Pumping Behavior Study on Rubber Lip Type Rotary Shaft Seal

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ABSTRACT

Radial lip seals for rotating shafts are used to retain oil and exclude contaminants in many different applications throughout industry. The seal lip is designed to have an interference fit with the shaft. In this study, a direct numerical simulation model has been developed to aid in the understanding of the pumping mechanism of radial lip seals. A commercial software CFD-ACE+R is used to simulate the flow field around a ribbed helix lip seal in the environment of a pumping-rate test rig, where both air and oil sides are filled with oil initially. The streamline pattern and pressure field around the seal lip are examined. Complicate three-dimensional streamline topology is analyzed. The vortex generated next to the lip on the oil side rotates such to create an inward pumping effect. On the air side, pressure built up on the windward faces of ribbed helices next to the lip also help pumping oil back to the sump. The pumping rates are calculated at shaft speeds, ranging from 2000 to 6000 rpm, and compared to the measured values from the test rig. Good agreement is observed. The current results demonstrate the promising application of CFD in the design of radial lip seals.

Keywords : Radial lip seal, ; Pumping rate ; Sealing

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