

Displacement Volume Optimization and Flow Fluctuation Analysis for  
External Spur Gear Pumps

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Abstract

The capability of volume displacements is essential in designing the external gear pumps (EGPs). Therefore, in this study an approach of optimization analysis intending to enhance their displacement capability of external gear pumps is proposed. Through the process, design parameters of the spur gears in the pumps are systematically resulted to achieve optimal volume displacements. Additionally, a solid CAD model to visualize the designed gear of the optimal design is parametrically created. Firstly, tooth profile equations of gears are generated by using the coordinate transformation and equation of meshing for gears to a rack cutter profile. Then, an analytic formula represented the enveloping area by an involute curve is derived. Next, volumes of output and trapped backflow of the EGP are achieved, respectively. Therefore, the net output volume can be calculated accurately and efficiently. After that, the optimization analysis to maximize its volume displacement is performed. Through that, optimal design parameters for the pumps are achieved under assigned constraints for considerations of design and manufacturing. Additionally, influences of module, pressure angle, and addendum correction factor for the gears in the pumps on their displacement capability are also investigated. The results demonstrate the success of the approach in optimizing the volume displacement for the pumps. Besides, flowrate fluctuation characteristics under different pressure angles of gears are discussed.

Keyword : External gear pump, Spur gear, Involute, Displacement volume, Optimization, Addendum correction factor, Flowrate.