An Optimization Approach to the Displacement Volumes for External Spur Gear Pumps

黃國饒,張文瑞,連文川
Mechanical Engineering
Engineering
kjhuang@chu.edu.tw

Abstract

To increase volume displacement is always concerning in designing external gear pumps
(EGPs). Therefore, an approach of optimization analysis intending to enhance their displacement
capability is proposed in this study. Through that, design parameters of the spur gears in the pumps are
systematically resulted to achieve their optimal volume displacements. Parametrically, a CAD model
to visualize the designed gear of the optimal design is also created. Firstly, the study derives tooth
profile equations by using the coordinate transformation and equation of meshing for gears on 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. Therefore the net
output volume can be calculated accurately and efficiently. After that, the optimization analysis to
maximize the 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. Additionally, flowrate fluctuation
characteristics under different pressure angles of gears are finally

discussed.