DEJB: a computer program to calculate fluid film bearing dynamic coefficients

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SUBJECT DEJB: A COMPUTER PROGRAM TO CALCULATE FLUID FILM BEARING DYNAMIC COEFFICIENTS

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I.R.G. Lowe

ISSUED TO

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1.0 INTRODUCTION

Under the sponsorship of NRC through the Industrial Research Assistance Program, Dominion Engineering Works Ltd., Lachine, Québec, has developed a computer program to calculate fluid film bearing characteristics including the prediction of dynamic stiffness and damping coefficients. This program has been made available to NRC for internal research purposes and has been adapted to suit the NRC computer system. The program output has been further modified to conform to the coordinate system and non-dimensional parameters adopted in References 6 and 7.

Several other Canadian industrial companies are developing or adapting programs for the same purpose and have expressed an interest in a mutual comparison of performance prediction results. Such a comparison will help the participants to confirm the range of accuracy and reliability of their own calculation methods. With NRC as a clearing house for this information, interested industries will be aware of the existence and availability of calculation procedures at other locations in Canada. Furthermore, the comparison will determine if significant areas of discrepancy exist and thus will outline any need for corrective work or experimental confirmation. The results of this comparison are reported separately, Reference 8.

This report is a discussion of the numerical experimentation which was necessary in order to understand the effects of the various parametric options available to the user of this program. Thus, the memorandum serves as a guide to future NRC use of the program. The numerical experimentation to be described was carried out with the kind assistance of the original program compiler at the Research Division, Dominion Engineering Works Ltd., see References 1 and 2.

It should be pointed out that no attempt was made to dissect and understand the computer program in the fullest sense. It was approached as a black box for which only an understanding of the required inputs was necessary. Many of the input options were never investigated. Only three types of fluid film journal bearings were considered, viz. full circular, partial arc and tilting pad, and only a brief sampling of those results are presented here as examples. This memorandum then does not replace the engineering report which accompanied the program, Reference 1, but is intended to complement that report and to give to the user a better perspective on the accuracy and logical structure of the program. A copy of Reference 1 is appended to the original copy of this memorandum with the intention that an NRC user refer to them concurrently.

2.0 DISCUSSION OF INPUT VARIABLES AND OPTIONS

The necessary inputs are outlined on pages 13 to 22 of Reference 1. Several errors have been corrected in the appended Engine Laboratory copy, thus when following pages 13 to 22 it is best to refer to the example input and output forming Appendix I of this memorandum and not the example given in Reference 1.

Several input parameters were found to be of primary importance to the operation of the program and in some of these cases an investigation was made of program sensitivity to input magnitudes. These points will now be discussed.

2.1 OPTION 12 - LOAD OR ECCENTRICITY INPUT

Of the 15 program control options available, number 12 is one of the most important since it controls the choice of program output in terms of bearing load carrying capacity. If this option is defaulted, i.e. not chosen, then the program calculates, for a given eccentricity ratio, the load capacity, film thickness, etc. appropriate to that eccentricity ratio. Several eccentricity ratios may be specified at input time providing an output listing giving the load-clearance characteristic for the bearing. This could be deemed the normal operating mode of the program.

If the eccentricity ratio for a given load is desired, to fill in a point on the above curve for example, option 12 must be exercised, load then becoming an input. However, two estimates of eccentricity must also be given at input time since the program finds eccentricity at the given load by calculating loads for the estimated eccentricities in the normal mode and then interpolating to find the desired eccentricity ratio for the input load. (Note that not more than two input estimates of eccentricity may be used with this option!) In the figures which follow to illustrate the operation of this program the darkened symbols represent calculations utilizing this option while the open symbols represent calculations by the normal mode, i.e. with option 12 defaulted.

Figure 1 is an example of a full circular journal bearing while Figure 2 is for a partial arc bearing, again at L/D equal to 1. Note that some deviations from the smooth curves occurred when option 12 was chosen, due probably, to the error involved in the interpolation procedure. This is not considered a significant problem however since the normal mode of program operation is the most logical choice for design purposes.

2.2 CONVERGENCE CRITERION, COA(K,18)

This is one of three items controlling the accuracy of computation. Of the other two, one is a constant value built into the program, the other, COJ(1), will be discussed in the next section.

KOA(K,18) is applicable only to the tilting pad journal bearing case. It governs the error tolerance on the calculated tilting moment of each pad.

Several tilting pad bearing geometries were examined and in each case a value of 0.001 for COA(K,18) was found necessary to achieve stable results. One set of comparative results is shown in Figures 3 to 9. For COA(K,18) set at 0.1, Figures 3 to 7, the pitch angle curves are far from smooth and the tilting moment curves oscillate violently about zero, the desired result. Figures 8 and 9 illustrate how the computed results settled down to smooth curves when COA(K,18) = 0.001 was used. Tilting moment curves are not shown because they collapsed to extremely small values as expected.

It should also be noted that the load capacity-eccentricity ratio curve was also affected by the change in COA(K,18). In Figure 8 the load capacities at low eccentricities are 20% less than those of Figure 3.

For all the other examples treated, a value of COA(K,18) equal to 0.001 was found to be satisfactory.

One problem encountered when reducing COA(K,18) is that the program becomes very sensitive to the starting value of pitch angle. If that initial value is not reasonably close to the final value, numerical instability can result in aborted computer runs. A procedure which was found reasonably but not completely successful was to determine an "initial" pitch angle by running the program with a relaxed convergence criterion, e.g. COA(K,18) = 0.1. (The input or starting pitch angle for this initial run was vanishingly small but non-zero.) The resultant, i.e. computed, pitch angle, Figures 4 to 7 for example, could then be used in a second computer run with COA(K,18) = 0.001. As stated, this procedure was not always successful and some trial and error adjustment of input pitch angle was necessary from time to time. More difficulty was encountered in this regard when running the program using option 12 than when running in the normal mode.

It should also be noted here that changes were made to the program operation by Dominion Engineering Works Ltd. after the printing of Reference 1. From the operational viewpoint the most significant change was the addition of another input card, 22b. The parameters entered on this card are described in a handwritten erratum opposite page 19 in the copy of Reference 1 appended to this memorandum. COA(K,18) is one of these parameters.

2.3 CONVERGENCE CRITERION COJ(1)

This criterion appears to control the accuracy of the iteration process when the variable viscosity option is chosen. This option was not exercised during this testing. A value for COJ(1) = 0.01 was found to be satisfactory.

2.4 PERCENT RELATIVE DISPLACEMENT COJ(11)

Percent relative displacement, COJ(11), is defined as $\Delta X/C$, where ΔX is an arbitrarily imposed displacement of the journal center around the static equilibrium point, and C is the radial clearance. This term affects only the stiffness coefficient calculation, not the damping coefficient calculation. It was found that values of COJ(11) in the range 1% to 5% resulted in stable values for the stiffness coefficients (References 2 and 3).

2.5 VELOCITY, XDOT AND YDOT, COJ(12)

COJ(12) is the velocity applied for damping coefficient evaluation. Figures 10 to 13 show damping coefficients as functions of the velocity term XDOT and YDOT. Figure 10 is for the case of full circular journal bearings and Figure 11 is for partial arc journal bearings. In both of the figures stable regions are evident where the variation of velocity does not have a large effect on the values of the damping coefficients. In the present study, values corresponding to the stable regions were selected, for example, 10^{-3} in/sec for the velocity term in the case of full circular journal bearings.

Figure 12 is of interest because it illustrates a misleading situation which can arise when the values of different input parameters are improperly initialized. Figure 12 could be interpreted as meaning that the damping coefficients were strongly affected by the input values of velocity. However, it was found that by reducing the convergence criterion COA(K,18) that the apparent velocity sensitivity disappeared, Figure 13.

2.6 PRELOADING AND RADIAL CLEARANCE, COB(6) AND COD(K,1)

There are two input clearance values which require additional explanation. COD(K,1), referred to as the machined radial clearance of arcs, is the radial clearance in the usual sense for full circular or partial arc bearings, i.e. it is the difference between the bearing radius and the journal radius. It is also equal to the operating radial clearance, COB(6), in those cases.

For tilting pad bearings however these two clearances are not necessarily the same. In the first case, that of no preloading, COB(6) is equal to COD(K,1). When preloading is employed, COB(6) the operating clearance, is dependent on the amount of preloading of the pads. COB(6) is equal to the difference between the radius of the largest circle which can be drawn inside the pads and the journal radius (Reference 5). This operating clearance has been termed the "clearance of the pivot circle" in Reference 4.

Thus the preloading factor:

$$m = 1 - \frac{COB(6)}{COD(K,1)}$$

is equal to zero when COB(6) = COD(K,1), full circular bearings or partial arcs without preload, and approaches one when the operating clearance COB(6) approaches zero in heavily preloaded tilting pad bearings.

2.7 INITIAL VALUES OF ATTITUDE ANGLE - PHI, OR PAD PITCH ANGLE, COA(K,15)

As pointed out in section 2.2 preliminary runs for tilting pad bearing cases were made with very small, but non-zero, values for the Pad Pitch Angle COA(K,15). The same technique was applied to the Attitude Angle, PHI, for the full circle and partial arc cases. In some instances the initial trials led to smooth, stable solutions, while at other times the initial trials served to produce "secondary" estimates of these input parameters for final, more accurate, calculation.

A trade-off situation with the convergence criterion COA(K,18) seemed to exist in the tilting pad case. If COA(K,18) was too demanding, computation frequently stopped in mid-run and it was necessary to restart using a revised input value for Pad Pitch Angle.

A number of additional minor points of clarification are outlined in Appendix II.

3.0 PROGRAM OUTPUT

Several input time options are available which control the printed output and these are explained adequately in Reference 1. Some modifications have been made to the output format in the course of this work and these will now be explained. Reference will be made to the example output in Appendix III.

Modifications were made only to the output format for the dynamic spring and damping coefficients. These are now printed in two columns, one headed SPRING COEFFICIENTS and the other headed SIGNS CHANGED. The first is the original program output. The second column prints the spring and damping coefficients in non-dimensional form and with the naming of the X and Y axes reversed to conform to References 6, 7, and 8. Thus, for example, the horizontal damping coefficient, K_{xx} in the system of Reference 1, becomes K_{yy} under the NRC coordinate system.

4.0 PROGRAM OPERATIONAL FORMATS

This program, DEJB, may be run in batch mode, using one of the available card decks, or in the conversational mode. A card deck backup is available for use with each of the currently available compilers, TSS FORTRAN or WATFIV.

5.0 CONCLUSIONS

A computer program developed by Dominion Engineering Works Ltd., Lachine, Québec has been adapted to suit the NRC computer system. The program has been further adapted for consistency with the non-dimensional coordinate systems used in References 6 and 7.

Three types of bearings were studied using this computer program, namely full circular, partial arc and tilting pad journal bearings. Options were restricted to constant viscosity and no misalignment. During these runs, important parameters related to logical structure, accuracy, mesh size, etc., were properly identified. Their roles and effect on the results were examined and detailed descriptions on those parameters have been given to complement Reference 1 as an aid to program users.

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Part III: Design Handbook for Fluid Film Type Bearings
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NRC-ENG-92, 1977

