

包含洩漏與應力分析之螺旋齒輪泵浦排量最佳化研究

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摘要

This study intends to perform the geometric displacement optimal analyses to the helical gear pumps including considerations of leakage and gear stresses. At first, using the control volume method, an analytic expression to represent pump flow rate is derived by which the theoretical displacements, dimensionless displacements, and flow rate fluctuation of the pumps can be calculated. Then, by using both the pressurized and shear flow theories of parallel plates, the leakage model of the pumps between tooth addendums and chamber is obtained. Also, the pressure distribution of carry over teeth of pump gears can also be resulted. In the gear stress consideration aspect, the above teeth pressure distribution is imported to the FE package ANSYS via APDL programming. After adequate settings including initial and boundary conditions and operation conditions, fillet bending stress and contact stress of gear pairs are obtained. Afterwards, including the numerous constraint considerations associated with the pump design, gear geometry and machining, leakage, and gear stresses, analyses of geometric displacement optimization to the helical gear pumps are performed by an optimal code, MOST. Finally parametric study is executed by which the influences of gear modules, teeth number, pressure angles et al. on the displacement and flow rate fluctuation of the optimization helical gear pumps are investigated.

關鍵字：Gear; Pump; Displacement; Finite element method; Optimization