

Design and Tooth Contact Analysis of Face Gear Drive with Modified Tooth Surface in Helicopter Transmission

Authors : Kazumasa Kawasaki, Isamu Tsuji, Hiroshi Gunbara

Abstract : A face gear drive is actually composed of a spur or helical pinion that is in mesh with a face gear and transfers power and motion between intersecting or skew axes. Due to the peculiarity of the face gear drive in shunt and confluence drive, it shows potential advantages in the application in the helicopter transmission. The advantages of such applications are the possibility of the split of the torque that appears to be significant where a pinion drives two face gears to provide an accurate division of power and motion. This mechanism greatly reduces the weight and cost compared to conventional design. Therefore, this has been led to revived interest and the face gear drive has been utilized in substitution for bevel and hypoid gears in limited cases. The face gear drive with a spur or a helical pinion is newly designed in order to determine an effective meshing area under the design parameters and specific design dimensions. The face gear has two unique dimensions which control the face width of the tooth, and the outside and inside diameters of the face gear. On the other hand, it is necessary to modify the tooth surfaces of face gear drive in order to avoid the influences of alignment errors on the tooth contact patterns in practical use. In this case, the pinion tooth surfaces are usually modified in the conventional method. However, it is hard to control the tooth contact pattern intentionally and adjust the position of the pinion axis in meshing of the gear pair. Therefore, a method of the modification of the tooth surfaces of the face gear is proposed. Moreover, based on tooth contact analysis, the tooth contact pattern and transmission errors of the designed face gear drive are analyzed, and the influences of alignment errors on the tooth contact patterns and transmission errors are investigated. These results showed that the tooth contact patterns and transmission errors were controllable and the face gear drive which is insensitive to alignment errors can be obtained.

Keywords : alignment error, face gear, gear design, helicopter transmission, tooth contact analysis

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