CHAOTIC BEHAVIOR OF ROTORS ON LUBRICATED BEARINGS

[1]G. Genta, [1]N. Amati, [2]A. Repaci
[1]Mechanics Department, Mechatronics Laboratory
[2]Mathematics Department
Politecnico di Torino
Corso Duca degli Abruzzi, 24, 10129 Torino
ITALY

Corresponding Author: Giancarlo Genta, giancarlo.genta@polito.it

ABSTRACT

Rotors running on lubricated bearings are affected by the behaviour of the fluid film within the bearings. The actual behaviour of the lubricant film must be modelled in some detail as the pressure of the fluid and therefore the resulting forces are affected by the rotor position ([1, 2]). For the study in the small, the journal bearing can be modelled using the conventional eight – coefficient linearized model ([3]). The static equilibrium position must be determined for each rotational speed before computing the dynamic analysis in the frequency domain. Typical phenomenon of oil whirl and oil wip characterise the motion of the rotor if the assumption of small amplitude motion is taken into account.

To study the motion of the rotor in the large it is necessary to resort the numerical integration of the equations of motion. Numerical simulations of a Jeffcott rotor on plain journal bearing (4), modelled as fully cavitated short bearings have evidenced that the system may reach, in certain conditions, a steady state chaotic condition.

The aim of the present paper is to investigate the dynamic behaviour of actual rotating machines running on actual lubricated bearings. The rotor is first modelled as a rigid, 4 d.o.f. rotor to account for gyroscopic effect and then modelled using a FE approach through Dynrot code to take the effect of the flexibility of the rotor into account.
The numerical analysis shows how the results obtained with a very simplified configuration can be extended to industrial prototypes.

BIBLIOGRAPHY

[1] G. Genta, *Vibration of structures and machines*, Springer Verlag, New York 1998.

[2] G. Genta, *Dynamics of rotating systems, Springer Verlag*, New York 2004, (to be published).

[3] T. Someya, *Journal Bearings Databook, Springer Verlag*, Tokyo, 1998

[4] G. Adiletta, A. Guido, C. Rossi, *Chaotic motion of a rigid rotor in short journal bearings*, Nonlinear Dynamics, vol. 10, pp. 251-269, 1996.