NUMERICAL AND EXPERIMENTAL INVESTIGATION OF SURFACE TEXURES

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INTRODUCTION

In recent years, surface texturing was found to have beneficial effects on the performances of lubricated surfaces[1]. However, under certain operating condition, surface texturing may also have a detrimental influence on the friction coefficient. The present work, which combines experimental and numerical approaches, aims at shedding light into the underlying physical mechanisms of friction variation with surface textures.

Surface textures; pattern orientation; