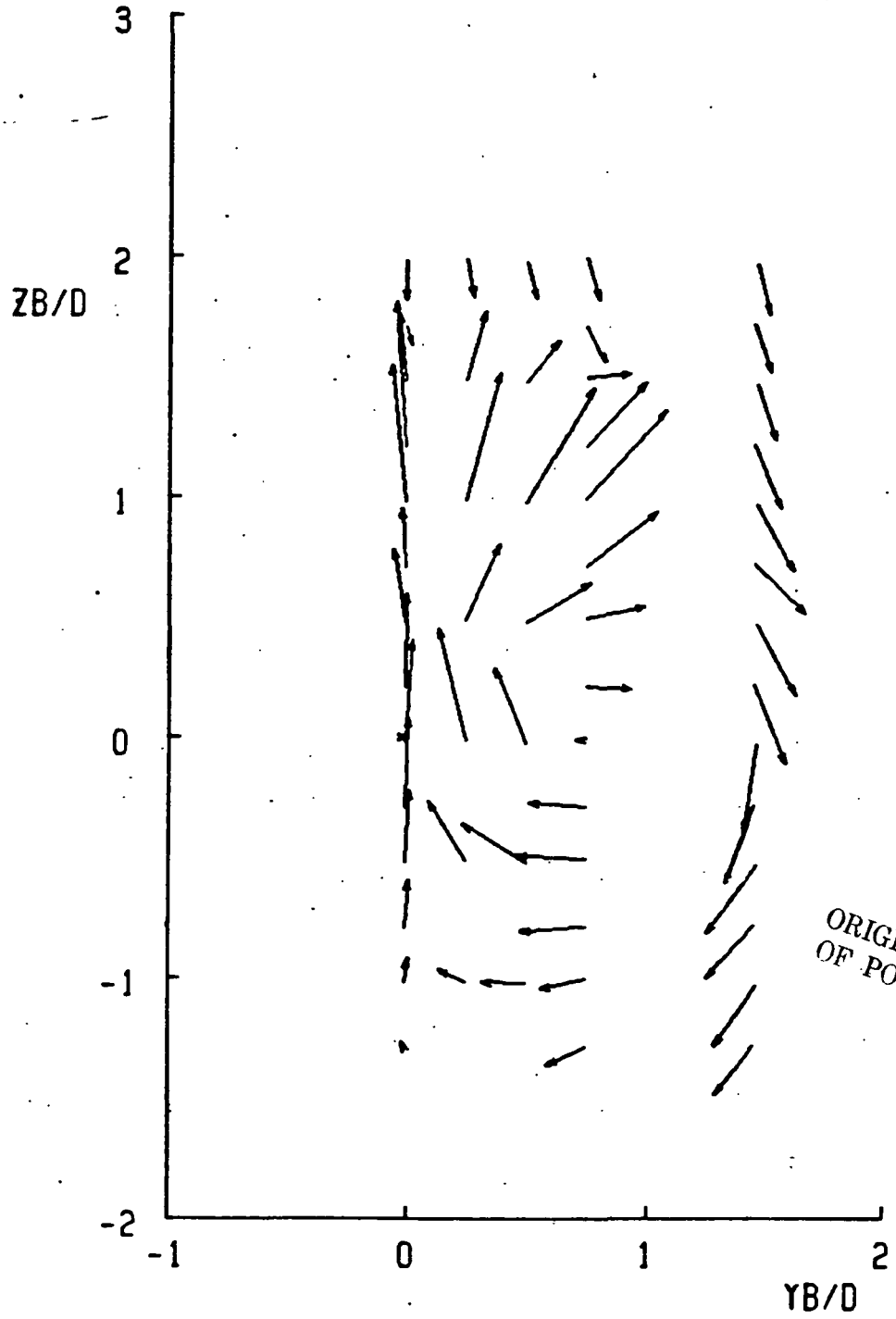


Figure 11b.- Cross-section velocities, R=8,
PH1 = 57.1°, cross-section 1

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	8.02		0.88	0.65	0.85	1.17	6.21	2.13	0.25	UB/UINF	0.83	1.05	1.24	1.77	1.70	0.57	0.43	R=	7.96	
UINF=	21.3	M/S	0.06	0.07	0.11	-0.19	-0.23	-0.11	-0.01	VB/UINF	-0.65	-0.80	-0.49	0.53	0.84	0.45	0.27	UINF=	21.3	M/S
X/D=	0.76		0.40	1.20	1.69	1.21	2.28	1.14	-0.66	WB/UINF	-0.82	-0.88	-1.31	-1.32	-0.92	-1.08	-0.81	X/D=	0.98	
Y/D=	-0.01		-0.88	-1.69	-4.06	-4.51	-7.69	-3.42	0.36	CP	-0.62	-2.38	-4.30	-5.32	-4.62	-1.57	-0.52	Y/D=	1.45	
Z/D=	3.60		-0.94	-0.91	-1.47	-2.63	37.05	1.49	-0.13	CPT	0.16	-0.84	-1.78	-1.17	-1.31	-0.87	-0.61	Z/D=	3.45	
PHI=	57.1	DEG	24.3	61.4	63.3	46.4	20.4	28.4	69.6	THETA	52.0	49.1	48.7	38.8	27.4	63.7	63.1	PHI=	57.0	DEG
R=	7.95		0.69	0.82	0.78	0.81	-3.42	5.17	0.46	UB/UINF										
UINF=	21.4	M/S	-0.04	0.06	0.05	0.02	-0.06	-0.16	0.08	VB/UINF										
X/D=	0.68		0.10	0.78	1.49	1.55	0.97	2.41	-0.33	WB/UINF										
Y/D=	-0.01		-0.52	-1.31	-3.11	-4.13	-8.21	-3.73	-1.55	CP										
Z/D=	3.44		-1.03	-1.02	-1.28	-2.06	3.61	28.93	-2.23	CPT										
PHI=	57.1	DEG	9.2	43.3	62.3	62.3	16.0	25.1	36.3	THETA										
R=	8.03		0.83	0.97	1.24	1.22	6.13	2.25	0.30	UB/UINF										
UINF=	21.1	M/S	-0.44	-0.62	-0.45	0.56	0.56	0.32	0.10	VB/UINF										
X/D=	0.75		0.21	1.01	1.89	1.27	2.13	1.14	-0.62	WB/UINF										
Y/D=	0.24		-0.28	-1.88	-4.92	-4.62	-8.47	-3.72	0.17	CP										
Z/D=	3.59		-0.35	-0.53	-0.62	-2.18	34.82	1.80	-0.35	CPT										
PHI=	57.0	DEG	31.8	51.3	57.7	48.2	19.4	27.4	64.0	THETA										
R=	8.05		1.01	1.53	2.31	2.05	5.85	1.63	0.36	UB/UINF										
UINF=	21.2	M/S	-0.71	-1.05	-0.51	1.08	1.12	0.54	0.15	VB/UINF										
X/D=	0.76		0.03	0.66	1.25	0.65	1.89	0.68	-0.62	WB/UINF										
Y/D=	0.49		-0.64	-3.48	-8.48	-7.24	-7.67	-3.65	0.10	CP										
Z/D=	3.59		-0.13	-0.59	-2.27	-3.41	31.96	-1.23	-0.37	CPT										
PHI=	57.1	DEG	36.4	40.1	30.7	30.5	19.9	27.4	60.0	THETA										
R=	7.99		0.98	1.78	3.12	3.54	5.10	0.90	0.29	UB/UINF										
UINF=	21.3	M/S	-0.75	-1.10	-0.17	0.00	1.33	0.74	0.19	VB/UINF										
X/D=	0.74		-0.15	0.07	-0.01	0.20	1.46	0.07	-0.70	WB/UINF										
Y/D=	0.74		-0.87	-4.40	-9.29	-9.23	-6.35	-2.70	0.24	CP										
Z/D=	3.59		-0.32	-0.88	-0.41	3.50	23.46	-2.34	-0.15	CPT										
PHI=	57.1	DEG	30.0	34.0	4.2	14.8	20.5	38.4	67.9	THETA										
R=	7.98		0.86	1.26	2.49	2.48	4.94	3.33	0.37	UB/UINF										
UINF=	21.3	M/S	-0.65	-1.09	-0.95	0.76	1.19	0.99	0.30	VB/UINF										
X/D=	0.98		-0.29	-0.06	0.09	-0.05	0.90	1.05	-0.60	WB/UINF										
Y/D=	0.74		-0.22	-1.99	-7.02	-9.10	-8.89	-5.26	-0.73	CP										
Z/D=	3.44		0.03	-0.19	-0.87	-3.32	17.51	7.11	-1.14	CPT										
PHI=	57.1	DEG	40.9	41.8	22.0	15.9	16.0	22.7	60.6	THETA										
R=	7.99		0.80	0.84	1.27	1.75	1.19	0.61	0.31	UB/UINF										
UINF=	21.3	M/S	-0.64	-0.73	-0.29	0.52	0.70	0.30	0.26	VB/UINF										
X/D=	0.86		-0.80	-1.12	-1.40	-1.15	-3.99	-0.99	-0.69	WB/UINF										
Y/D=	1.47		-0.78	-2.02	-4.45	-5.36	-3.92	-1.40	0.01	CP										
Z/D=	3.43		-0.06	-0.52	-1.80	-1.58	-2.01	-0.94	-0.04	CPT										
PHI=	57.2	DEG	52.8	58.4	48.6	36.2	45.1	59.2	71.4	THETA										

