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Influence of Flexible Plate's Contour on Dynamic Behavior of High Speed Flexible Coupling of Combat Aircraft

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Abstract : A lightweight High Speed Flexible Coupling (HSFC) is used to connect the Engine Gear Box (EGB) with an Accessory Gear Box (AGB) of the combat aircraft. The HSFC transmits the power at high speeds ranging from 10000 to 18000 rpm from the EGB to AGB. The HSFC is also accommodates larger misalignments resulting from thermal expansion of the aircraft engine and mounting arrangement. The HSFC has the series of metallic contoured annular thin cross-sectioned flexible plates to accommodate the misalignments. The flexible plates are accommodating the misalignment by the elastic material flexure. As the HSFC operates at higher speed, the flexural and axial resonance frequencies are to be kept away from the operating speed and proper prediction is required to prevent failure in the transmission line of a single engine fighter aircraft. To study the influence of flexible plate's contour on the lateral critical speed (LCS) of HSFC, a mathematical model of HSFC as a elven rotor system is developed. The flexible plate being the bending member of the system, its bending stiffness which results from the contoured governs the LCS. Using transfer matrix method, Influence of various flexible plate contours on critical speed is analyzed. In the above analysis, the support bearing flexibility on critical speed prediction is also considered. Based on the study, a model is built with the optimum contour of flexible plate, for validation by experimental modal analysis. A good correlation between the theoretical prediction and model behavior is observed. From the study, it is found that the flexible plate's contour is playing vital role in modification of system's dynamic behavior and the present model can be extended for the development of similar type of flexible couplings for its computational simplicity and reliability.

Keywords : flexible rotor, critical speed, experimental modal analysis, high speed flexible coupling (HSFC), misalignment
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