Dynamic Behavior of Hybrid Sodium Bearings. Theoretical & Experimental Studies

Mlle N. Juignet, M. Queval
Commissariat à l'Energie Atomique,
C.E.N. Saclay, Département des Etudes Mécaniques et Thermiques,
B.P. No. 2, F-91190 Gif-sur-Yvette, France

J. Guidez
Commissariat à l'Energie Atomique,
C.E.N. Cadarache, D.R.N.R., B.P. No. 1, F-13115 St Paul-lez-Durance, France

ABSTRACT

The primary sodium pump shaft lower section of a fast breeder reactor is guided by a hydrostatic sodium bearing. This recess type bearing is supplied via orifices restrictors. Sodium is sampled at hight pressure at the diffuser outlet and is then centrifuged towards the orifices restrictors.

Bearing stiffness and damping data is essantial for the study of rotor dynamic behavior. Two points in particular may then be studied :

- calculation of rotor instability ranges and critical speeds,
- dynamic behavior of the rotor in the event of an earthquake.

As regards the bearing design, the problem is to obtain the pressure fields in the liquid film. The integration of these pressure fields will then give the stiffness coefficients. The damping coefficients can then be obtained by the same calculation after slight displacement.

The Reynolds equation can be used to study the liquid film (under any conditions for the turbulent and inertia effects).

Then the computer code DELPAL is explained that solves the modified Reynolds equation using a finite element method.

The presentation of tests conducted in 1981 at DEMT on the Super-Phenix 1 full scale bearing (Ø 850 mm) in water is made.

In conclusion this paper describes a method for calculating the stiffness and damping matrices of a hydrostatic bearing using the DELPAL calculation code and shows the loop of behavior tests on a bearing with sinusoidal excitation. The results, obtained by calculation and by testing, are indispensable when calculating the dynamic behavior of the shaft line.