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FRICTION INTERFACES MODEL FOR BLADED-DISKS DYNAMIC ANALYSIS

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Efficiency improvement of aircraft engines, as well as pollution and noise reduction goals, lead to have a better knowledge and control on physical phenomena taking place in the engines. Friction in contact interfaces allows decreasing the dynamic response of a system due to a damping effect. Hence, mastering it can induce important design improvements for manufacturers.

This work aims at studying nonlinear forced response of a topological bladed-disk model, considering dry friction at the interfaces between the blade and the disk. A detailed description of the phenomena taking place in the interfaces is conducted, including contact forces distribution, edge effects and stick-slip behaviour of the contact at resonance. An equivalent friction induced damping coefficient study will finally be proposed.

The structural matrices of the bladed-disk sector are extracted from a finite element solver. To reduce the number of degrees of freedom and keep a reasonable computation time, a fixed-interface component mode synthesis is used. The nonlinear forced response of the system is then calculated using Harmonic Balance Method (HBM) coupled with an Alternating Frequency Time method (AFT) developed by Nacivet [1] to take Coulomb's friction law into account. Those algorithms are then coupled with a semi-analytical contact solver [2] to be able to make a detailed study on the contact interfaces, while keeping fast computations. These analyses as well as a mesh convergence study with regard to the different parameters allowed validating the model accuracy. Finally, an analysis on an equivalent damping coefficient was proposed, computed using dissipated energy in the contact and an analogy with a viscous damping model.

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