INFLUENCES OF LOCAL TEMPERATURES ON THE PERFORMANCE OF SURFACE STRUCTURES

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ABSTRACT
Surface structuring, can influence contact temperatures. However, the relationship between local temperatures, fluid film, cavitation and cavitation pressure is not fully explored. A detailed experimental observation of the interaction between cavitation and contact temperature is lacking. This study aims to provide insight into this relationship. For this reason, the contact of a structured sliding contact is directly observed with the monitoring of cavitation formation. Local temperatures are mapped using infrared thermography [1]. Furthermore, by manipulating the observed local temperatures, potential positive or negative effects of local temperatures are demonstrated numerically.

It is demonstrated that when high temperatures are placed in the divergent zone while maintaining the mean temperature constant, cavitation does not immediately occur at the edge of the divergent gap. Instead, it is pushed to a later location in the divergent gap. Conversely, locating cooler temperatures in the converging gap leads to high pressures occurring over a larger region. Moreover, the influences of varying cavitation pressure and fluid viscosity within the cavitation zone are shown numerically. In previous work, cavitation pressure was predicted for a parallel sliding contact system without considering local temperatures. Here, the influences of local temperatures on this prediction are also discussed.

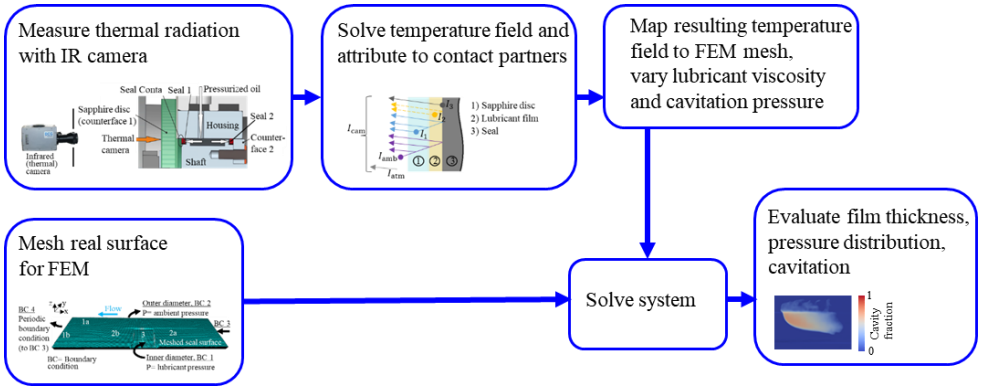

Fig.1 Measurement of local temperatures and integrating them into HL simulations of a structured sliding contact.

Subsequently, film thickness is calculated using the mass conservative Jakobsen-Floberg-Olsson (JFO) cavitation model with the Fischer-Burmeister-Newton (FBN) algorithm. In the simulations, viscosity and cavitation pressure are varied based on the measured local temperatures. The influences of these variations on fluid film thickness are shown numerically.

REFERENCES
[1] Adjemout, M., Brunetière, N., Bouyer J., 2018, "Friction and Temperature Reduction in a Mechanical Face Seal by a Surface Texturing: Comparison between TEHD Simulations and Experiments," Tribology Transactions, 61:6, 1084-1093. DOI: 10.1080/10402004.2018.1478053