journal of lubrication technology discussion

An Accurate Solution of the Gas Lubricated, Flat Sector Thrust Bearing[1]

V. Castelli.[2] the authors present useful information about the equilibrium characteristics of Flat Sector Bearings operating with compressible lubricants.

For the purpose of clarification this writer would like to ask the following questions:

1) What grid spacings and convergence criteria were used in the numerical solution?

2) What accuracy checks were employed aside from the comparison with a rectangular slider solution?

3) What results are presented in reference [6] that are not presented here?

4) The range of compressibility numbers covered in the paper is very small since it barely enters the compressibility region (the largest presented deviation from the incompressibile solution is forty percent in the paper). Is this done because higher values are deemed practically useless or because numerical difficulties barred the road?

5) Is the generating computer program maintained and available for general use?

The authors' patience in providing the answers is deeply appreciated.

Authors' Closure

The authors wish to thank Professor Castelli for his comments and interest in the paper. The answers to his questions follow.

(1) The grid spacing was 14 mesh points radially and 20 circumferentially. Between successive iterations the change in the variable $Q = (PH)^2$ at each grid point is obtained. The largest change is then tested against a convergence criterion which was 10^{-5}.

(2) Different grid spacings were examined to check their effect on the solution. It was found that a mesh as coarse as 8 by 12 gave results for the pressure distribution over the pad area which differed trivially from pressure values calculated with the finer mesh size. The overall performances were also compared with the results of reference [4] in those cases where the pads were the same.

(3) Bearing performance characteristics in the same form as in this paper are presented in reference [6] for the whole range of radius ratios 0.3, 0.5, and 0.7 at pad angles of 30, 45, and 60 degrees.

(4) The range of compressibility numbers was selected from practical considerations [10]. No attempt was made to solve for compressibility numbers higher than 100. However, no numerical difficulties were encountered in the range covered. Convergence was usually achieved after 40 to 50 iterations and took about 1 to 2 seconds for each case.

(5) The computer program is available from COSMIC, Barrow Hall, University of Georgia, Athens, GA 30601. The listing and instructions for use are in [8], which has been published, subsequent to the preprinting of this paper, as NASA TM X-73595, 1977.

Additional Reference

10 Etsion I., A Cantilever Mounted Resilient Pad Gas Thrust Bearing," JOURNAL LUBRICATION TECHNOLOGY, TRANS. ASME, Series F, Vol. 99, No. 1, Jan. 1977, pp. 95–100.

[1] By I. Etsion and D. P. Fleming, published in the January, 1977, issue of the JOURNAL OF LUBRICATION TECHNOLOGY, TRANS. ASME, Series F, Vol. 99, pp. 82–88.

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Dynamic Life Estimation for Track Surfaces under Periodic Loadings and Nonuniform Backup Supports[1]

J. Y. Liu.[2] The authors are to be commended for using a relatively simple procedure to solve the complicated problem of estimating the fatigue life of a roller track system with complex geometry.

For a track support with complex cross sectional design, the load deflection relationship can only be analyzed using a numerical approach, such as the finite element method employed by the authors. In the sample problem of the paper, the track support is approximated by an infinite cantilever plate, which, however, does not possess a complex cross sectional shape. The problem of an infinite cantilever plate carrying a concentrated load was solved by T. J. Jaramillo (see p. 336 of reference [7] of the paper). For a group of concentrated loads acting on the plate, the solution can simply be obtained by applying the principle of superposition. It would be of interest if the authors could compare their finite element solution with that obtained by Jaramillo's method.

It will be recalled that the Lundberg and Palmgren fatigue life theory is based on the assumptions that in a rolling contact the contacting bodies are of the same material and the risks of fatigue failure for them are equally great. If the roller and the track considered by

[1] By M. J. Hartnett and A. N. Palazotto, published in the October, 1976, issue of the JOURNAL OF LUBRICATION TECHNOLOGY, TRANS. ASME, Vol. 98, pp. 602–606.

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