A FINITE ELEMENT INVESTIGATION TO MODAL AND DYNAMIC BEHAVIORS OF PLANETARY GEARINGS CONCERNING THE EFFECT OF BEARING AND CARRIER STIFFNESSES

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Abstract

A finite element (FE) method is used to analyze modal and dynamic behavior of planetary gear systems (PGSs) focusing on the effect of bearing and carrier stiffness. Using derived tooth profile equations, elements for gear can be parametrically created. Then, the 2D/3D FE models of a planetary gear system (PGS) are constructed. Accordingly, structural natural frequencies and modal shapes are calculated after adequately assigning the material, boundary conditions, and tooth contact of gear pairs. An index, namely dimensionless slope, is defined to reflect the modal property due to the bearing stiffness change. Influence of carrier material and gear bearing stiffnesses on modal behavior is investigated. Several results of the PGS modal characteristics affected by the material and bearing stiffness are also obtained. Besides, the dynamic responses of the PGSs are analyzed under the carrier rotation. Finally, dynamic fillet stress and loading inequality among gear pairs due to planet bearing stiffness variation are analyzed. The FE approach presented can conveniently demonstrate modal and dynamic behaviors of PGSs.

Keyword：planetary gear system, finite element, stiffness