TABLE A11.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PH1 = 57.1°, CROSS-SECTION 1

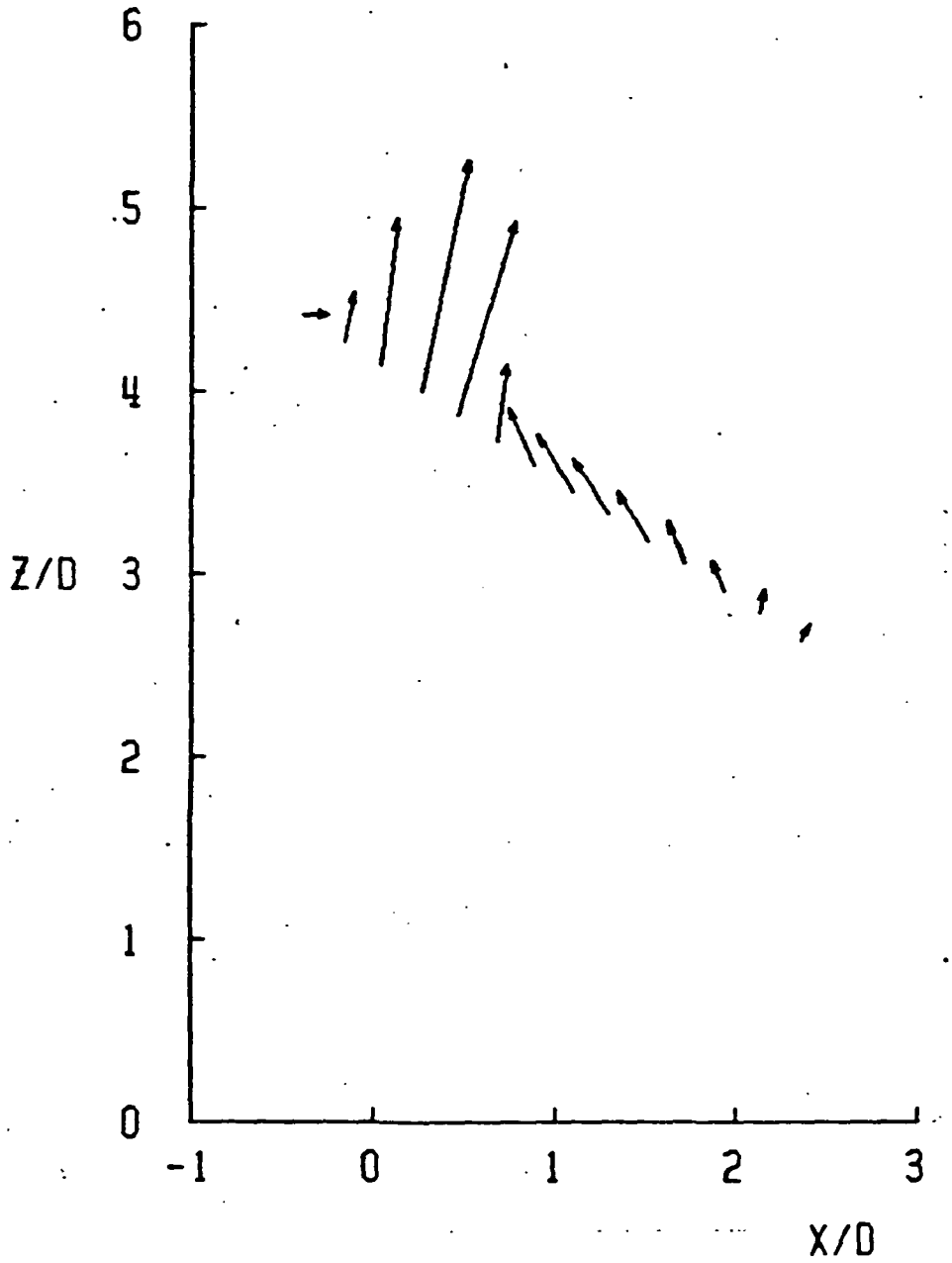


Figure A12a.- Symmetry plane velocities, R=8,
PH1 = 57.1°, cross-section 2

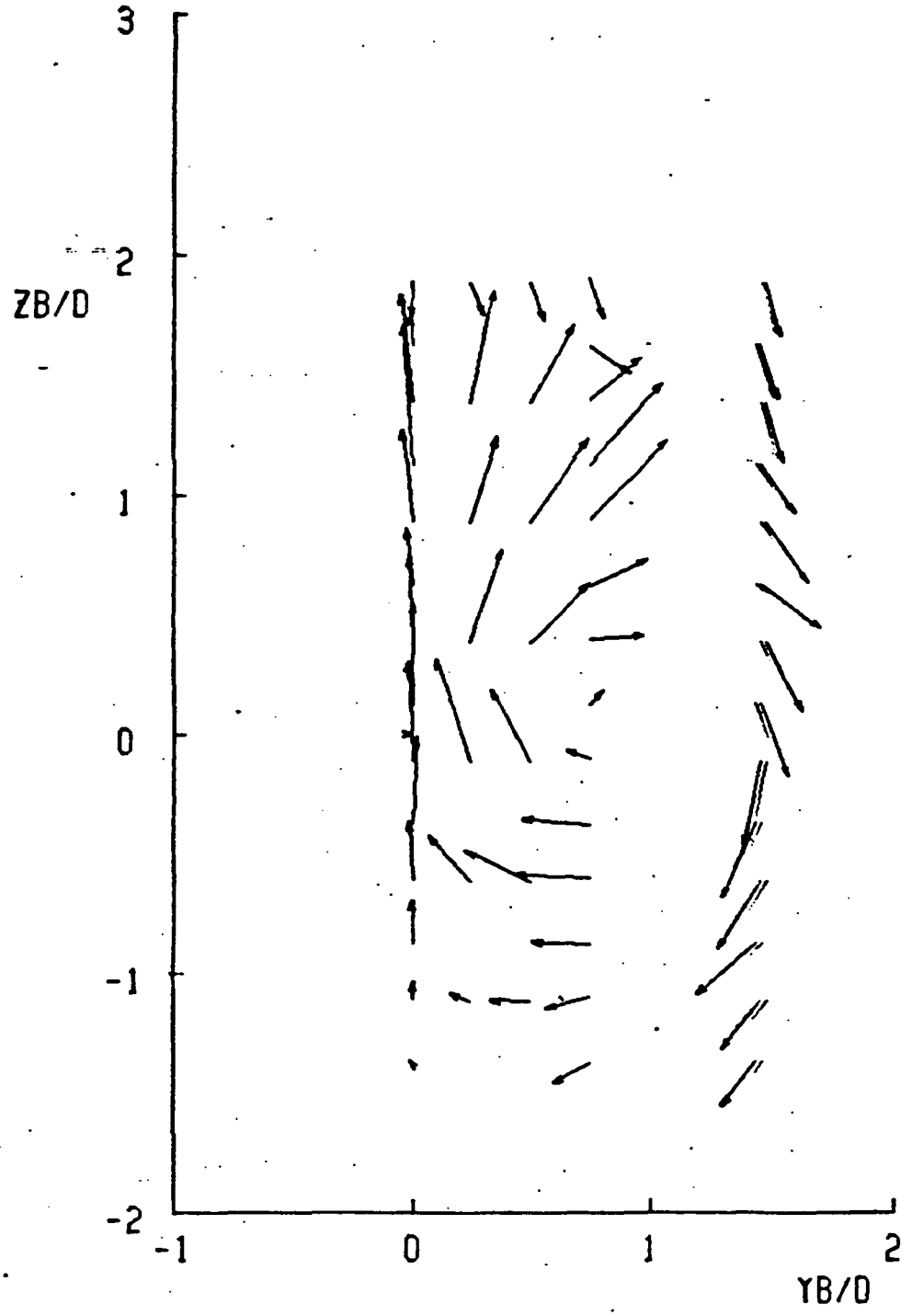


Figure A12b.- Cross-section velocities, R=8,
PH1 = 57.1°, cross-section 2

TEST CONDITIONS			ZO/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	8.04		0.65	0.76	0.74	0.96	5.36	3.64	0.38	UB/UINF	0.88	0.67	1.36	1.98	2.12	0.95	0.34	R=	7.97	
UINF=	21.2	M/S	0.02	-0.05	-0.07	-0.07	-0.17	-0.19	-0.03	VB/UINF	-0.57	-1.00	-0.57	0.44	0.99	0.57	0.30	UINF=	21.3	M/S
X/D=	0.88		0.30	0.58	1.07	1.43	1.53	1.79	-0.58	WB/UINF	-0.73	-0.86	-1.24	-1.23	-0.74	-0.81	-0.90	X/D=	1.10	
Y/D=	0.0		-0.54	-1.54	-3.33	-3.78	-9.99	-4.19	-0.65	CP	-0.63	-0.83	-4.46	-5.86	-5.43	-3.10	-0.40	Y/D=	1.45	
Z/D=	3.60		-1.03	-1.02	-0.96	-1.81	21.12	11.59	-0.97	CPT	0.0	0.36	-1.71	-1.22	-0.37	-2.21	-0.38	Z/D=	3.46	
PHI=	57.1	DEG	24.9	52.3	66.1	56.3	16.2	26.5	56.6	THETA	46.9	63.6	45.4	33.2	29.7	45.6	69.8	PHI=	57.0	DEG
R=	7.99		0.53	0.55	0.70	0.80	1.98	6.07	1.30	UB/UINF										
UINF=	21.4	M/S	-0.05	-0.01	0.06	0.0	-0.11	-0.16	-0.04	VB/UINF										
X/D=	1.10		0.05	0.76	1.48	1.70	0.95	2.35	-0.51	WB/UINF										
Y/D=	0.0		-0.36	-0.75	-2.06	-3.99	-6.25	-7.03	-2.83	CP										
Z/D=	3.45		-1.34	-0.90	-0.39	-1.44	-2.41	36.22	-1.98	CPT										
PHI=	57.1	DEG	8.9	53.7	64.7	65.0	25.8	21.3	21.6	THETA										
R=	8.00		0.99	1.07	1.23	0.97	5.14	3.76	0.40	UB/UINF										
UINF=	21.3	M/S	-0.34	-0.68	-0.56	0.52	0.46	0.39	0.22	VB/UINF										
X/D=	0.88		0.13	0.77	1.73	1.55	1.43	1.88	-0.54	WB/UINF										
Y/D=	0.24		-0.39	-1.31	-4.55	-3.60	-9.30	-3.83	-0.57	CP										
Z/D=	3.59		-0.28	-0.12	-0.71	-0.97	19.26	13.31	-1.07	CPT										
