UNBALANCE RESPONSE AND STABILITY OF SYMMETRIC AND ASYMMETRIC ROTORS

By

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Thesis submitted in fulfilment of the
requirements of the degree of
DOCTOR OF PHILOSOPHY

Department of Mechanical Engineering

INDIAN INSTITUTE OF TECHNOLOGY, DELHI

March 1987

to

Bharat Heavy Electricals Limited (India)

CERTIFICATE

This is to certify that the thesis entitled, "UNBALANCE RESPONSE AND STABILITY OF SYMMETRIC AND ASYMMETRIC ROTORS" being submitted by Mr. K.V. Bhaskara Sarma to the Department of Mechanical Engineering, Indian Institute of Technology, New Delhi for the award of the Degree of 'Doctor of Philosophy' in Mechanical Engineering is a record of bonafide research work carried out by him. He has worked under our supervision and guidance, and has fulfilled the requirement for the submission of this thesis which has reached the requisite standard.

The results contained in this work have not been submitted in part or in full to any University or Institute for the award of any degree or diploma.

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ACKNOWLEDGEMENTS

I wish to express my gratitude to Prof. J.S. Rao and Dr. K. Gupta for their guidance and inspiration throughout the course of this work.

I am thankful to the Management of M/s. Bharat Heavy Electricals Limited, Hyderabad, in particular to Mr. C.K. Khot, General Manager (Engineering) and Mr. Raghavendra Rao, Deputy General Manager (Gas. Turbines) for providing facilities and permission to carry out this work.

I express my sincere gratitude to Mr. K.V.V. Gopala-Krishna, Dy. General Manager (Turbines and Compressors) for encouragement and guidance received from him during the course of this work.

Acknowledgements are also due to Dr. N.F. Rieger, Technical Manager, M/s. Stress Technology Incorporated, (STI) Rochester, and University of Rochester, U.S.A. for providing facilities, guidance and financial support to this work.

I am thankful to Dr. Vyas, Mr. K.D. Gupta, Mr. K. Ramamohan Rao, Mr. N. Adinarayana, Mr. R.K. Wanchoo, Mr. S. Zhou and other friends for their encouragement and help. Acknowledgements are also due to Mr. Ch. Koteswara Rao, Mr. R. Jaganmohan Rao for neatly preparing the drawings and Mr. Michel Rieger (STI) for preparation of input data sheets and Mr. V.P. Gulati for excellent typing of this thesis.

Finally, I am indebted to Mrs. Indira Rao for her encouragement and to my wife Sarada for her patience and understanding.

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July, 1987

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ABSTRACT

Study presented in this thesis is concerned with the unbalance response and stability analysis of symmetric and asymmetric rotors, mounted on fluid film bearings. Jeffcott models of rotors as well as the actual multi-mass rotors are analysed.

A numerical integration procedure to study the Jeffcott model of asymmetric shafts mounted on rigid as well as fluid film bearings is developed. The coupled differential equations of motion are solved by modified Euler's method using a time marching procedure to obtain whirl orbits of asymmetric rotors taking into account both the gravity and unbalance effects. Under stable operating conditions the final orbit shows good agreement with the closed form solution.

To study the actual rotor-bearing systems, a time marching transfer matrix method is developed to obtain the whirl orbits of the rotor. Several case studies are presented for symmetric as well as asymmetric rotors and the results obtained are compared with Jeffcott models.

This work also presents the transfer matrix method with a continuous element model to determine the unbalance response of a rotor mounted on fluid film bearings. These results are compared with Jeffcott model analysis. Though the critical speeds obtained by both the methods are in good agreement, the amplitudes of whirl obtained by the Jeffcott model at the critical speed are higher than those determined with the transfer matrix approach.

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