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NRC-ENG-101, 1979

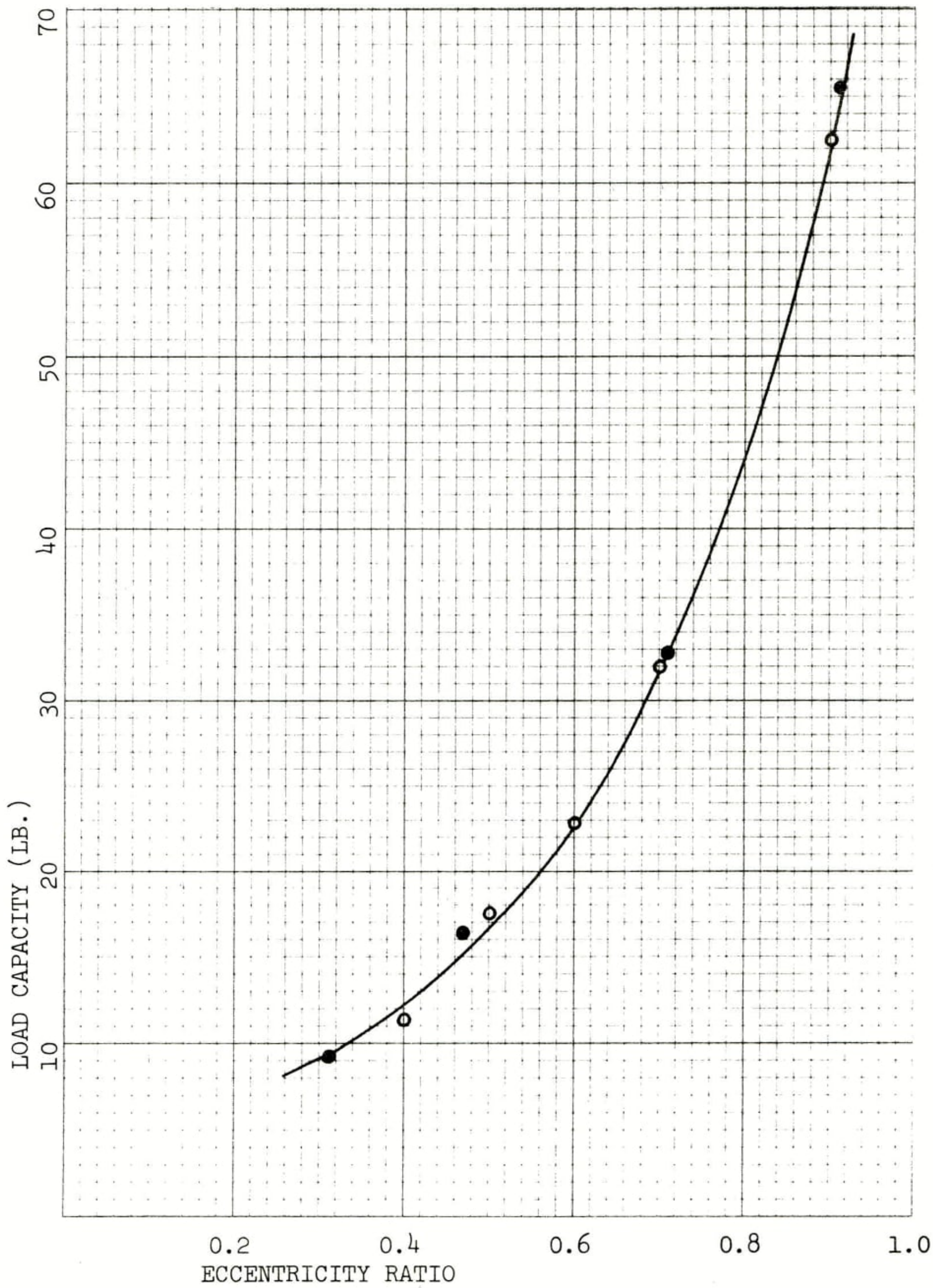

FIG. 3 Tilting Pad Journal Bearing
4 Pads @ 80°, L/D = 0.5
Load Between Pads

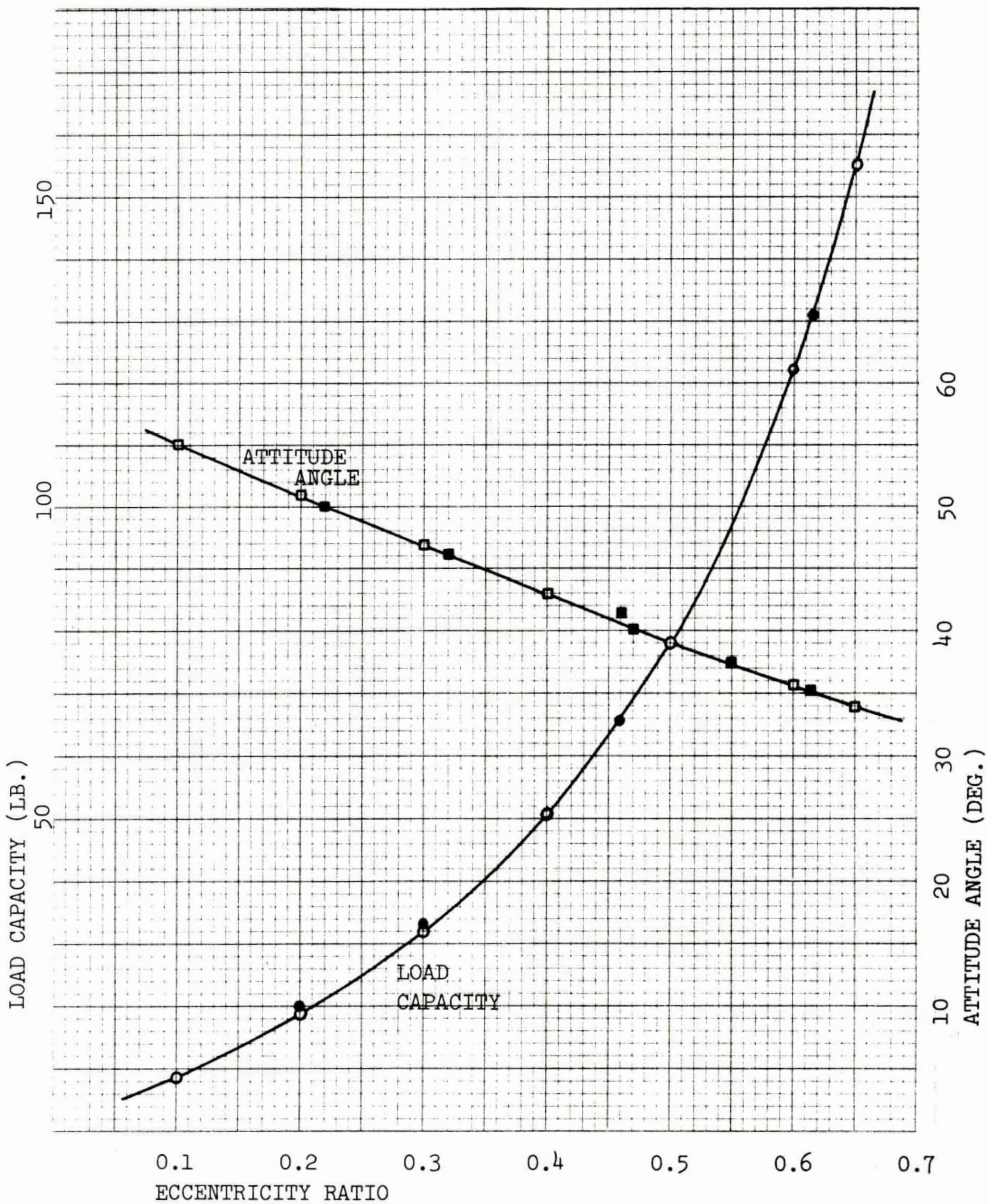

FIG. 2 Partial Arc Journal Bearing
Arc = 120°, L/D = 1.0

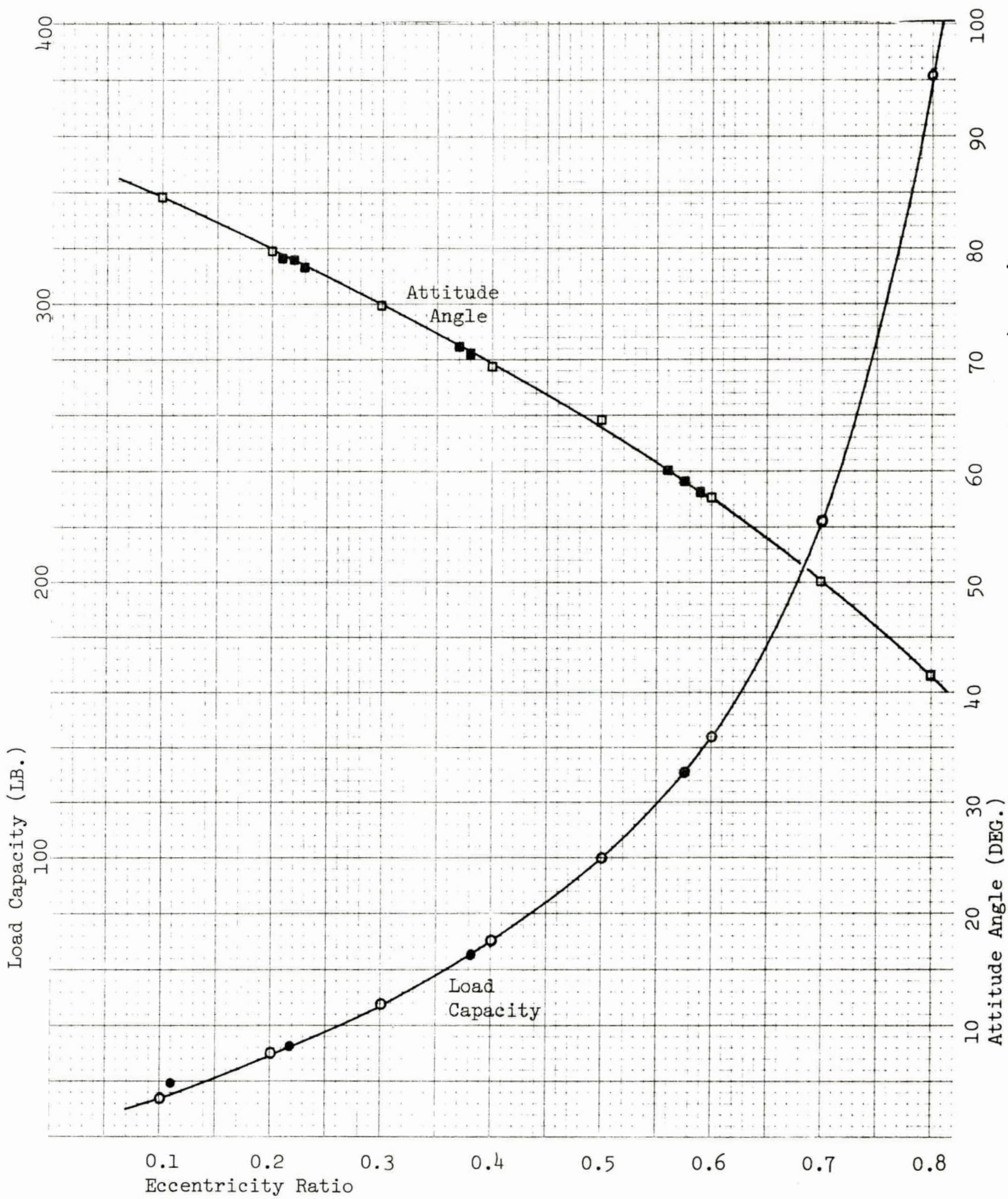

FIG. 1 Full Circular Journal Bearing
L/D = 1.0

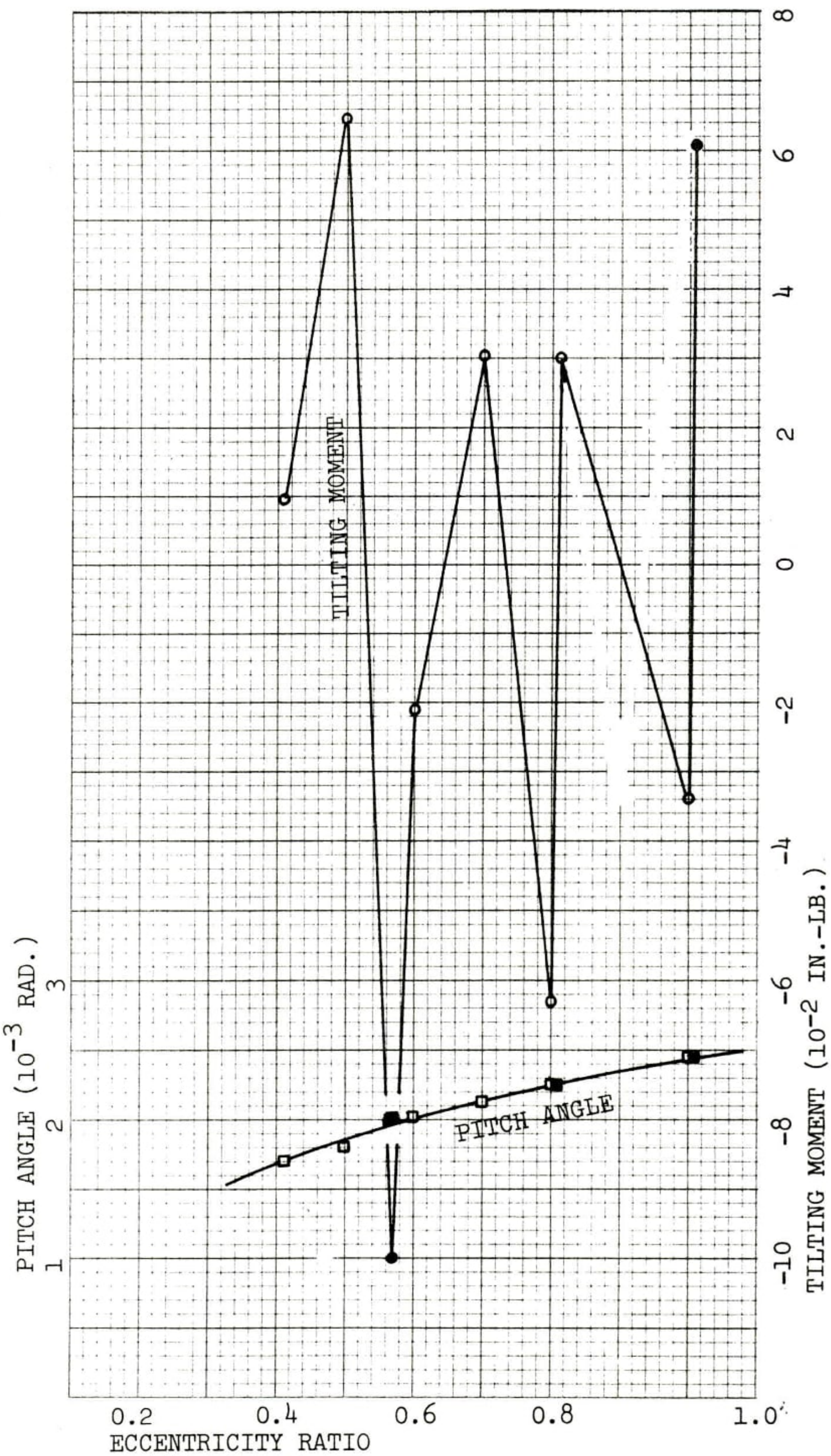

FIG. 4 Tilting Pad Journal Bearing
4 Pads @ 80°, L/D = 0.5, Arc #1
Load Between Pads