PHI=	57.0	DEG	21.5	44.6	56.3	59.0	15.9	26.7	54.9	THETA										
R=	8.06		0.83	1.43	2.18	1.76	5.49	2.78	0.32	UB/UINF										
UINF=	21.3	M/S	-0.45	-1.07	-0.65	0.98	0.98	0.72	0.22	VB/UINF										
X/D=	0.88		0.01	0.52	1.22	0.98	1.41	1.29	-0.63	WB/UINF										
Y/D=	0.49		-0.21	-2.49	-7.73	-6.30	-9.29	-4.04	-0.17	CP										
Z/D=	3.59		-0.10	-0.02	-2.02	-2.28	23.86	4.94	-0.62	CPT										
PHI=	57.1	DEG	39.0	40.9	33.0	37.4	16.7	27.3	64.5	THETA										
R=	8.04		0.87	1.33	2.69	2.59	5.36	1.97	0.34	UB/UINF										
UINF=	21.2	M/S	-0.74	-1.25	-0.43	0.92	1.33	0.88	0.23	VB/UINF										
X/D=	0.86		-0.18	0.07	0.14	0.05	1.30	0.68	-0.66	WB/UINF										
Y/D=	0.74		-0.54	-2.65	-8.34	-8.36	-8.12	-4.11	-0.21	CP										
Z/D=	3.59		-0.20	-0.29	-1.91	-1.72	24.17	0.02	-0.61	CPT										
PHI=	57.1	DEG	42.5	44.4	10.1	18.5	18.3	28.6	63.6	THETA										
R=	7.98		0.73	1.03	2.15	2.76	4.12	4.53	0.42	UB/UINF										
UINF=	21.4	M/S	-0.61	-0.96	-1.12	0.22	0.98	1.23	0.69	VB/UINF										
X/D=	1.10		-0.33	0.04	0.10	0.24	0.42	1.35	-0.47	WB/UINF										
Y/D=	0.76		0.04	-1.28	-6.18	-9.24	-9.09	-6.12	-1.18	CP										
Z/D=	3.45		0.06	-0.30	-1.26	-2.43	8.37	17.38	-1.30	CPT										
PHI=	57.1	DEG	44.6	43.9	28.6	6.1	13.5	21.3	62.5	THETA										
R=	7.99		0.74	0.85	1.17	1.86	1.52	0.62	0.33	UB/UINF										
UINF=	21.3	M/S	-0.73	-0.95	-0.53	0.60	0.73	0.56	0.23	VB/UINF										
X/D=	0.96		-0.79	-1.11	-1.46	-1.21	-0.83	-1.02	-0.68	WB/UINF										
Y/D=	1.47		-0.51	-1.14	-3.48	-5.40	-4.96	-1.67	-0.19	CP										
Z/D=	3.53		0.21	0.72	-0.69	-1.10	-2.40	-0.92	-0.25	CPT										
PHI=	57.2	DEG	55.9	60.5	53.3	35.6	35.5	61.9	69.7	THETA										

TABLE A12.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PH1 = 57.1°, CROSS-SECTION 2

