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An Engineering Application of the H-P Version of the Finite Element Method on Vibration Behavior of Rotors

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Abstract : The hybrid h-p finite element method for the dynamic behavior of nonlinear rotors is described in this paper. The standard h-version method of discretizing the problem is retained, but modified to allow the use of polynomially-enriched beam elements. A hierarchically enriching element will thus not affect the nodal displacement and rotation, but will influence the values of the nodal bending moment and shear force is used. The deterministic movements of rotation and translation of the support which are coupled to the excitations due to unbalance are also taken into account. We study also the geometric dissymmetry of the shaft and the disc, thus the equations of motion of the rotor contain variable parametric coefficients over time that can lead to a lateral dynamic instability. The effects of movements combined support for bearings are analyzed and discussed through Campbell diagrams and spectral analyses. A program is made in Matlab. After validation of the program, several examples are studied. The influence of physical and geometric parameters on the natural frequencies of the shaft is determined through the study of these examples. Among these parameters, we include the variation in the diameter and the thickness of the rotor, the position of the disc.

Keywords : Campbell diagram, critical speeds, nonlinear rotor, version h-p of FEM
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