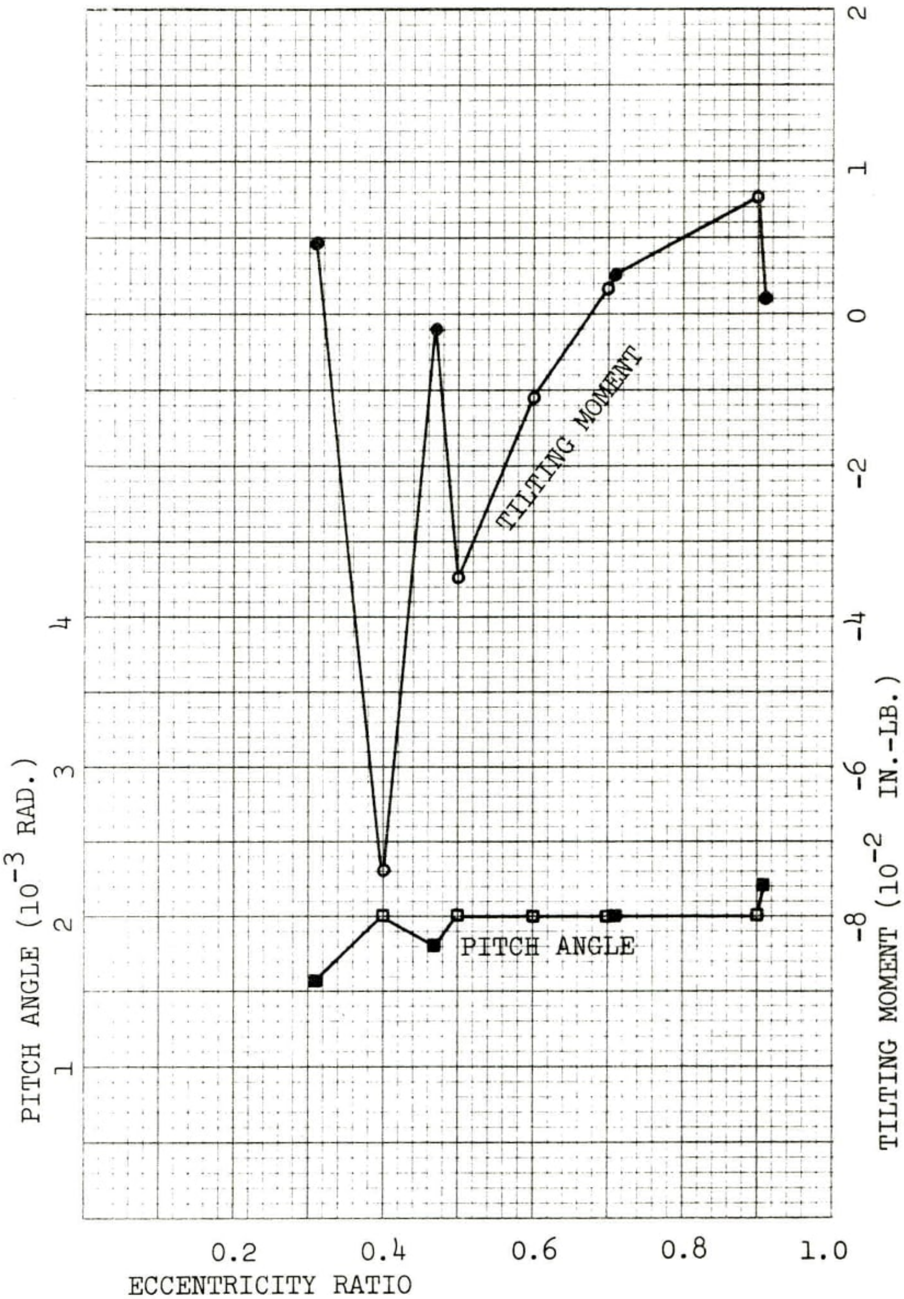

FIG. 5 Tilting Pad Journal Bearing
4 Pads @ 80°, L/D = 0.5, Arc #2
Load Between Pads

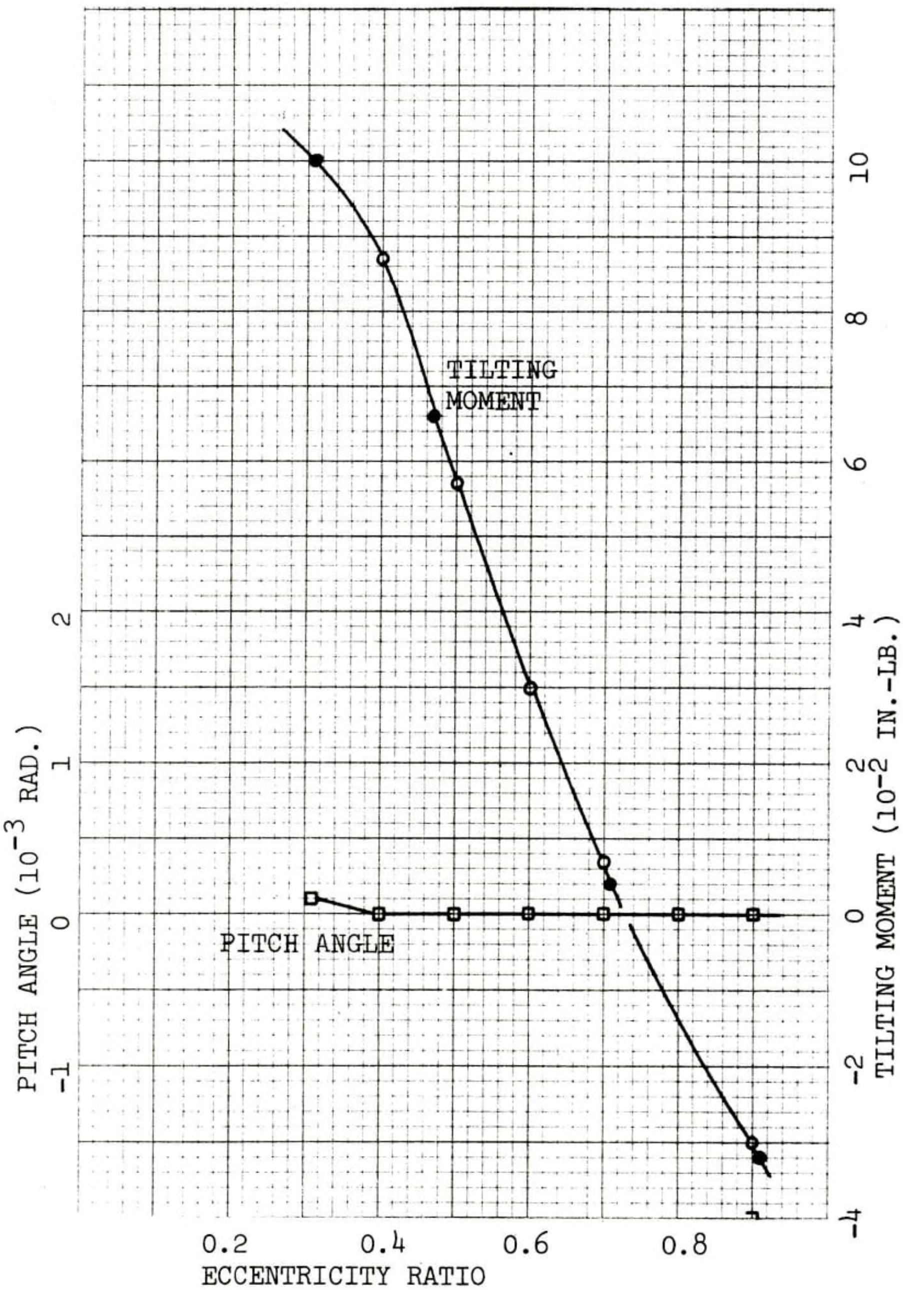

FIG. 6 Tilting Pad Journal Bearing
4 Pads @ 80°, L/D = 0.5, Arc #3
Load Between Pads

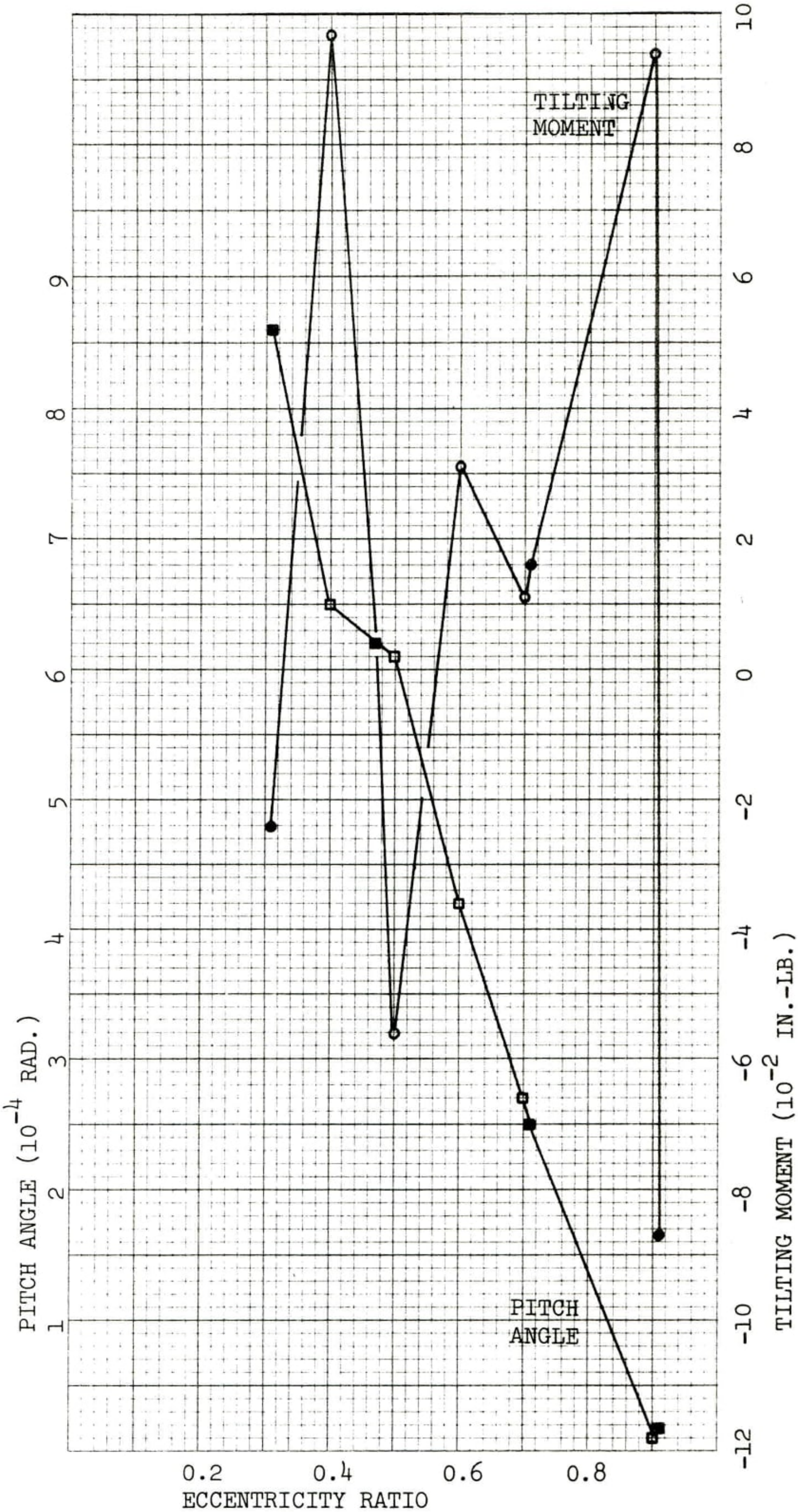

FIG. 7 Tilting Pad Journal Bearing
4 Pads @ 80°, L/D = 0.5, Arc #4
Load Between Pads