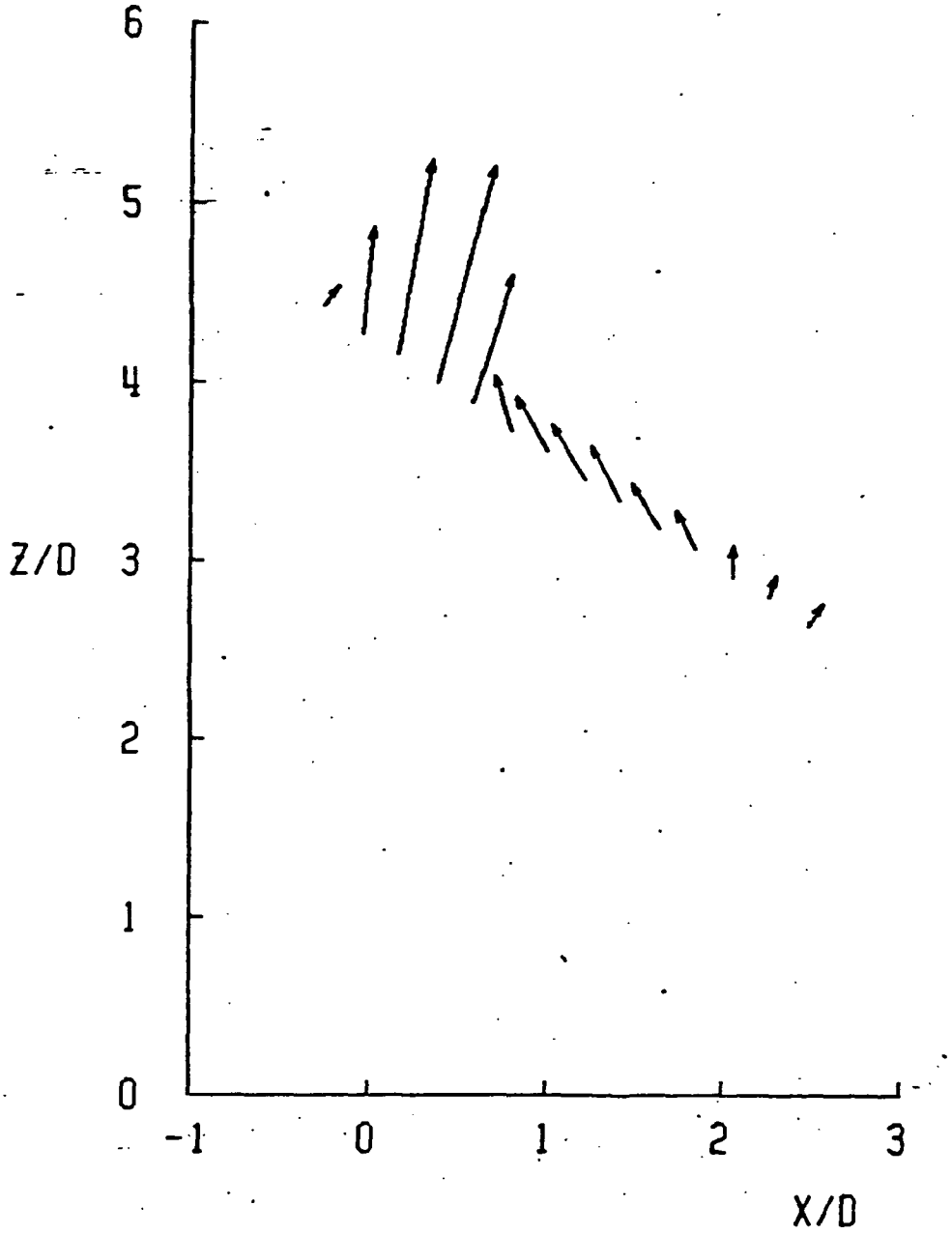


Figure A13a.-Symmetry plane velocities, R=8,
PH1 = 57.1°, cross-section 3

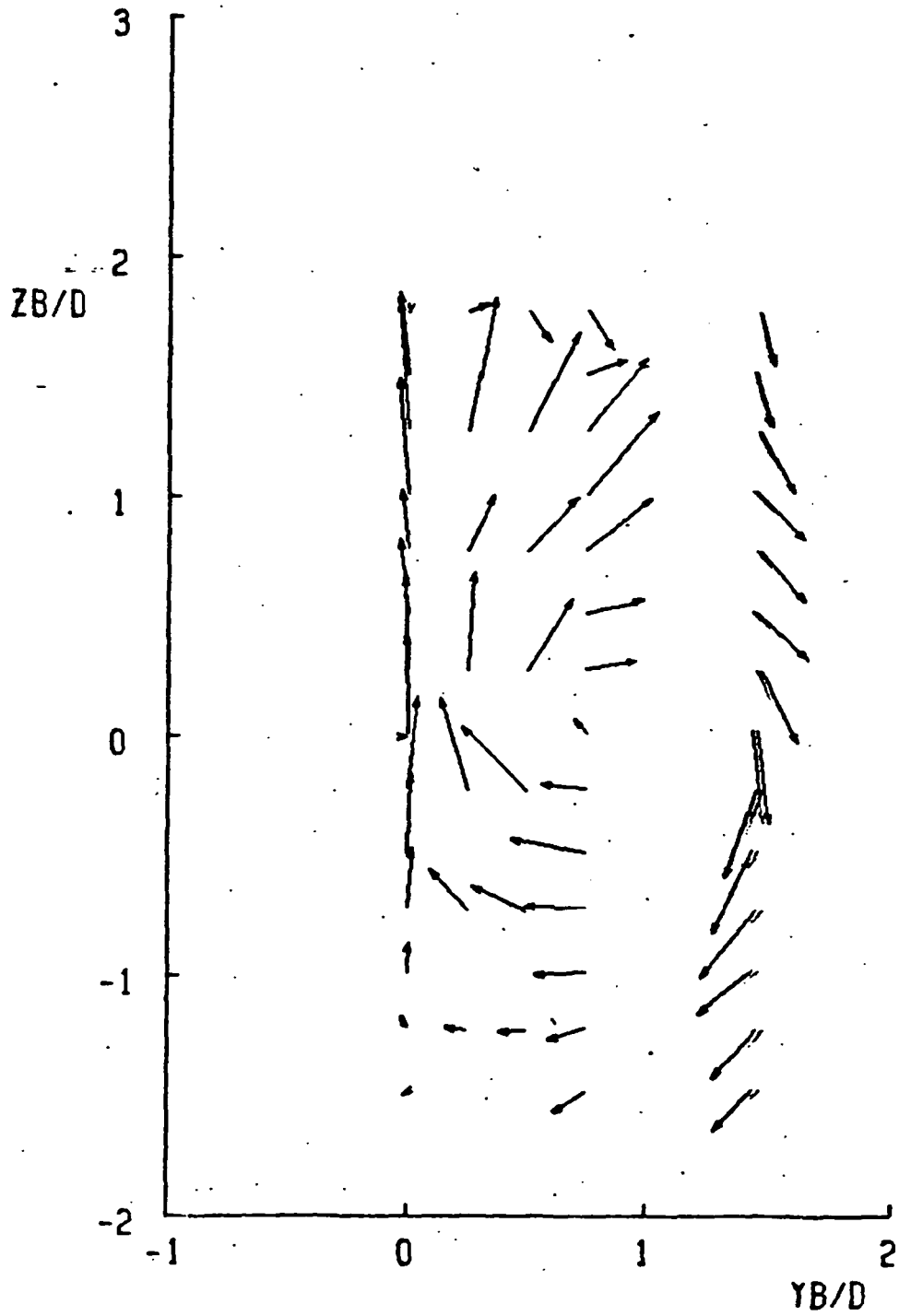


Figure A13b.- Cross-section velocities, R=8
PHI = 57.1°, cross-section 3

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	7.99		0.63	0.66	0.83	0.83	3.60	5.10	0.71	UB/UINF	0.78	0.99	1.13	1.52	2.24	1.08	0.42	R=	7.98	
UINF=	21.2	M/S	-0.07	0.10	0.17	-0.03	-0.10	-0.14	-0.01	VB/UINF	-0.64	-0.90	-0.66	0.19	0.85	0.80	0.28	UINF=	21.4	M/S
X/D=	1.00		0.19	1.01	1.52	1.56	0.99	2.13	-0.07	WB/UINF	-0.67	-0.72	-1.38	-1.54	-0.80	-0.80	-0.91	X/D=	1.22	
Y/D=	0.0		-0.55	-0.97	-3.51	-3.67	-8.61	-5.76	-1.93	CP	-0.36	-1.30	-2.86	-4.38	-6.02	-3.38	-0.82	Y/D=	1.45	
Z/D=	3.61		-1.11	-0.50	-1.47	-1.53	4.52	24.78	-2.42	CPT	0.11	0.02	-0.24	-0.65	-0.60	-1.94	-0.73	Z/D=	3.47	
PHI=	57.1	DEG	17.9	56.8	61.3	62.0	15.6	22.8	6.2	THETA	50.8	45.8	83.9	45.6	26.9	45.9	65.8	PHI=	57.0	DEG
R=	8.01		0.76	0.76	0.67	0.79	1.08	5.95	2.49	UB/UINF										
UINF=	21.4	M/S	-0.05	0.03	0.06	-0.01	-0.12	-0.14	-0.14	VB/UINF										
X/D=	1.22		-0.03	0.51	1.34	1.66	1.25	1.93	1.37	WB/UINF										
Y/D=	0.0		-0.43	-0.89	-1.54	-4.16	-4.09	-9.15	-3.83	CP										
Z/D=	3.45		-0.85	-1.05	-0.23	-1.77	-2.33	30.58	4.41	CPT										
PHI=	57.1	DEG	6.1	33.6	63.4	64.6	49.6	19.1	27.2	THETA										
R=	8.07		0.82	0.73	1.06	1.09	3.53	5.15	0.43	UB/UINF										
UINF=	21.2	M/S	-0.35	-0.60	-0.44	0.10	0.42	0.45	0.33	VB/UINF										
X/D=	1.00		0.05	0.69	1.56	1.65	0.93	2.23	0.11	WB/UINF										
Y/D=	0.25		-0.10	-0.54	-3.69	-4.63	-8.73	-5.03	-1.66	CP										
Z/D=	3.59		-0.31	-0.18	-0.94	-1.69	3.94	26.66	-2.36	CPT										
PHI=	57.0	DEG	24.7	52.0	57.2	56.4	15.5	23.6	37.8	THETA										
R=	7.99		0.88	1.09	1.92	1.79	4.49	4.01	0.41	UB/UINF										
UINF=	21.3	M/S	-0.46	-0.91	-1.09	0.76	0.84	0.85	0.36	VB/UINF										
X/D=	1.00		-0.03	0.41	1.06	1.20	0.89	1.65	-0.50	WB/UINF										
Y/D=	0.50		-0.22	-1.28	-5.89	-6.42	-9.36	-4.59	-0.28	CP										
Z/D=	3.59		-0.23	-0.08	-0.85	-2.16	11.75	14.36	-1.44	CPT										
PHI=	57.1	DEG	28.9	43.4	39.1	37.8	14.5	24.3	55.6	THETA										
R=	8.00		0.93	1.33	2.53	2.18	4.95	3.00	0.37	UB/UINF										
UINF=	21.3	M/S	-0.63	-1.03	-0.76	0.85	1.09	1.00	0.42	VB/UINF										
X/D=	0.99		-0.20	0.03	0.07	0.13	0.84	1.18	-0.67	WB/UINF										
Y/D=	0.75		-0.46	-2.45	-7.65	-7.52	-9.21	-4.61	-0.40	CP										
Z/D=	3.59		-0.16	-0.61	-1.60	-2.98	16.94	5.93	-0.63	CPT										
PHI=	57.1	DEG	36.4	38.9	17.9	20.5	14.7	26.5	64.4	THETA										
R=	7.99		0.80	1.01	1.63	2.94	3.08	5.13	1.21	UB/UINF										
UINF=	21.4	M/S	-0.53	-0.86	-1.26	-0.19	0.97	1.20	0.66	VB/UINF										
X/D=	1.22		-0.32	-0.03	0.24	0.24	0.22	1.37	0.23	WB/UINF										
Y/D=	0.75		-0.04	-0.86	-4.21	-9.71	-8.07	-7.78	-3.18	CP										
Z/D=	3.45		-0.01	-0.11	-0.90	-1.89	1.48	21.78	-2.21	CPT										
PHI=	57.1	DEG	38.6	41.5	39.3	6.7	16.8	18.8	28.9	THETA										
R=	8.09		0.83	0.75	1.15	2.16	2.05	0.96	0.39	UB/UINF										
UINF=	21.3	M/S	-0.63	-0.94	-0.66	0.29	0.96	0.70	0.30	VB/UINF										
X/D=	1.08		-0.72	-0.98	-1.42	-1.13	-0.72	-0.92	-0.86	WB/UINF										
Y/D=	1.47		-0.55	-0.73	-3.21	-6.24	-5.21	-2.73	-0.65	CP										
Z/D=	3.54		0.06	0.68	-0.43	-1.17	-0.53	-1.47	-0.68	CPT										
PHI=	57.2	DEG	49.4	61.6	53.9	28.3	29.8	49.9	66.6	THETA										

TABLE A13.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PHI = 57.1°, CROSS-SECTION 3

