Dynamic analysis of gear pairs with a gross motion effect using the dynamic stiffness matrix method

黃國饒
Mechanical Engineering
Engineering
kjhuang@chu.edu.tw

Abstract

A continuum approach using the dynamic stiffness matrix (DSM) method (DSMM) is presented for the dynamic analyses of spur gear pairs incorporating the gross motion effect. A continuum dynamic model of spur gears was formulated based on the dynamic stiffness using the nonuniform Timoshenko beam theory. A systematic DSM for a gear pair was assembled including the elemental DSMs of two mating gears and nonlinear Hertzian contact stiffness. The DSMs were updated at each computing step to reflect the time-varying property due to the moving mesh points. A bisection procedure was used to calculate the natural frequencies as the systematic DSM of the gear pair became singular. The mass and stiffness matrices were calculated by taking a numerical derivative of the systematic DSM. Finally, the gear dynamic responses caused by the external torque and gross motion excitation resulted. The effect of gross motion is also discussed.

Keyword：pur gear, gross motion, dynamic analysis, dynamic stiffness matrix method, Timoshenko beam, centrifugal acceleration