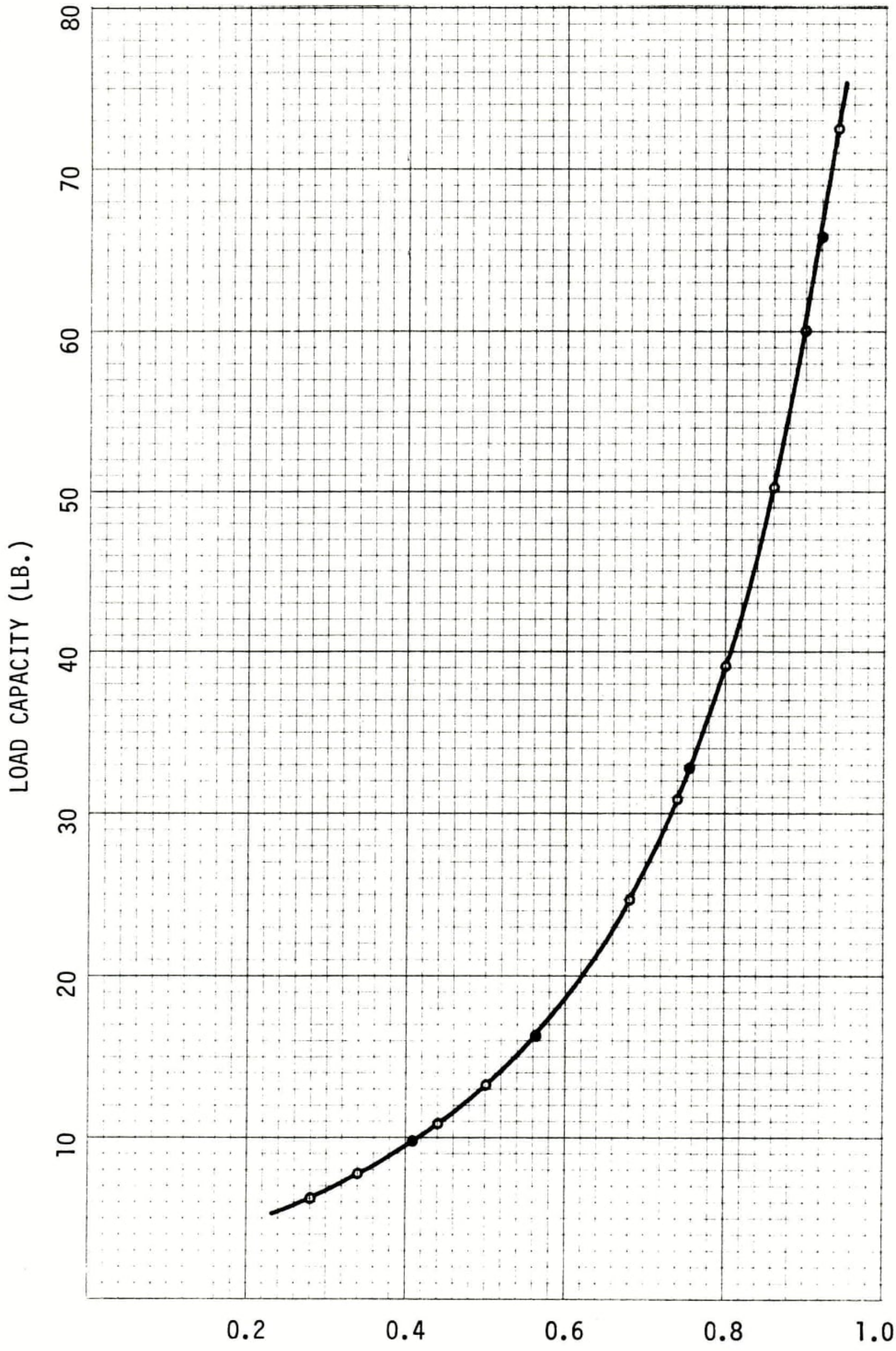

Fig. 8 Tilting Pad Journal Bearing
4 Pads @ 80°, L/D = 0.5
Load Between Pads
Convergence Criteria = 0.001

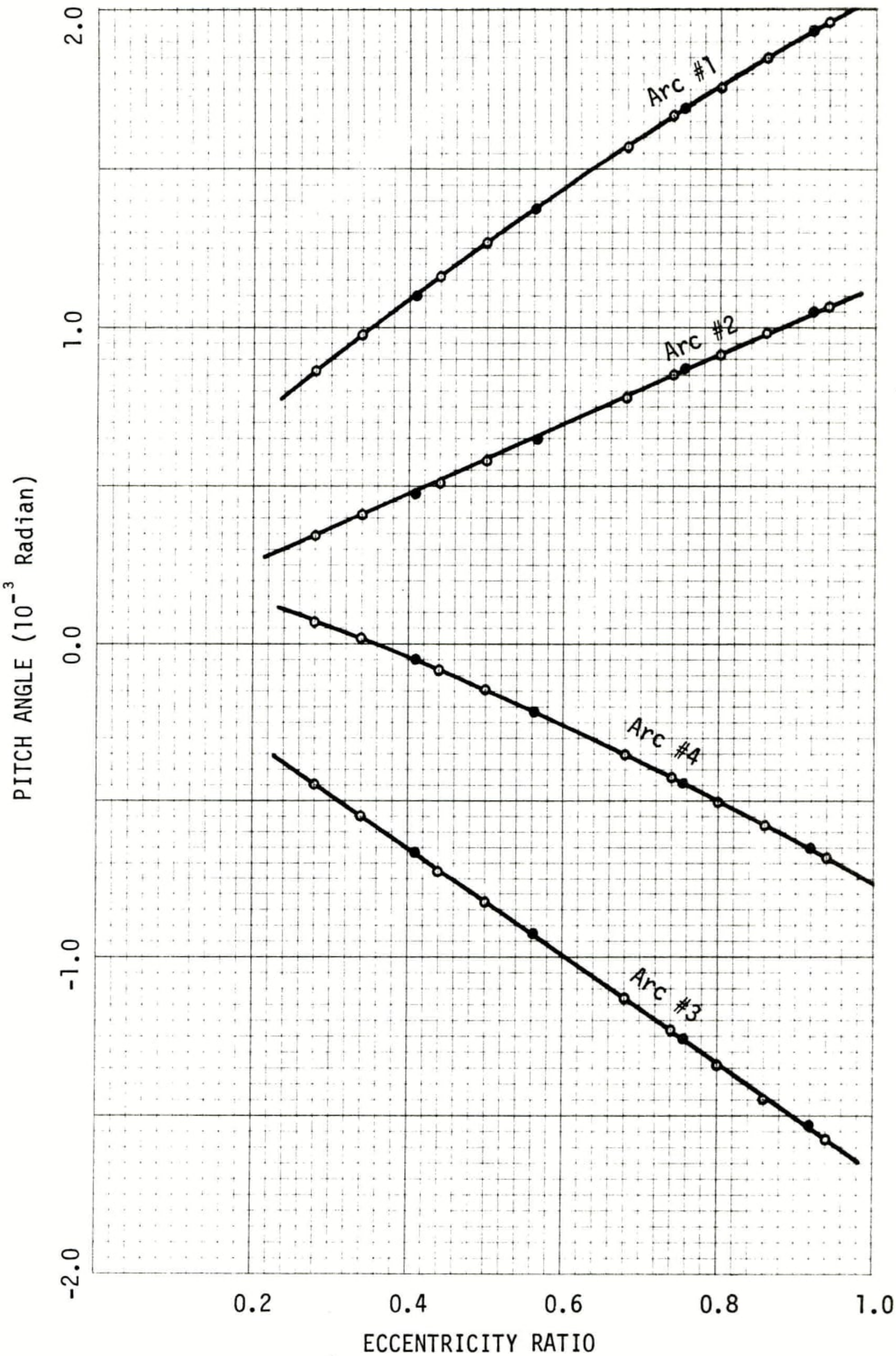

Fig. 9 Tilting Pad Journal Bearing
4 Pads @ 80°, L/D = 0.5
Load Between Pads
Convergence Criteria = 0.001

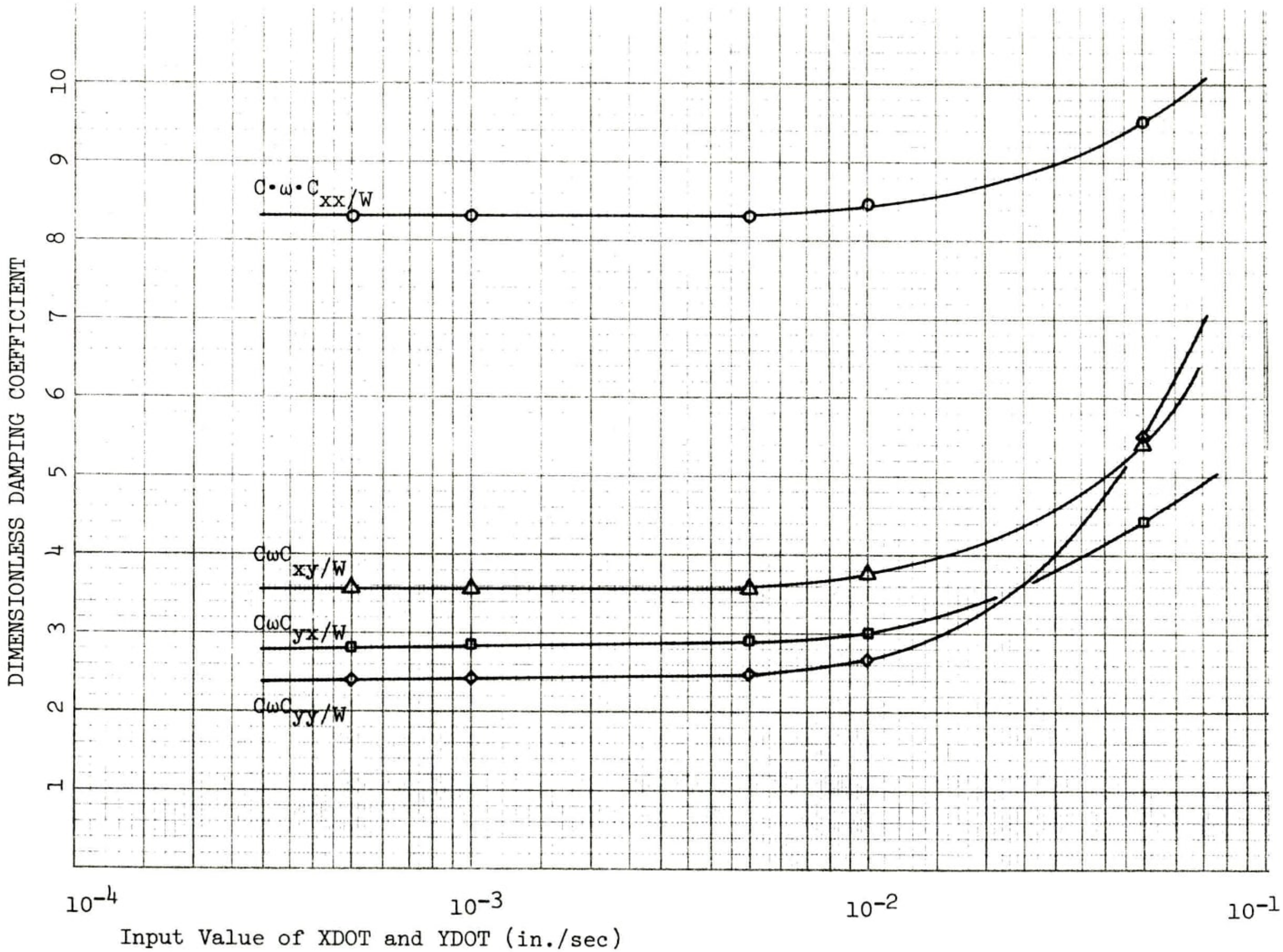

FIG. 10 Effect of Velocity Variation on Damping Coefficients
Full Circular Journal Bearing
L/D = 0.5, S = 0.15