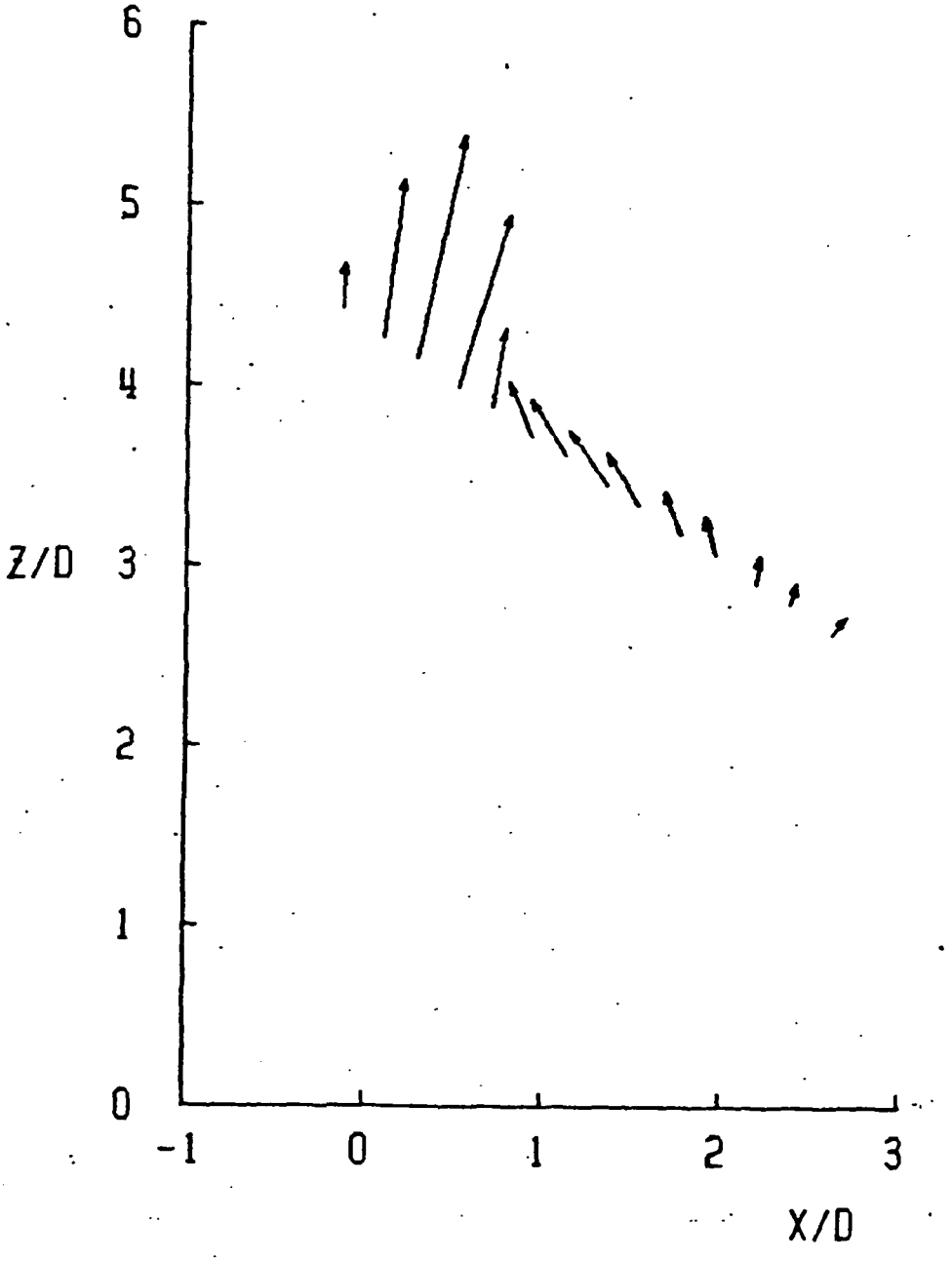


Figure A14a.- Symmetry plane velocities, R=8,
PHI = 57.1°, cross-section 4

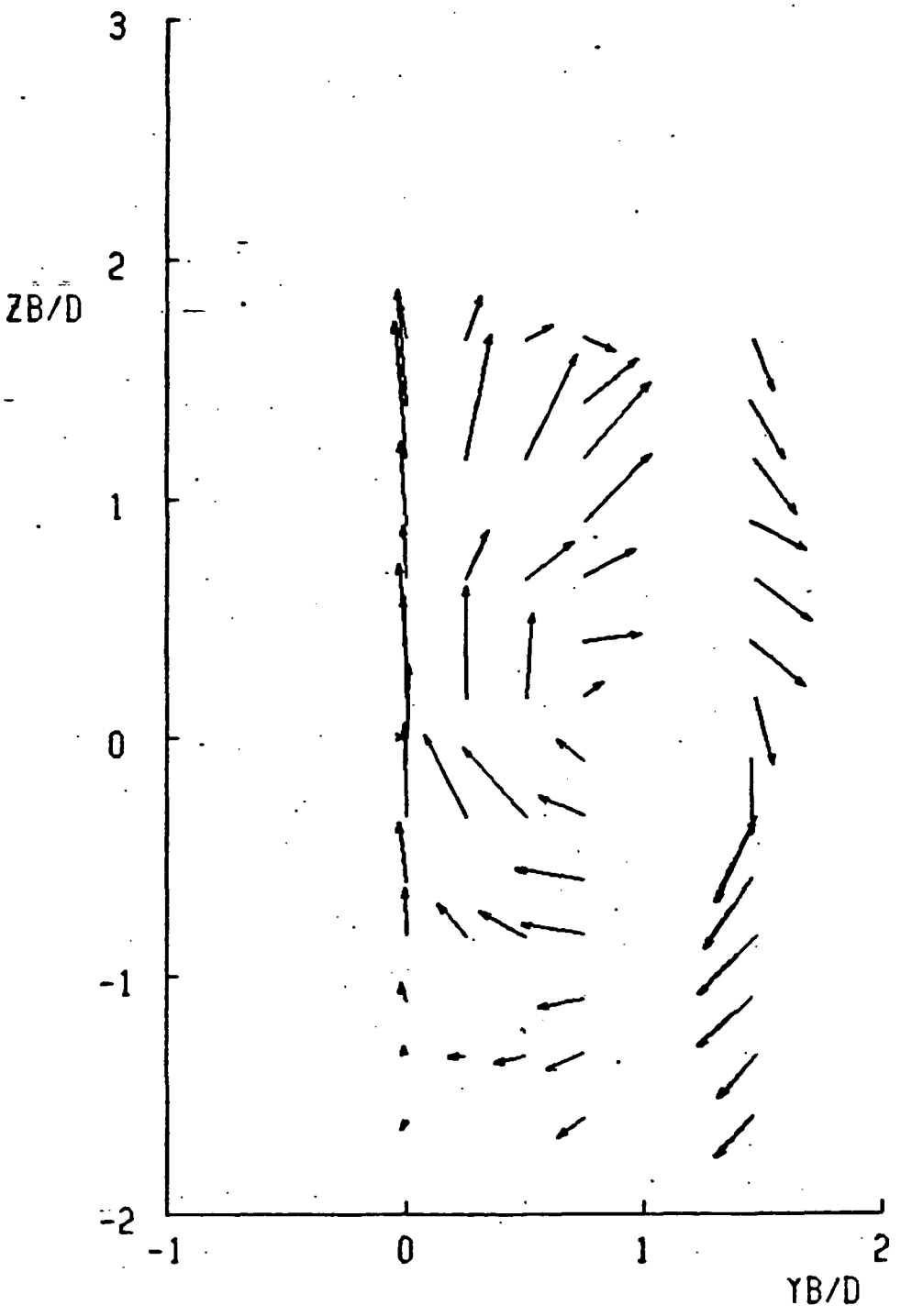


Figure A14b.- Cross-section velocities, R=8.
PH1 = 57.1°, cross-section 4

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.8	TEST CONDITIONS		
R=	8.13		0.59	0.75	0.73	0.82	2.06	5.92	1.11	UR/UINF	0.76	0.72	1.13	1.96	2.57	1.49	0.39	R=	7.97	
UINF=	31.6	M/S	-0.02	-0.01	-0.01	-0.02	-0.04	-0.18	-0.11	VB/UINF	-0.58	-0.86	-0.76	0.0	0.02	0.04	0.58	UINF=	21.3	M/S
X/D=	1.12		0.15	0.81	1.58	1.69	0.88	2.27	0.63	WB/UINF	-0.68	-0.93	-1.18	-1.28	-0.79	-0.50	-0.98	X/D=	1.34	
Y/D=	0.0		-0.58	-1.11	-2.57	-4.36	-6.21	-2.41	-1.96	CP	-0.30	-0.50	-3.03	-5.78	-6.02	-4.35	-0.54	Y/D=	1.45	
Z/D=	3.61		-1.20	-0.99	-0.53	-1.79	-2.14	40.50	-1.31	CPT	0.09	0.45	-0.77	-1.28	1.12	-1.97	-0.20	Z/D=	3.47	
PHI=	57.1	DEG	14.7	47.2	65.1	64.1	23.3	21.2	30.3	THETA	50.2	59.6	51.6	33.1	24.7	34.8	70.9	PHI=	57.0	DEG
R=	8.00		0.63	0.73	0.81	0.73	0.93	4.83	4.01	UR/UINF										
UINF=	21.4	M/S	-0.08	-0.08	-0.11	0.06	-0.11	-0.08	-0.12	VB/UINF										
X/D=	1.35		-0.14	0.32	1.01	1.68	1.36	1.39	1.94	WB/UINF										
Y/D=	0.0		-0.29	-0.81	-1.97	-3.64	-3.75	-9.80	-4.42	CP										
Z/D=	3.45		-0.87	-1.16	-1.27	-1.26	-2.01	15.13	14.84	CPT										
PHI=	57.1	DEG	14.6	24.3	51.6	66.4	55.9	16.2	25.9	THETA										
R=	8.02		0.82	0.97	1.08	1.07	8.17	8.88	1.38	UR/UINF										
UINF=	21.2	M/S	-0.28	-0.45	-0.68	0.01	0.37	0.42	0.27	VB/UINF										
X/D=	1.12		-0.01	0.56	1.40	1.89	0.83	2.10	0.74	WB/UINF										
Y/D=	0.25		-0.09	-0.76	-2.74	-4.24	-6.71	-7.48	-2.79	CP										
Z/D=	3.60		-0.34	-0.31	-0.13	-0.52	-2.16	31.42	-1.26	CPT										
