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A refined analytical model for the mesh stiffness calculation of plastic gear pairs. (English)

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Summary: The accurate calculation of the mesh stiffness for a plastic gear pair is significant for analyzing its transmission performance. During the meshing process, factors such as gear tooth meshing deformation and thermal effect will cause variations of the meshing position and tooth load particularly for plastic gears. These increase the difficulty for the accurate calculation of the gear mesh stiffness for plastic gear pair. To address this issue, the instantaneous gear tooth meshing deformation is obtained based on the potential energy method. Then, the effects of the above factors on the contact condition of a meshing tooth pair are analyzed, based on which the actual mesh position is accurately obtained via an iterative algorithm. Under the commonly-used elastic contact assumption, the contact stiffness at the new meshing position is calculated based on the Hertzian contact theory, and the algorithm of the mesh stiffness calculation for a plastic gear pair is derived by analyzing the influence of the elastic approach of meshing tooth on load distribution mechanism of gear pair. Compared with previous analytical methods, the proposed algorithm for mesh stiffness calculation shows higher accuracy, and it can also properly analyze the effect of load and other parameters on the mesh behavior of plastic gear pair, which can provide a theoretical basis for the performance analysis of plastic gear transmission system.

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Keywords:

plastic gear; mesh stiffness; thermal effect; actual mesh position; elastic approach

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