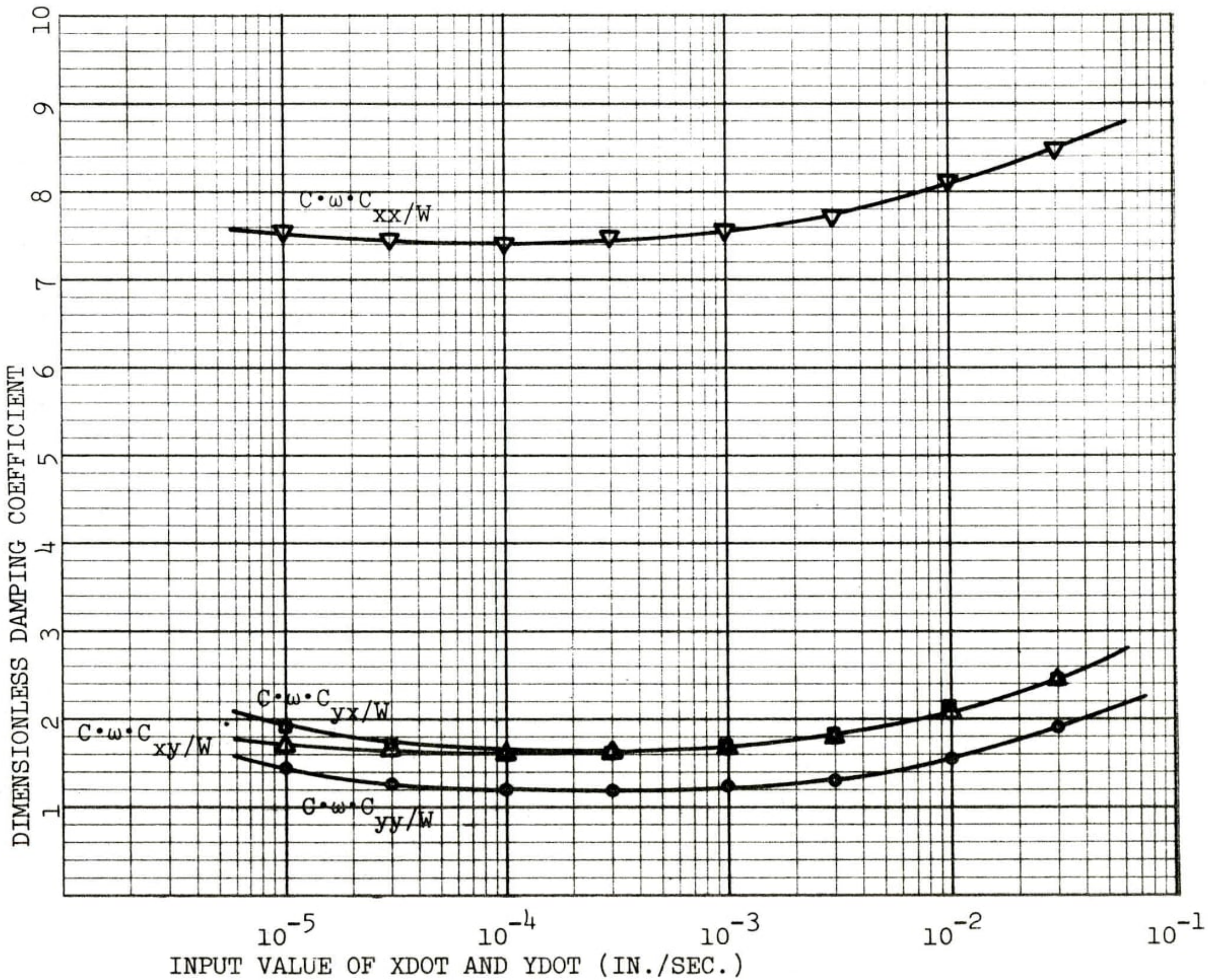

FIG. 11 Effect of Velocity Variation on Damping Coefficients Partial Arc Journal Bearing, Arc = 130°, L/D = 0.8, S = 0.15

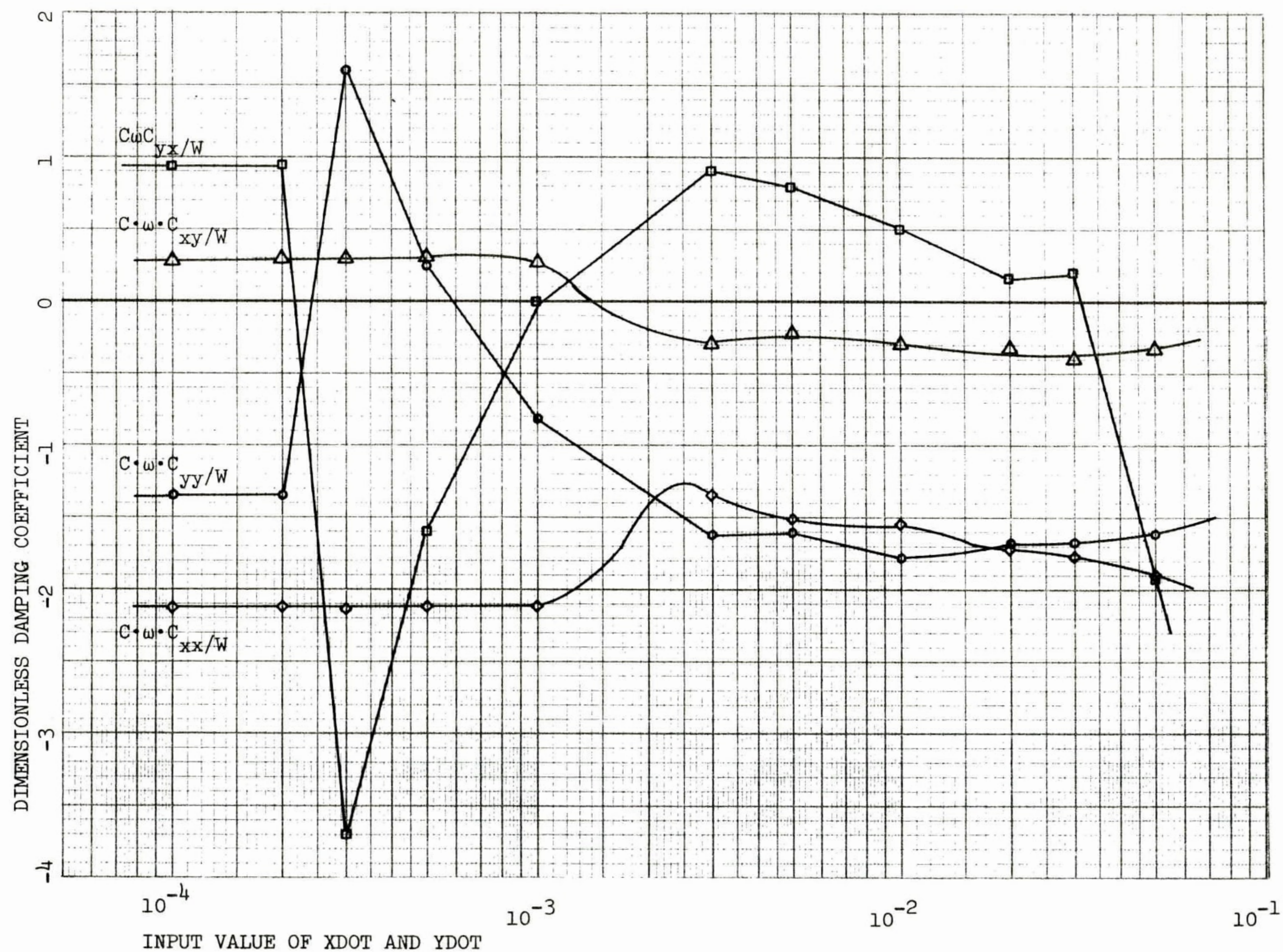

FIG. 12 Effect of Velocity Variation on Damping Coefficients, Tilting Pad Journal Bearing 4 Pads @ 80°, L/D = 0.5, S = 0.15, COA(K,18) = 0.1

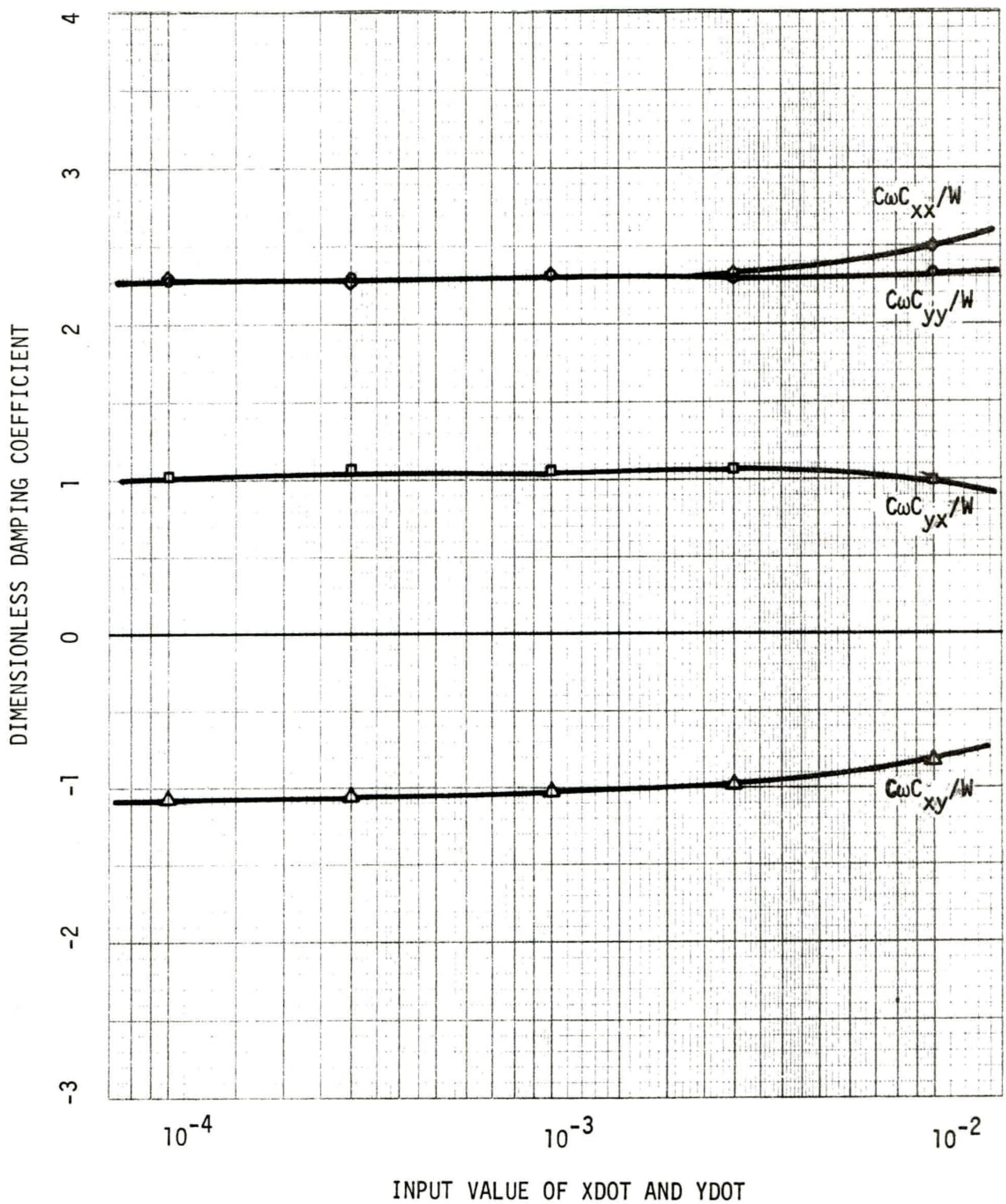

Fig. 13 Effect of Velocity Variation on Damping Coefficients, Tilting Pad Journal Bearing, 4 Pads @ 80°, Load Between Pads, L/D = 0.5, S = 0.15, COA (K, 18) = 0.001

APPENDIX I

CARD No.

```
1 ——*TILTING PAD JOURNAL BEARING
    *4 PADS;  80 DEGREES;  LOAD BETWEEN PADS
    *S=1.0
    *L/D=0.75
5 ——*
    1.2 0.0 0.0 1.2 0.0
    1.2 0.0 0.0 1.2 1.2
    0.0 1.2 1.2 1.2 0.0
    0.0 0.0 0.0 0.0 0.75
10——.001 0.50 1600.0 14.7 14.7
    .03245 115. 910. 74. .47
    .01 10.0 4.0 14.74 0.0
    0.0 180.0 0.0 180.0 2.0
    1.0 0.001 0.0 0.0 0.0
15——.2995 .2997
    0. 0.
    45. 135. 225. 315.                 M
    80. 80. 80. 80.                    N
19——0.001 0.0 0.0 7.0 39.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 1.2 0.0 0.86488D-3
22b—45.0 1.0D-6 0.001
    0 0 0 0 0 0 0 0 0 0
    14.7 14.7 14.7 14.7 14.7
25——180. 180. 180. 180. 180.
   {055555555555555555555555555555555555550   → N COLUMNS
   {066666666666666666666666666666666666660
26 {066666666666666666666666666666666666660
   {066666666666666666666666666666666666660
   {066666666666666666666666666666666666660
   {066666666666666666666666666666666666660
   {000000000000000000000000000000000000000   ↓ M ROWS
    0.001 0.0 0.0 7.0 39.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 1.2 0.0 0.36864D-3
    135.0 1.0D-5 0.001
    0 0 0 0 0 0 0 0 0 0
    14.7 14.7 14.7 14.7 14.7
    180. 180. 180. 180. 180.
    055555555555555555555555555555555555550
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    000000000000000000000000000000000000000
    0.001 0.0 0.0 7.0 39.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 1.2 0.0 -0.47555D-3
    225.0 1.0D-5 0.001
    0 0 0 0 0 0 0 0 0 0
    14.7 14.7 14.7 14.7 14.7
    180. 180. 180. 180. 180.
    055555555555555555555555555555555555550
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    000000000000000000000000000000000000000
    0.001 0.0 0.0 7.0 39.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 0.0 0.0 0.0
    0.0 0.0 1.2 0.0 0.1954D-4
    315.0 1.0D-5 0.001
    0 0 0 0 0 0 0 0 0 0
    14.7 14.7 14.7 14.7 14.7
    180. 180. 180. 180. 180.
    055555555555555555555555555555555555550
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    066666666666666666666666666666666666660
    000000000000000000000000000000000000000
```

APPENDIX II

COB(1) to COB(4)	Refer to cases treating misalignment of shaft and bearing axis. This option was not envisaged.
COB(10)	Use ambient pressure when cavitation is of no concern.
COJ (4)	This value is ignored when option (12) is defaulted.
COJ(5)	Set to 0.0 unless otherwise specified.
COJ(6) to COJ(9)	Only constant temperature/constant viscosity option was used COJ(6) = COJ(8) = 0.0 COJ(7) = COJ(9) = T(constant). Also COT(K,1)------COT(K,5) = T.
COJ(13) = COJ(4) = 0.0	except when squeeze film effect treated.
COJ(15)	Assumed = 0.0 i.e. pad thickness is zero.
ANGLE(I)	Initial values = 0.0 found to be satisfactory when OPTION(12) not used.
ARCDEG(I)	ALFAPA shown as +α in Figure 4 of reference 1, measured in the counterclockwise direction starting from the 6 o'clock position.
COD(K,2) = COD(K,3) = 0.0	for these trials.
COD(K,4); COD(K,5)	These numbers specify the pad grid point arrangement. The maximum values are COD(K,4) = 19 and COD(K,5) = 39. Computation time increases with the number of good points chosen. NOTE: Full circular bearings must also be given this grid specification, with M rows for the half-length of the bearing and N columns for the bearing circumference.
COA(K,1) = COA(K,12) - 0.0	Hydrostatic pocket case not considered during this study.
COA(K,13) = 1.2	Maintained throughout this study.
COA(K,14) = 0.0	No compliance in bearing surface considered.
ICOQ(K,1)----ICOQ(K,10) = 0	Applicable only to bearings with recesses; not considered
CARD 27	Not required when compliance not considered.