PHI=	57.0	DEG	20.5	37.4	55.9	60.5	22.1	19.9	29.5	THETA										
R=	8.05		0.80	1.15	1.59	1.84	2.99	5.42	0.95	UR/UINF										
UINF=	21.2	M/S	-0.51	-0.76	-1.04	0.13	0.82	0.87	0.47	VB/UINF										
X/D=	1.12		-0.12	0.43	1.19	1.43	0.81	1.74	0.23	WB/UINF										
Y/D=	0.50		0.01	-1.14	-4.70	-6.95	-8.11	-7.72	-2.49	CP										
Z/D=	3.60		-0.09	-0.05	-0.66	-2.45	0.98	25.53	-2.32	CPT										
PHI=	57.1	DEG	34.4	38.2	45.5	37.8	17.8	19.2	27.8	THETA										
R=	8.01		0.82	1.07	2.46	2.33	4.14	4.28	0.63	UR/UINF										
UINF=	21.3	M/S	-0.63	-1.09	-0.78	0.33	0.86	1.11	0.54	VB/UINF										
X/D=	1.11		-0.27	0.18	0.32	0.23	0.46	1.26	-0.22	WB/UINF										
Y/D=	0.75		-0.12	-1.31	-7.40	-8.74	-9.22	-5.99	-1.79	CP										
Z/D=	3.60		0.03	0.04	-1.61	-4.10	8.21	14.63	-2.05	CPT										
PHI=	57.1	DEG	40.8	46.9	19.9	9.0	12.2	20.7	41.8	THETA										
R=	7.99		0.78	0.84	1.55	2.79	2.55	5.29	2.28	UR/UINF										
UINF=	21.4	M/S	-0.45	-0.78	-1.16	-0.46	0.97	1.13	0.90	VB/UINF										
X/D=	1.34		-0.33	-0.15	0.19	0.35	0.12	1.13	0.71	WB/UINF										
Y/D=	0.75		0.01	-0.53	-3.47	-6.64	-7.85	-9.23	-4.38	CP										
Z/D=	3.46		-0.07	-0.20	-0.66	-1.45	-1.34	21.23	1.16	CPT										
PHI=	57.1	DEG	36.9	44.4	38.2	12.5	10.0	16.0	25.9	THETA										
R=	7.99		0.76	0.84	0.98	1.84	2.21	1.13	0.37	UR/UINF										
UINF=	21.4	M/S	-0.64	-0.75	-0.76	0.08	0.87	0.82	0.39	VB/UINF										
X/D=	1.20		-0.70	-0.85	-1.26	-1.33	-0.70	-0.75	-0.94	WB/UINF										
Y/D=	1.47		-0.37	-1.27	-2.74	-5.60	-5.79	-3.51	-0.63	CP										
Z/D=	3.56		0.11	-0.28	-0.60	-1.41	-0.61	-1.99	-0.46	CPT										
PHI=	57.2	DEG	51.8	54.1	56.8	36.0	26.2	43.9	70.0	THETA										

