Geometric displacement optimization of external helical gear pumps

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Abstract

An approach to geometric displacement optimization of external helical gear pumps is presented. In addition, relations of pump flow property and its influence factors are also investigated. During that, only the pumps with transverse contact ratios of not less than one are discussed. First, using the involute property, an analytic representation for flowrates is deduced, by which displacements and fluctuation coefficients of helical gear pumps can be calculated accurately and efficiently. Then, by incorporating several design considerations, optimization problems for maximum geometric displacement are formulated and solved integrally by an optimization code, Multifunctional Optimization System Tool, with which various types of design variables including real, integer, and discrete can be simultaneously dealt with. Finally, the desired pumps with optimal displacement can be obtained. The proposed approach facilitates the design optimization of helical gear pumps. Moreover, influences of design parameters on the displacement and flow characteristics of the optimal pumps by assigning individual parameters are investigated. The result also concludes that the pump with a larger module, larger face width, or smaller tooth number has bigger displacement but may cause more severe flowrate fluctuation.

Keyword：helical gear pump, displacement, optimization, flow rate, flow fluctuation, module, helical angle