APPENDIX III

Example Output of Computer Program Using the Input of Appendix I

```
****************************************************************************
         MULTI - ARCS  JOURNAL  BEARING  COMPUTER PROGRAM
         RESEARCH  SERVICE  -  DOMINION  ENGINEERING  WORKS
****************************************************************************
*TILTING PAD JOURNAL BEARING
*4 PADS;  80 DEGREES;  LOAD BETWEEN PADS
*S=1.0
*L/D=0.75
*


TURBULENT REGIME
HYDRODYNAMIC BEARING
CONSTANT OIL FILM TEMPERATURE
ARC BEARING
STEADY STATE
PRINT OF BEARING PERFORMANCE
PRINT OF FILM PRESSURE DISTRIBUTION
PRINT OF INPUT DATA
SEARCH OF JOURNAL EQUILIBRIUM ECCENTRICITY FOR AN APPLIED LOAD
TILTING PAD OPTION
EVALUATION OF DYNAMIC COEFFICIENTS
OIL IS LUBRICANT

                    GENERAL INFORMATION
COB( 1)=  0.0000D 00 RAD        SKEWING ANGLE OF ROTOR ABOUT THE X AXIS
COB( 2)=  0.0000D 00 RAD        SKEWING ANGLE OF ROTOR ABOUT THE Y AXIS
COB( 3)=  0.0000D 00 RAD        SKEWING ANGLE OF STATOR ABOUT THE X AXIS
COB( 4)=  0.0000D 00 RAD        SKEWING ANGLE OF STATOR ABOUT THE Y AXIS
COB( 5)=      0.7500 IN         LENGHT OF BEARING
COB( 6)=      0.0010 IN         OPERATING RADIAL CLEARANCE
```

```
COB( 7)=      0.5000 IN              RADIUS OF JOURNAL
COB( 8)=   1600.0000 RPM             ROTATION OF JOURNAL
COB( 9)=     14.7000 PSI             AMBIENT PRESSURE
COB(10)=     14.7000 PSI             CAVITATION PRESSURE

COV(1)=  0.32450D-01 LB/CU.IN                  WEIGHT DENSITY OF LUBRICANT
COV(2)=    115.0000 'SSU'  UNITS               AVERAGE LUBRICANT VISCOSITY
COV(3)=    910.0000 'SSU'  UNITS               LUBRICANT VISCOSITY AT 100 F.DEG
COV(4)=     74.0000 'SSU'  UNITS               LUBRICANT VISCOSITY AT 210 F.DEG
COV(5)=  0.47000 00 BTU/LB-F.DEG               SPECIFIC HEAT OF LUBRICANT
COJ(1)=      0.0100             THE CONVERGENCE CRITERIA APPLIED FOR THE LOADING FORCE
                                IN THE ITERATIVE PROCESS   (0.1-0.001)
COJ(2)=     10.0000             MAXIMUM NUMBER OF ITERATION ALLOWED FOR THE CONVERGENCE
                                OF THE TEMPERATURE FIELD
COJ(3)=      4.0000             NUMBER OF ARCS
COJ(4)=     14.7400 LBS         THE APPLIED LOAD
COJ(5)=      0.0000 IN          MINIMUM FILM THICKNESS ALLOWED
COJ(6)=      0.0000             THE OVERALL HEAT TRANSFERT COEFFICIENT FROM LUBRICANT
                                TO BEARING (BTU/HR-SQ.FT-F.DEG)
COJ(7)=    180.0000 F DEG       TEMPERATURE AT BEARING
COJ(8)=      0.0000             THE OVERALL HEAT TRANSFERT COEFFICIENT FROM LUBRICANT
                                TO THE JOURNAL (BTU/HR-SQ.FT-F.DEG)
COJ(9)=    180.0000 F.DEG       TEMPERATURE AT THE JOURNAL SURFACE
COJ(10)=     2.0000             NUMBER OF ECCENTRICITY RATIO TO BE STUDIED
COJ(11)=     1.0000             PERCENT RELATIVE DISPLACEMENT
                                ABOUT THE EQUILIBRIUM POINT.
COJ(12)=     0.0010 IN./SEC.    VELOCITY  APPLIED FOR XDOT AND YDOT
                                IN DAMPING COEFFICIENT CALCULATION.
COJ(13)=     0.0000 IN./SEC.    VELOCITY COMPONENT IN X  AXIS.
COJ(14)=     0.0000 IN./SEC.    VELOCITY COMPONENT IN Y  AXIS.
COJ(15)=     0.0000 IN.         RADIAL DISTANCE BETWEEN  THE PAD PIVOT CENTRE
                                AND THE PAD BEARING SURFACE

ECCENTRICITY RATIOS        0.2995 0.2997

GUESS VALUES OF THE ANGULAR POSITION OF JOURNAL CENTER
   0.0DEG.    0.0DEG.
```

```
ARCDEG(1)=     45.0000 DEGREE          ANGULAR LOCATION OF CENTER OF ARC NO.1
ANGDEG(1)=     80.0000 DEGREE          INCLUDED ANGLE OF ARC NO.1

ARCDEG(2)=    135.0000 DEGREE          ANGULAR LOCATION OF CENTER OF ARC NO.2
ANGDEG(2)=     80.0000 DEGREE          INCLUDED ANGLE OF ARC NO.2

ARCDEG(3)=    225.0000 DEGREE          ANGULAR LOCATION OF CENTER OF ARC NO.3
ANGDEG(3)=     80.0000 DEGREE          INCLUDED ANGLE OF ARC NO.3

ARCDEG(4)=    315.0000 DEGREE          ANGULAR LOCATION OF CENTER OF ARC NO.4
ANGDEG(4)=     80.0000 DEGREE          INCLUDED ANGLE OF ARC NO.4
```

SPECIFICATIONS OF ARC NO. 1

```
COD 1= 0.10000000D-02  COD 2= 0.00000000D 00  COD 3= 0.00000000D 00  COD 4= 0.70000000D 01  COD 5= 0.39000000D 02
COA 1= 0.00000000D 00  COA 2= 0.00000000D 00  COA 3= 0.00000000D 00  COA 4= 0.00000000D 00  COA 5= 0.00000000D 00
COA 6= 0.00000000D 00  COA 7= 0.00000000D 00  COA 8= 0.00000000D 00  COA 9= 0.00000000D 00  COA10= 0.00000000D 00
COA11= 0.00000000D 00  COA12= 0.00000000D 00  COA13= 0.12000000D 01  COA14= 0.00000000D 00  COA15= 0.86488000D-03
COA16= 0.45000000D 02  COA17= 0.10000000D-05  COA18= 0.10000000D-02  COA
ICOQ 1=         0      ICOQ 2=         0      ICOQ 3=         0      ICOQ 4=         0      ICOQ 5=         0
ICOQ 6=         0      ICOQ 7=         0      ICOQ 8=         0      ICOQ 9=         0      ICOQ10=         0
COP 1=   14.7000       COP 2=   14.7000       COP 3=   14.7000       COP 4=   14.7000       COP 5=   14.7000
COT 1=  180.0000       COT 2=  180.0000       COT 3=  180.0000       COT 4=  180.0000       COT 5=  180.0000
```

INDEX ARRAY FOR ARC NO 1

```
0555555555555555555555555555555555555550
0666666666666666666666666666666666666660
0666666566665656666666666666666666666660
0666666666666666666666666666666666666660
0666666666666666666666666666666666665660
0666666666666666666666666666666666666660
0000000000000000000000000000000000000000
```

SPECIFICATIONS OF ARC NO.2

COD 1= 0.10000000D-02	COD 2= 0.00000000D 00	COD 3= 0.00000000D 00	COD 4= 0.70000000D 01	COD 5= 0.39000000D 02
COA 1= 0.00000000D 00	COA 2= 0.00000000D 00	COA 3= 0.00000000D 00	COA 4= 0.00000000D 00	COA 5= 0.00000000D 00
COA 6= 0.00000000D 00	COA 7= 0.00000000D 00	COA 8= 0.00000000D 00	COA 9= 0.00000000D 00	COA10= 0.00000000D 00
COA11= 0.00000000D 00	COA12= 0.00000000D 00	COA13= 0.12000000D 01	COA14= 0.00000000D 00	COA15= 0.36864000D-03
COA16= 0.13500000D 03	COA17= 0.10000000D-04	COA18= 0.10000000D-02	COA	
ICOQ 1= 0	ICOQ 2= 0	ICOQ 3= 0	ICOQ 4= 0	ICOQ 5= 0
ICOQ 6= 0	ICOQ 7= 0	ICOQ 8= 0	ICOQ 9= 0	ICOQ10= 0
COP 1= 14.7000	COP 2= 14.7000	COP 3= 14.7000	COP 4= 14.7000	COP 5= 14.7000
COT 1= 180.0000	COT 2= 180.0000	COT 3= 180.0000	COT 4= 180.0000	COT 5= 180.0000

INDEX ARRAY FOR ARC NO 2

```
0555555555555555555555555555555555555550
0656666666666666666666666666666666666660
0666656666566666666666666556666666666560
0665666656666666666666666666666666666660
0666666666666666666666666666666666666660
0666666666666666666666666666666666666660
0000000000000000000000000000000000000000
```

SPECIFICATIONS OF ARC NO.3

```
COD 1= 0.10000000D-02  COD 2= 0.00000000D 00  COD 3= 0.00000000D 00  COD 4= 0.70000000D 01  COD 5= 0.39000000D 02
COA 1= 0.00000000D 00  COA 2= 0.00000000D 00  COA 3= 0.00000000D 00  COA 4= 0.00000000D 00  COA 5= 0.00000000D 00
COA 6= 0.00000000D 00  COA 7= 0.00000000D 00  COA 8= 0.00000000D 00  COA 9= 0.00000000D 00  COA10= 0.00000000D 00
COA11= 0.00000000D 00  COA12= 0.00000000D 00  COA13= 0.12000000D 01  COA14= 0.00000000D 00  COA15=-0.47555000D-03
COA16= 0.22500000D 03  COA17= 0.10000000D-04  COA18= 0.10000000D-02  COA
ICOQ 1=        0       ICOQ 2=        0       ICOQ 3=        0       ICOQ 4=        0       ICOQ 5=        0
ICOQ 6=        0       ICOQ 7=        0       ICOQ 8=        0       ICOQ 9=        0       ICOQ10=        0
COP 1=    14.7000      COP 2=    14.7000      COP 3=    14.7000      COP 4=    14.7000      COP 5=    14.7000
COT 1=   180.0000      COT 2=   180.0000      COT 3=   180.0000      COT 4=   180.0000      COT 5=   180.0000
```