TABLE A14.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PHI = 57.1°, CROSS-SECTION 4

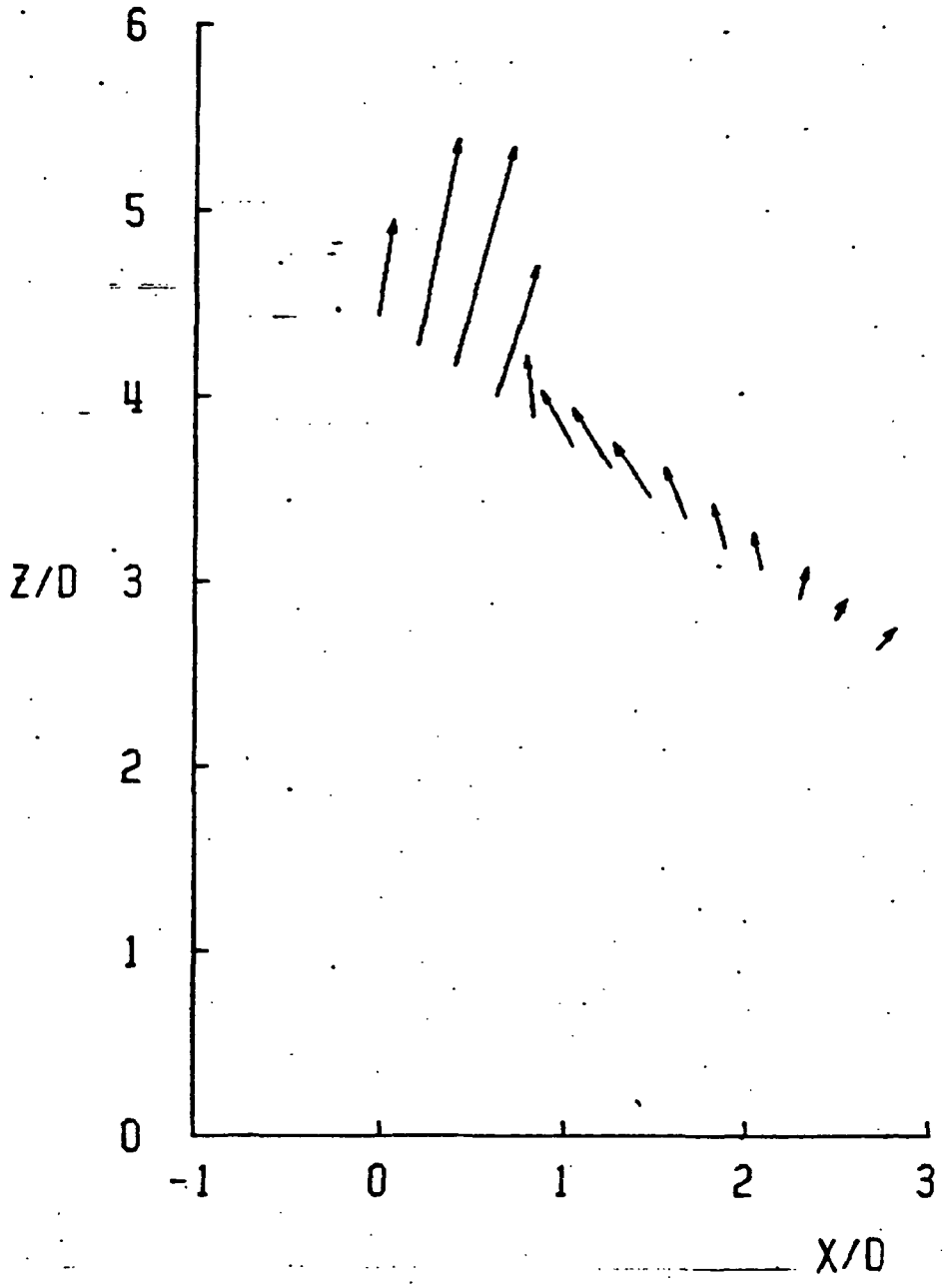


Figure A15a.- Symmetry plane velocities, R=8, PH1 = 57.1°, cross-section 5

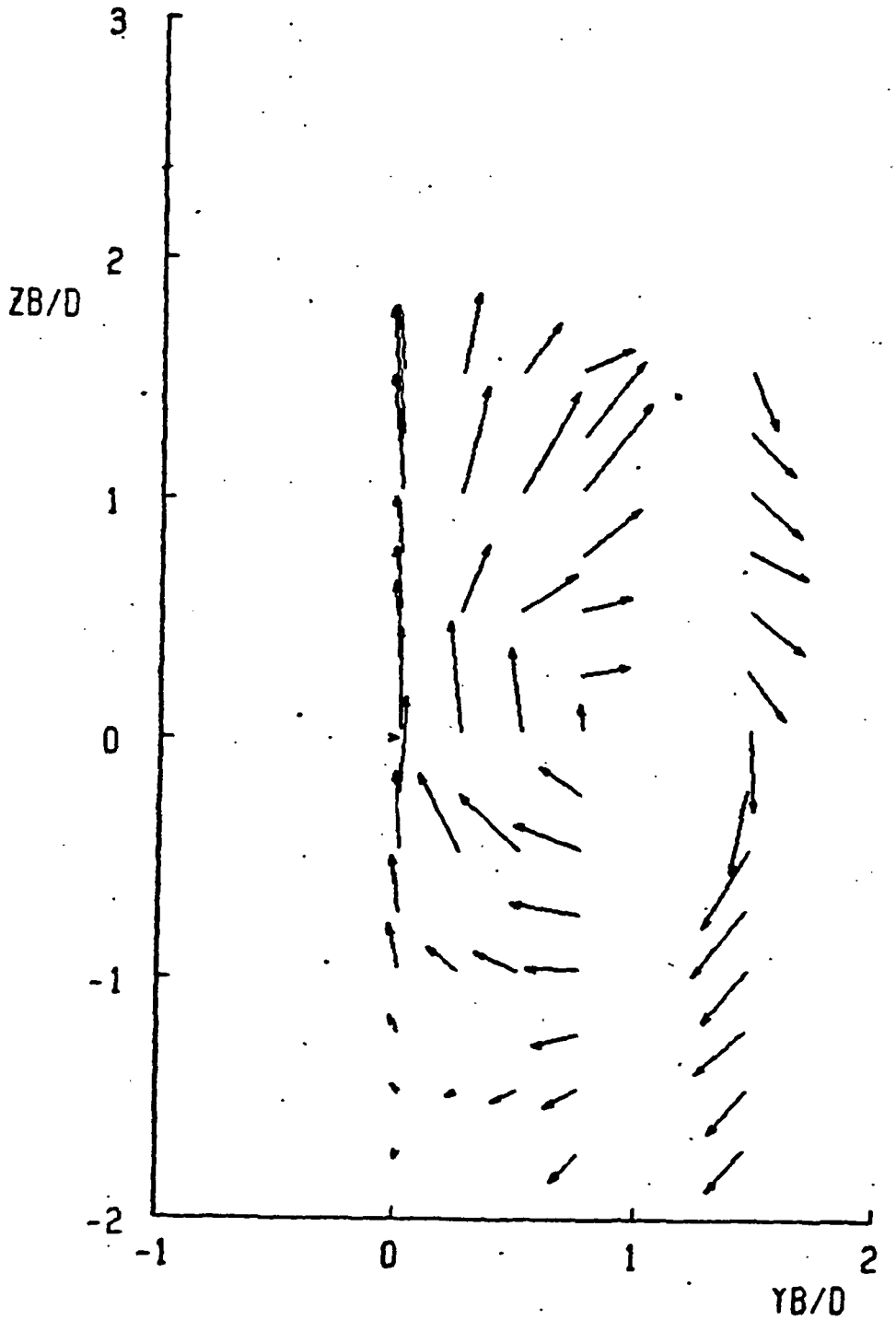


Figure A15b.- Cross-section velocities, R=8, PH1 = 57.1°, cross-section 5

TEST CONDITIONS			ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5		ZB/D -1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	TEST CONDITIONS		
R=	8.01		0.59	0.69	0.81	0.80	1.30	5.80	2.37	UB/UINF	0.73	0.81	0.90	1.65	2.80	2.06	0.61	R=	7.97	
UINF=	21.3	M/S	-0.05	-0.14	-0.06	0.01	-0.09	-0.14	-0.10	VB/UINF	-0.61	-0.83	-0.88	-0.27	0.60	0.96	0.73	UINF=	21.3	M/S
X/D=	1.24		0.05	0.71	1.26	1.67	1.92	1.88	1.03	WB/UINF	-0.65	-0.71	-1.07	-1.38	-0.91	-0.45	-0.73	X/D=	1.46	
Y/D=	0.01		-0.31	-0.71	-2.62	-3.87	-4.89	-8.09	-4.12	CP	-0.08	-0.65	-2.09	-4.92	-7.19	-5.23	-1.87	Y/D=	1.46	
Z/D=	3.62		-0.96	-0.71	-1.36	-1.42	-3.16	28.63	1.60	CPT	0.23	0.19	-0.34	-1.20	0.74	-0.85	-1.43	Z/D=	3.48	
PHI=	57.1	DEG	7.6	46.6	57.4	64.5	30.3	18.1	23.7	THETA	52.5	54.0	57.6	40.5	19.4	26.7	59.1	PHI=	57.0	DEG
R=	7.99		0.71	0.82	0.83	0.69	0.80	3.54	5.20	UB/UINF										
UINF=	21.3	M/S	-0.03	-0.11	-0.11	0.11	-0.09	-0.10	-0.16	VB/UINF										
X/D=	1.45		-0.11	0.29	0.95	1.41	1.52	0.95	2.10	WB/UINF										
Y/D=	0.01		-0.35	-0.67	-1.51	-3.04	-3.42	-8.49	-6.65	CP										
Z/D=	3.46		-0.43	-0.90	-0.91	-0.95	-1.46	4.14	24.81	CPT										
PHI=	57.1	DEG	9.9	21.3	49.3	66.8	62.4	15.3	22.2	THETA										
R=	8.01		0.78	0.92	0.96	0.84	1.29	8.78	8.91	UB/UINF										
UINF=	21.2	M/S	-0.16	-0.49	-0.68	-0.18	0.43	0.40	0.25	VB/UINF										
X/D=	1.24		-0.09	0.38	1.28	1.83	1.10	1.74	1.31	WB/UINF										
Y/D=	0.26		-0.20	-0.55	-1.75	-3.82	-4.56	-9.44	-3.58	CP										
Z/D=	3.60		-0.54	-0.32	0.29	-0.53	-2.50	26.81	3.57	CPT										
PHI=	57.0	DEG	14.6	35.1	57.1	63.0	42.0	17.0	27.6	THETA										
R=	8.06		0.81	0.92	1.57	2.01	2.02	5.59	2.00	UB/UINF										
UINF=	21.2	M/S	-0.42	-0.71	-0.99	-0.18	0.89	0.90	0.58	VB/UINF										
X/D=	1.24		-0.18	0.31	0.94	1.40	0.60	1.64	0.80	WB/UINF										
Y/D=	0.51		-0.02	-0.55	-4.16	-7.33	-6.61	-8.91	-3.84	CP										
Z/D=	3.60		-0.16	-0.11	-0.82	-2.26	-2.35	26.07	0.17	CPT										
PHI=	57.1	DEG	30.5	41.3	42.0	35.3	25.9	17.9	25.6	THETA										
