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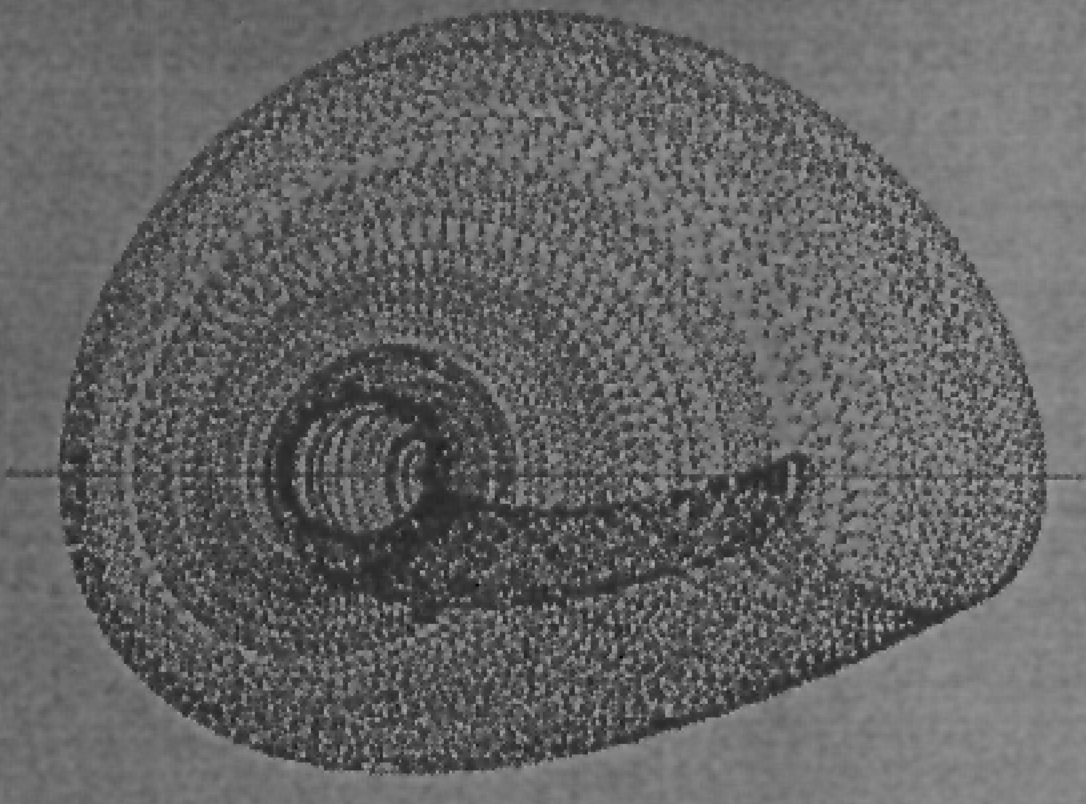

FINAL PROGRAM
ABSTRACTS

HYDRODYNAMIC BEARING REPRESENTATIONS ON THE FINITE ELEMENT SIMULATION OF ROTATORY SYSTEMS

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In this paper a formulafion for the analysis of shaft-rotor-bearing type rotating systems is extended to accommodate the effects of hydrodynamic bearings in its dynamic response. These effects, which are associated to the nonlinear force on the shaft at the bearings, are dependent of the transverse displacements, transverse linear velocities and the angular velocity of the shaft. The structure behavior is modeled by employing the finite element method. The shaft is represented by the two node Timoshenko model for beams, with four degrees-of-freedom per node and Hermite interpolation functions to represent the displacement fields along the beam axis. Rotors are modeled by using concentrated inertia elements associated to the degrees-of-freedom of one nodal point of the model. To represent the hydrodynamic bearings the equation of Reynolds was used under the simplified Ocvirk conditions for short bearings, providing a closed form solution for the oil film pressure distribution. This pressure distribution allows for the calculation of stifffiess and damping matrices associated to the shaft degrees-of-freedom at the bearing nodal point. In the numerical analysis considering the time integration of the system differential equation, a step-by-step procedure was employed with the Newmark technique in its unconditionally stable form. Due to the nonlinearities associated with the hydrodynamic bearings, the solution of the system of equations is obtained using a modified Newton-Raphson procedure at each time step for solution convergence. In the evaluation of the proposed computational system, comparison with solutions obtained from analytical/numerical results available in the literature are used. Also, a numeric representation of tilting-pad bearings is presented using the theory for plain journal bearings, under the same simplified conditions. In this case an evaluation of the numerical procedure is given by comparing calculated solutions with experimental results obtained from the evaluation of a hydrogeneration plant provided by CEPEL-Brazilian Research Center for

Eletrobras. In both plain and tilting-pad journal bearing numerical procedures, the idealized Jeffcott rotor is employed as a case study for different operating conditions. As a result, it is shown that the solutions associated to the main oil whirl and oil whip effects and afterwards dynamic stabilization are represented by the proposed numerical procedures employed.

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