INDEX ARRAY FOR ARC NO 3

```
0555555555555555555555555555555555555550
0666666666666666666666666666666666666660
0666666666666666666666666666666666666660
0666666666666666666666666666666666666660
0666666666666666666666666666666666666660
0666666666666666666666666666666666666660
0000000000000000000000000000000000000000
```

```
                         SPECIFICATIONS OF ARC NO.4

COD 1= 0.10000000D-02  COD 2= 0.00000000D 00  COD 3= 0.00000000D 00  COD 4= 0.70000000D 01  COD 5= 0.39000000D 02
COA 1= 0.00000000D 00  COA 2= 0.00000000D 00  COA 3= 0.00000000D 00  COA 4= 0.00000000D 00  COA 5= 0.00000000D 00
COA 6= 0.00000000D 00  COA 7= 0.00000000D 00  COA 8= 0.00000000D 00  COA 9= 0.00000000D 00  COA10= 0.00000000D 00
COA11= 0.00000000D 00  COA12= 0.00000000D 00  COA13= 0.12000000D 01  COA14= 0.00000000D 00  COA15= 0.19540000D-04
COA16= 0.31500000D 03  COA17= 0.10000000D-04  COA18= 0.10000000D-02  COA
ICOQ 1=        0       ICOQ 2=        0       ICOQ 3=        0       ICOQ 4=        0       ICOQ 5=        0
ICOQ 6=        0       ICOQ 7=        0       ICOQ 8=        0       ICOQ 9=        0       ICOQ10=        0
COP 1=   14.7000       COP 2=   14.7000       COP 3=   14.7000       COP 4=   14.7000       COP 5=   14.7000
COT 1=  180.0000       COT 2=  180.0000       COT 3=  180.0000       COT 4=  180.0000       COT 5=  180.0000

                 INDEX ARRAY FOR ARC NO 4

            0555555555555555555555555555555555555550
            0666666666666666666666666666666666666660
            0666666666666666666666666666666666666650
            0666666666666666666666666666666666666660
            0666666666666666666666666666666666666650
            0666666666666666666666666666666666666660
            0000000000000000000000000000000000000000

            ECCENTRICITY = 0.2595 ; ANGULAR LOCATION OF JOURNAL CENTER =  0.000 DEG.

PITCH ANGLE =           0.26488000000000000D-03
TILTING MOMENT =          -0.70311632923351740D-04

            *****KPI= 1*****
PITCH ANGLE =           0.36864000000000000D-03
TILTING MOMENT =          -0.14805075670206670D-03

            *****KPI= 1*****
PITCH ANGLE =          -0.47550000000000010D-03
TILTING MOMENT =          -0.65473312463565790D-03

            *****KPI= 1*****
PITCH ANGLE =           0.19540000000000000D-04
TILTING MOMENT =          -0.18428598853359700D-03

            *****KPI= 1*****
```

ECCENTRICITY = 0.2397 ; ANGULAR LOCATION OF JOURNAL CENTER = 0.000 DEG.

PITCH ANGLE = 0.86488000000000000D-03
TILTING MOMENT = 0.46089575234509010D-03

*****KPI= 1*****

PITCH ANGLE = 0.36864000000000000D-03
TILTING MOMENT = -0.54567568251639480D-04

*****KPI= 1*****

PITCH ANGLE = -0.47555000000000001D-03
TILTING MOMENT = -0.79278588754933420D-03

*****KPI= 1*****

PITCH ANGLE = 0.19540000000000000D-04
TILTING MOMENT = -0.42851649748700160D-03

*****KPI= 1*****

ECCENTRICITY = 0.2996 ; ANGULAR LOCATION OF JOURNAL CENTER = 0.000 DEG.

PITCH ANGLE = 0.86488000000000000D-03
TILTING MOMENT = 0.25340333964642920D-03

*****KPI= 1*****

PERFORMANCE OF ARC NO. 1

PRESSURE DISTRIBUTION(PSI)

	J = 1	J = 2	J = 3	J = 4	J = 5	J = 6	J = 7	J = 8	J = 9	J =10
I= 1	14.70	18.95	23.01	26.89	30.59	34.09	37.40	40.51	43.42	46.12
I= 2	14.70	18.86	22.57	26.66	30.30	33.72	36.96	40.00	42.84	45.47
I= 3	14.70	18.65	22.42	26.00	29.38	32.59	35.60	38.42	41.05	43.48
I= 4	14.70	19.25	21.60	24.76	27.74	30.53	33.14	35.58	37.84	39.93
I= 5	14.70	17.60	20.30	22.80	25.12	27.28	29.29	31.14	32.85	34.42
I= 6	14.70	16.57	18.23	19.73	21.09	22.33	23.46	24.50	25.45	26.32
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
	J =11	J =12	J =13	J =14	J =15	J =16	J =17	J =18	J =19	J =20

I= 1	48.60	50.87	52.92	54.74	56.32	57.66	58.76	59.59	60.17	60.48
I= 2	47.90	50.11	52.11	53.88	55.42	56.72	57.79	58.60	59.16	59.46
I= 3	45.72	47.76	49.59	51.22	52.63	53.82	54.79	55.54	56.04	56.31
I= 4	41.84	43.58	45.14	46.51	47.71	48.71	49.53	50.15	50.57	50.78
I= 5	35.85	37.15	38.31	39.33	40.21	40.95	41.55	42.00	42.30	42.45
I= 6	27.11	27.83	28.46	29.02	29.50	29.90	30.22	30.46	30.62	30.69
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =21	J =22	J =23	J =24	J =25	J =26	J =27	J =28	J =29	J =30
I= 1	60.52	60.28	59.76	58.96	57.86	56.48	54.81	52.85	50.61	48.10
I= 2	59.49	59.26	58.75	57.96	56.89	55.54	53.91	52.00	49.81	47.35
I= 3	56.33	56.10	55.62	54.89	53.90	52.64	51.13	49.36	47.33	45.05
I= 4	50.79	50.58	50.16	49.52	48.66	47.57	46.27	44.74	42.99	41.03
I= 5	42.44	42.27	41.94	41.44	40.78	39.95	38.96	37.79	36.46	34.97
I= 6	30.68	30.57	30.38	30.09	29.71	29.24	28.67	28.01	27.26	26.41
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =31	J =32	J =33	J =34	J =35	J =36	J =37	J =38	J =39	J =
I= 1	45.31	42.26	38.95	35.41	31.65	27.67	23.51	19.18	14.70	
I= 2	44.63	41.65	38.42	34.96	31.28	27.39	23.32	19.08	14.70	
I= 3	42.53	39.76	36.77	33.56	30.14	26.53	22.74	18.79	14.70	
I= 4	38.85	36.47	33.88	31.10	28.14	25.01	21.72	18.28	14.70	
I= 5	33.31	31.49	29.52	27.39	25.12	22.71	20.17	17.49	14.70	
I= 6	25.47	24.43	23.31	22.10	20.80	19.41	17.93	16.36	14.70	
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	

THE LOADING CAPACITY= 10.48 LBS
(AXIAL LOCATION= 0.0OIN ; ANGULAR LOCATION= 45.27DEG)

THE PAD PITCH ANGLE = 0.664880000-03 RAD

THE LUBRICANT FLOWS (IGPM)

LEADING EDGE	TOP EDGE	TRAILING EDGE	BOTTOM EDGE	
0.0059	-0.0004	-0.0050	-0.0004	0.0000

THE FRICTIONAL LOSSES = 0.00 HORSE-POWER (0.00 KW)

THE AVERAGE INCREASE TEMPERATURE = 3.57 F.DEG (FOR ADIABATIC FILM)

THE MINIMUM FILM CLEARANCE = 0.00070 IN

THE MAXIMUM PRESSURE = 60.52 PSI

FILM TEMPERATURE = 130.00 F.DEG

PITCH ANGLE = 0.36864000000000000D-03
TILTING MOMENT = -0.91067701487543450D-04

*****KPI= 1*****

PERFORMANCE OF ARC NO. 2

PRESSURE DISTRIBUTION(PSI)

	J = 1	J = 2	J = 3	J = 4	J = 5	J = 6	J = 7	J = 8	J = 9	J =10
I= 1	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 2	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 3	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 4	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 5	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 6	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =11	J =12	J =13	J =14	J =15	J =16	J =17	J =18	J =19	J =20
I= 1	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 2	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 3	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 4	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 5	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 6	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =21	J =22	J =23	J =24	J =25	J =26	J =27	J =28	J =29	J =30
I= 1	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.83	15.01	15.17
I= 2	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.84	15.02	15.18
I= 3	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.88	15.04	15.19
I= 4	14.70	14.70	14.70	14.70	14.70	14.70	14.74	14.91	15.07	15.20
I= 5	14.70	14.70	14.70	14.70	14.70	14.70	14.79	14.93	15.06	15.16
I= 6	14.70	14.70	14.70	14.70	14.70	14.71	14.80	14.88	14.96	15.03
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =31	J =32	J =33	J =34	J =35	J =36	J =37	J =38	J =39	J =
I= 1	15.29	15.39	15.44	15.45	15.42	15.33	15.18	14.98	14.70	
I= 2	15.30	15.39	15.44	15.45	15.42	15.33	15.18	14.98	14.70	

I= 3	15.31	15.39	15.44	15.45	15.41	15.33	15.18	14.97	14.70
I= 4	15.30	15.38	15.42	15.43	15.39	15.31	15.17	14.97	14.70
I= 5	15.25	15.31	15.35	15.36	15.32	15.25	15.13	14.95	14.70
I= 6	15.09	15.13	15.16	15.16	15.14	15.10	15.01	14.88	14.70
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

THE LOADING CAPACITY= 0.07 LBS
(AXIAL LOCATION= 0.00IN ; ANGULAR LOCATION= 162.83DEG)

THE PAD PITCH ANGLE = 0.36864000D-03 RAD

THE LUBRICANT FLOWS (IGPM)

LEADING EDGE	TOP EDGE	TRAILING EDGE	BOTTOM EDGE	
0.0078	-0.0000	-0.0081	-0.0000	-0.0004

THE FRICTIONAL LOSSES = 0.00 HORSE-POWER (0.00 KW)

THE AVERAGE INCREASE TEMPERATURE = 1.78 F.DEG (FOR ADIABATIC FILM)

THE MINIMUM FILM CLEARANCE = 0.00114 IN

THE MAXIMUM PRESSURE = 15.45 PSI

FILM TEMPERATURE = 180.00 F.DEG

PITCH ANGLE = -0.47555000000000010-03
TILTING MOMENT = -0.73897699470358560-03

*****KPI= 1*****

PERFORMANCE OF ARC NO. 3

PRESSURE DISTRIBUTION(PSI)

	J = 1	J = 2	J = 3	J = 4	J = 5	J = 6	J = 7	J = 8	J = 9	J =10
I= 1	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 2	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 3	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 4	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 5	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 6	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =11	J =12	J =13	J =14	J =15	J =16	J =17	J =18	J =19	J =20
I= 1	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 2	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 3	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 4	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 5	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 6	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =21	J =22	J =23	J =24	J =25	J =26	J =27	J =28	J =29	J =30
I= 1	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.88	15.05	15.21
I= 2	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.89	15.06	15.21
I= 3	14.70	14.70	14.70	14.70	14.70	14.70	14.73	14.91	15.08	15.22
I= 4	14.70	14.70	14.70	14.70	14.70	14.70	14.78	14.95	15.10	15.23
I= 5	14.70	14.70	14.70	14.70	14.70	14.70	14.82	14.96	15.08	15.19
I= 6	14.70	14.70	14.70	14.70	14.70	14.72	14.81	14.90	14.98	15.04
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =31	J =32	J =33	J =34	J =35	J =36	J =37	J =38	J =39	J =
I= 1	15.33	15.42	15.47	15.48	15.44	15.35	15.20	14.98	14.70	
I= 2	15.33	15.42	15.47	15.48	15.44	15.35	15.20	14.98	14.70	
I= 3	15.34	15.42	15.47	15.47	15.43	15.34	15.19	14.98	14.70	
I= 4	15.33	15.41	15.45	15.45	15.41	15.32	15.18	14.97	14.70	
I= 5	15.27	15.33	15.37	15.37	15.34	15.26	15.13	14.95	14.70	
I= 6	15.10	15.14	15.17	15.17	15.15	15.10	15.02	14.89	14.70	
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	

THE LOADING CAPACITY= 0.07 LBS
(AXIAL LOCATION= 0.00IN ; ANGULAR LOCATION= 252.65DEG)

THE PAD PITCH ANGLE = -0.47555000D-03 RAD

THE LUBRICANT FLOWS (IGPM)

LEADING EDGE	TOP EDGE	TRAILING EDGE	BOTTOM EDGE	
0.0078	-0.0000	-0.0091	-0.0000	-0.0004

THE FRICTIONAL LOSSES = 0.00 HORSE-POWER (0.00 KW)

THE AVERAGE INCREASE TEMPERATURE = 1.78 F.DEG (FOR ADIABATIC FILM)

THE MINIMUM FILM CLEARANCE = 0.00115 IN

THE MAXIMUM PRESSURE = 15.48 PSI

FILM TEMPERATURE = 180.00 F.DEG

PITCH ANGLE = 0.19540000000000000D-04
TILTING MOMENT = -0.33306438684358590D-03

*****KPI= 1*****

PERFORMANCE OF ARC NO. 4

PRESSURE DISTRIBUTION(PSI)

