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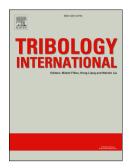
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ACCEPTED MANUSCRIPT

1	A Transient Hydrodynamic Lubrication Model for Piston/Cylinder Interface of
2	Variable Length
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12	
13	Abstract
14	
15	Hydraulic machinery transfers energy between a fluid and a mechanical system. The
16	swash plate pump is one of the most widely used pumps because of its simple and
17	compact structure. The piston/cylinder system is the core of the swash plate pump, and its
18	lubrication characteristics greatly affect the overall pumping performance. This study is
19	aimed at the development of a transient hydrodynamic lubrication model for the pumps
20	with varying length of the piston-cylinder interface and the investigation of the influences
21	of cylinder length, clearance, as well as other design parameters, on the pump piston
22	forces and friction. The changing domain and moving boundaries of the varying
23	piston-cylinder interface impose a challenge to the modeling, and a novel
24	equal-displacement-step method is developed to tackle this issue. The pressure, film
25	thickness, and friction performances of varying and constant interface-length systems are
26	studied, and the former is further analyzed in detail. The results indicate that increasing
27	the cylinder length reduces the misalignment angle and raises the minimum film
28	thickness, but it increases the maximum friction force at and slightly off the location for
29	the maximum velocity because friction is related to velocity and the interfacial area. A
30	longer piston is preferred, and the optimal length for stability should be $L_0/L_{min} = 1.71$ for
31	the system analyzed in this study.
32	
33	Keywords:
34	
35	Transient Hydrodynamic Lubrication, Variable Piston/Cylinder Interface, Swash Plate

36

37

Pump.

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