R=	8.08		0.77	1.02	1.88	2.37	3.36	5.20	1.24	UB/UINF										
UINF=	21.3	M/S	-0.55	-0.88	-1.10	-0.03	0.80	1.12	0.80	VB/UINF										
X/D=	1.23		-0.30	0.01	0.41	0.42	0.18	1.42	0.33	WB/UINF										
Y/D=	0.76		0.04	-1.12	-5.21	-8.10	-8.67	-7.73	-2.66	CP										
Z/D=	3.60		0.02	-0.29	-1.28	-3.29	2.47	22.54	-1.38	CPT										
PHI=	57.1	DEG	40.5	42.1	33.1	10.3	12.6	18.5	33.9	THETA										
R=	7.97		0.79	0.82	1.30	2.55	2.45	4.69	3.37	UB/UINF										
UINF=	21.4	M/S	-0.43	-0.76	-1.13	-0.68	0.79	0.95	0.99	VB/UINF										
X/D=	1.47		-0.42	-0.17	0.21	0.47	0.14	0.78	1.24	WB/UINF										
Y/D=	0.76		0.08	-0.20	-2.41	-7.27	-7.78	-9.35	-5.05	CP										
Z/D=	3.46		0.06	0.06	-0.39	-1.05	-2.08	13.75	7.98	CPT										
PHI=	57.1	DEG	37.7	44.5	42.7	18.9	17.2	13.8	24.6	THETA										
R=	7.99		0.76	0.84	0.98	1.84	2.21	1.13	0.37	UB/UINF										
UINF=	21.4	M/S	-0.64	-0.75	-0.76	0.08	0.87	0.82	0.39	VB/UINF										
X/D=	1.20		-0.70	-0.85	-1.26	-1.33	-0.70	-0.75	-0.94	WB/UINF										
Y/D=	1.47		-0.37	-1.27	-2.74	-5.60	-5.79	-3.51	-0.63	CP										
Z/D=	3.54		0.11	-0.28	-0.60	-1.41	-0.61	-1.99	-0.48	CPT										
PHI=	87.2	DEG	61.8	54.1	86.8	36.0	26.2	43.9	70.0	THETA										

TABLE A15.- TABULATED VALUES OF CROSS-SECTION VELOCITIES AND PRESSURES FOR R=8 AND PH1 = 57.1°, CROSS-SECTION 5

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15. Supplementary Notes
This report supplements the information presented in NASA TP 1087, INDUCED VELOCITY FIELD OF A JET IN A CROSSFLOW by Richard L. Fearn and Robert P. Weston.

16. Abstract
Experimentally determined velocities at selected locations near the jet orifice are presented and analyzed for a round jet in crossflow. Jet-to-crossflow velocity ratios of four and eight were studied experimentally for a round subsonic jet of air exhausting perpendicularly through a flat plate into a subsonic crosswind of the same temperature. Velocity measurements were made in cross sections to the jet plume located from one to four jet diameters from the orifice. Jet centerline and vortex properties are presented and utilized to extend the results of a previous study into the region close to the jet orifice.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
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