ABSTRACT

ORBIT® motors and GEROTOR® pumps are widely used in medium range pressure applications due to their poor leakage characteristics. Improving the leakage characteristics of such units is still a challenging area of research.

In the present study, deformations/gaps which occur at all ideally form-closed active contacts in epitrochoid (cycloidal class) generated star-ring set of ORBIT® motor, were estimated. The problem is statically indeterminate, as there are multiple contacts. FEM in ANSYS® environment was used to model the problem. The model was developed to assess more accurate and realistic boundary conditions as well as loading patterns. In ORBIT motor momentary occurrence of gap at the transition active contact, i.e., the contact separating two adjacent chambers with a substantial inter-chamber pressure difference is unavoidable. The proposed method can be used for any such unit of any geometric design and kinematic model. The results have a reasonably good agreement with that of a trial and error method proposed earlier.

Also in a GEROTOR pump, the chambers are separated by geometrically form-closed higher pair active contacts of star-ring components. With the rotation when the chamber volumes expand and contract, the active contacts move on lobe profiles and are subjected to deformations caused by fluid pressure and transmitted torque. From the earlier experimentation conducted in WTU, Poland, inter-chamber leakages through these gaps at some angular positions of the star-ring were visualized. To access this observation critically, deformations were evaluated at ideally form-closed active contacts in GEROTOR pump using static structural analysis in ANSYS environment. Next, to investigate the flow characteristics, including the occurrence of cavitation in the GEROTOR pump, numerical analysis using the CFD tool in the ANSYS environment has been carried out. The flow processes were analyzed for different angular positions of the star. Results obtained by the numerical analysis exhibits good agreement with the flow patterns reported from experimental visualization.

Abstract

Further, an analysis was carried out to predict the inter-chamber leakage flow through transition active contacts in the cycloidal class toothed star-ring of ORBIT motors. The characteristics of leakage flows through such gaps were then established by CFD analysis using Fluent® in ANSYS environment.

Key words: Active and Transition contacts, CFD analysis, Deformations and Gaps, Epitrochoid star, Inter-Chamber Leakage flow, Photo-imaging.