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Linear Dynamic Stability Analysis of a Continuous Rotor-Disk-Blades System

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Abstract : Nowadays, using rotating systems like shafts and disks in industrial machines have been increased constantly. Dynamic stability is one of the most important factors in designing rotating systems. In this study, linear frequencies and stability of a coupled continuous flexible rotor-disk-blades system are studied. The Euler-Bernoulli beam theory is utilized to model the blade and shaft. The equations of motion are extracted using the extended Hamilton principle. The equations of motion have been simplified using the Coleman and complex transformations method. The natural frequencies of the linear part of the system are extracted, and the effects of various system parameters on the natural frequencies and decay rates (stability condition) are clarified. It can be seen that the centrifugal stiffening effect applied to the blades is the most important parameter for stability of the considered rotating system. This result highlights the importance of considering this stiffing effect in blades equation.

Keywords : rotating shaft, flexible blades, centrifugal stiffness, stability
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