

The Contact Behaviors of Seals Under Combined Normal and Tangential Loading: A Multiscale Finite Element Contact Analysis

Authors : Runliang Wang, Jianhua Liu, Duo Jia, Xiaoyu Ding

Abstract : The contact between sealing surfaces plays a vital role in guaranteeing the sealing performance of various seals. To date, analyses of sealing structures have rarely considered both structural parameters (macroscale) and surface roughness information (microscale) of sealing surfaces due to the complex modeling process. Meanwhile, most of the contact analyses applied to seals were conducted only under normal loading, which still exists some distance from real loading conditions in engineering. In this paper, a multiscale rough contact model, which took both macrostructural parameters of seals and surface roughness information of sealing surfaces into consideration for the cone-cone seal, was established. By using the finite element method (FEM), the combined normal and tangential loading was applied to the model to simulate the assembly process of the cone-cone seal. The evolution of the contact behaviors during the assembly process, such as the real contact area (RCA), the distribution of contact pressure, and contact status, are studied in detail. The results showed the non-linear relationship between the RCA and the load, which was different from the normal loading cases. In addition, the evolution of the real contact area of cone-cone seals with isotropic and anisotropic rough surfaces are also compared quantitatively.

Keywords : contact mechanics, FEM, randomly rough surface, real contact area, sealing

Conference Title : ICTIE 2022 : International Conference on Tribology and Interface Engineering

Conference Location : Sydney, Australia

Conference Dates : December 02-03, 2022