	J = 1	J = 2	J = 3	J = 4	J = 5	J = 6	J = 7	J = 8	J = 9	J =10
I= 1	14.70	18.95	23.02	26.90	30.59	34.10	37.41	40.52	43.43	46.14
I= 2	14.70	18.88	22.87	26.68	30.30	33.73	36.97	40.01	42.86	45.49
I= 3	14.70	18.65	22.42	26.00	29.39	32.59	35.61	38.43	41.06	43.50
I= 4	14.70	18.25	21.61	24.77	27.75	30.54	33.15	35.59	37.86	39.95
I= 5	14.70	17.60	20.30	22.80	25.13	27.29	29.29	31.15	32.86	34.43
I= 6	14.70	16.57	18.23	19.73	21.09	22.33	23.47	24.51	25.46	26.33
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =11	J =12	J =13	J =14	J =15	J =16	J =17	J =18	J =19	J =20
I= 1	48.63	50.90	52.95	54.77	56.35	57.70	58.79	59.63	60.21	60.53
I= 2	47.92	50.14	52.14	53.91	55.45	56.76	57.82	58.64	59.20	59.50
I= 3	45.74	47.78	49.62	51.25	52.66	53.86	54.83	55.57	56.08	56.35
I= 4	41.86	43.60	45.16	46.54	47.73	48.74	49.56	50.18	50.60	50.82
I= 5	35.87	37.16	38.32	39.35	40.23	40.97	41.57	42.02	42.33	42.47
I= 6	27.12	27.63	28.47	29.03	29.51	29.91	30.24	30.48	30.63	30.71
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =21	J =22	J =23	J =24	J =25	J =26	J =27	J =28	J =29	J =30
I= 1	60.57	60.33	59.81	59.01	57.91	56.53	54.86	52.90	50.66	48.14
I= 2	59.54	59.30	58.79	58.01	56.94	55.59	53.96	52.05	49.86	47.40
I= 3	56.37	56.15	55.67	54.93	53.94	52.69	51.18	49.40	47.38	45.09
I= 4	50.82	50.62	50.20	49.56	48.70	47.61	46.31	44.78	43.03	41.06
I= 5	42.47	42.30	41.97	41.47	40.81	39.99	38.99	37.82	36.49	35.00
I= 6	30.69	30.59	30.40	30.11	29.73	29.26	28.69	28.03	27.28	26.43
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

	J =31	J =32	J =33	J =34	J =35	J =36	J =37	J =38	J =39	J =
I= 1	45.35	42.30	38.99	35.45	31.67	27.69	23.53	19.19	14.70	
I= 2	44.67	41.69	38.46	34.99	31.30	27.41	23.34	19.09	14.70	
I= 3	42.57	39.80	36.81	33.59	30.17	26.55	22.75	18.80	14.70	
I= 4	38.89	36.50	33.91	31.13	28.17	25.03	21.73	18.28	14.70	
I= 5	33.34	31.52	29.54	27.41	25.14	22.73	20.18	17.50	14.70	
I= 6	25.48	24.45	23.32	22.11	20.81	19.42	17.94	16.37	14.70	
I= 7	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	

THE LOADING CAPACITY= 10.49 LBS
(AXIAL LOCATION= 0.00IN ; ANGULAR LOCATION= 315.28DEG)

THE PAD PITCH ANGLE = 0.19540000D-04 RAD

THE LUBRICANT FLOWS (IGPM)

LEADING EDGE	TOP EDGE	TRAILING EDGE	BOTTOM EDGE	
0.0059	-0.0004	-0.0050	-0.0004	0.0000

THE FRICTIONAL LOSSES = 0.00 HORSE-POWER (0.00 KW)

THE AVERAGE INCREASE TEMPERATURE = 3.57 F.DEG (FOR ADIABATIC FILM)

THE MINIMUM FILM CLEARANCE = 0.00070 IN

THE MAXIMUM PRESSURE = 60.57 PSI

FILM TEMPERATURE = 180.00 F.DEG

PERFORMANCE OF BEARING

THE TOTAL LOADING CAPACITY = 14.74 LBS
(ANGULAR LOCATION = 0.06 DEG.)

THE VERTICAL LOAD = 14.74LBS

THE HORIZONTAL LOAD = 0.01LBS

THE TOTAL FRICTIONAL LOSSES = 0.01 HORSE-POWER (0.01 KW)

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PITCH ANGLE =           0.86488000000000000D-03
TILTING MOMENT =           0.27179831590362660D-01
PITCH ANGLE =           0.87488000000000000D-03
TILTING MOMENT =           0.13387912580571560D-01
PITCH ANGLE =           0.88458707018440320D-03
TILTING MOMENT =          -0.34546554970275610D-03
PITCH ANGLE =           0.36864000000000000D-03
TILTING MOMENT =           0.41653342663788220D-02
PITCH ANGLE =           0.37864000000000000D-03
TILTING MOMENT =           0.48319105945072130D-03
PITCH ANGLE =          -0.47555000000000010D-03
TILTING MOMENT =          -0.81029591679551150D-02
PITCH ANGLE =          -0.48555000000000000D-03
TILTING MOMENT =          -0.35585310878165990D-02
PITCH ANGLE =          -0.49338073288584630D-03
TILTING MOMENT =          -0.30108684884625710D-03
PITCH ANGLE =           0.19540000000000000D-04
TILTING MOMENT =          -0.13308610475193690D-01
PITCH ANGLE =           0.95399999999999980D-05
TILTING MOMENT =           0.11596176856628350D-02
PITCH ANGLE =           0.10341492534379670D-04
TILTING MOMENT =           0.13453566671759200D-04
PITCH ANGLE =           0.86488000000000000D-03
TILTING MOMENT =          -0.12683181473066920D-01
PITCH ANGLE =           0.85488000000000000D-03
TILTING MOMENT =           0.17694405770705550D-02
PITCH ANGLE =           0.85510430425336590D-03
TILTING MOMENT =           0.19601880962105520D-04
PITCH ANGLE =           0.36864000000000000D-03
TILTING MOMENT =           0.62114373530482000D-02
PITCH ANGLE =           0.37864000000000000D-03
TILTING MOMENT =           0.26504473073473490D-02
PITCH ANGLE =           0.38608300678556290D-03
TILTING MOMENT =          -0.36893919559047182D-03
PITCH ANGLE =          -0.47555000000000010D-03
TILTING MOMENT =           0.36215507933505490D-02
PITCH ANGLE =          -0.46555000000000000D-03
TILTING MOMENT =          -0.14147381675553870D-03
PITCH ANGLE =           0.19540000000000000D-04
TILTING MOMENT =          -0.26540993283725410D-01
PITCH ANGLE =           0.95399999999999980D-05
TILTING MOMENT =          -0.12873699376371870D-01
PITCH ANGLE =           0.12065227563910340D-06
TILTING MOMENT =          -0.31335196121150270D-03
PITCH ANGLE =           0.86488000000000000D-03
TILTING MOMENT =          -0.25950207429201950D-01
PITCH ANGLE =           0.85488000000000000D-03
TILTING MOMENT =          -0.12297604513820700D-01
PITCH ANGLE =           0.84587248356519170D-03
TILTING MOMENT =          -0.29322613371003580D-03
PITCH ANGLE =           0.36864000000000000D-03
TILTING MOMENT =          -0.51924905930528480D-02
PITCH ANGLE =           0.35864000000000000D-03
TILTING MOMENT =          -0.70056018651469280D-03
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PITCH ANGLE =           -0.47555000000000010D-03
TILTING MOMENT =            0.56838814361527170D-02
PITCH ANGLE =           -0.46555000000000000D-03
TILTING MOMENT =            0.20327415791000620D-02
PITCH ANGLE =           -0.45998258363501590D-03
TILTING MOMENT =           -0.24407368033059660D-03
PITCH ANGLE =            0.19540000000000000D-04
TILTING MOMENT =            0.11159482951807310D-01
PITCH ANGLE =            0.29540000000000000D-04
TILTING MOMENT =           -0.19854990873057620D-02
PITCH ANGLE =            0.28094617333741570D-04
TILTING MOMENT =            0.20970279266218150D-04
PITCH ANGLE =            0.86488000000000000D-03
TILTING MOMENT =            0.11709110107140050D-01
PITCH ANGLE =            0.87488000000000000D-03
TILTING MOMENT =           -0.13213993572419030D-02
PITCH ANGLE =            0.87386591388455790D-03
TILTING MOMENT =            0.15451000260859570D-04
PITCH ANGLE =            0.36864000000000000D-03
TILTING MOMENT =           -0.73679614771434140D-02
PITCH ANGLE =            0.35864000000000000D-03
TILTING MOMENT =           -0.23932636702835750D-02
PITCH ANGLE =            0.35221088527598660D-03
TILTING MOMENT =           -0.23052209761726190D-03
PITCH ANGLE =           -0.47555000000000010D-03
TILTING MOMENT =           -0.59391153063803300D-02
PITCH ANGLE =           -0.48555000000000000D-03
TILTING MOMENT =           -0.13795425374035960D-02
PITCH ANGLE =           -0.48857559605318720D-03
TILTING MOMENT =           -0.91316649741951760D-04
PITCH ANGLE =            0.19540000000000000D-04
TILTING MOMENT =            0.26598114721134160D-01
PITCH ANGLE =            0.29540000000000000D-04
TILTING MOMENT =            0.12790828007388640D-01
PITCH ANGLE =            0.38803824437465350D-04
TILTING MOMENT =           -0.32235061831826020D-03
PITCH ANGLE =            0.86488000000000000D-03
TILTING MOMENT =           -0.23509556374581780D-01
PITCH ANGLE =            0.85488000000000000D-03
TILTING MOMENT =           -0.96242623860964080D-02
PITCH ANGLE =            0.84794878696125480D-03
TILTING MOMENT =           -0.20624463182279688D-03
PITCH ANGLE =            0.36864000000000000D-03
TILTING MOMENT =           -0.56256268194026010D-02
PITCH ANGLE =            0.35864000000000000D-03
TILTING MOMENT =           -0.11403050396449250D-02
PITCH ANGLE =            0.35609769507869610D-03
TILTING MOMENT =           -0.70673945520891880D-04
PITCH ANGLE =           -0.47555000000000010D-03
TILTING MOMENT =            0.66522368366679260D-02
PITCH ANGLE =           -0.46555000000000000D-03
TILTING MOMENT =            0.31785312702866490D-02
PITCH ANGLE =           -0.45639973896167140D-03
TILTING MOMENT =           -0.47162753595155680D-03
PITCH ANGLE =            0.19540000000000000D-04
TILTING MOMENT =           -0.45320377454080310D-07
PITCH ANGLE =            0.86468000000000000D-03
TILTING MOMENT =           -0.69025391227164720D-04
PITCH ANGLE =            0.36864000000000000D-03
TILTING MOMENT =            0.71633847964699580D-02
PITCH ANGLE =            0.37864000000000000D-03
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PITCH ANGLE =            0.38968439975585400D-03
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PITCH ANGLE =          -0.4655500000000000D-03
TILTING MOMENT =            0.2567142125492151D-03
PITCH ANGLE =           0.1954000000000000D-04
TILTING MOMENT =          -0.2411057934815503D-01
PITCH ANGLE =           0.9533999999999998D-05
TILTING MOMENT =          -0.1021011914654519D-01
PITCH ANGLE =           0.2194833725531277D-05
TILTING MOMENT =          -0.2239593745986777D-03
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TILTING MOMENT =       -0.6054070328555209D-03
PITCH ANGLE =         -0.4755500000000001D-03
TILTING MOMENT =        0.4000005223347670D-02
PITCH ANGLE =         -0.4655500000000000D-03
TILTING MOMENT =        0.2567142125492151D-03
PITCH ANGLE =          0.1954000000000000D-04
TILTING MOMENT =       -0.2411057934815503D-01
PITCH ANGLE =          0.9533999999999998D-05
TILTING MOMENT =       -0.1021011914654519D-01
PITCH ANGLE =          0.2194833725531277D-05
TILTING MOMENT =       -0.2239593745986777D-03
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FILM FORCE COMPONENTS AROUND THE EQUILIBRIUM POINT'

ECCENTRICITY= 0.2996;ANGULAR LOCATION= 0.000 DEG

	X-COMPONENTS	Y-COMPONENTS
0	0.0144 LBS	14.7400 LBS
1	0.0287 LBS	15.2604 LBS
2	0.5297 LBS	14.7480 LBS
3	0.0288 LBS	14.2375 LBS
4	-0.4873 LBS	14.7506 LBS
5	0.3163 LBS	14.4746 LBS
6	0.2923 LBS	15.0320 LBS

DYNAMIC COEFFICIENTS AT THE EQUILIBRIUM POINT'

ECCENTRICITY= 0.2996ANGULAR LOCATION= 0.000 DEG

*****SPRING COEFFICIENTS SIGNS CHANGED***

KXX= 0.5065D 05 LB/IN.	C*KYY/W= 0.3450D 01
KXY= -0.2697D 01 LB/IN.	C*KYX/W= -0.1830D-03
KYX= -0.1279D 03 LB/IN.	C*KXY/W= -0.8678D-02
KYY= 0.5115D 05 LB/IN.	C*KXX/W= 0.3470D 01

*****DAMPING COEFFICIENTS

CXX= -0.3019D 03 LB.SEC./IN.	C*OMEGA*CYY/W= 0.3432D 01
CXY= -0.2779D 03 LB.SEC./IN.	C*OMEGA*CYX/W= 0.3159D 01
CYX= 0.2654D 03 LB.SEC./IN.	C*OMEGA*CXY/W= -0.3017D 01
CYY= -0.2920D 03 LB.SEC./IN.	C*OMEGA*CXX/W= 0.3319D 01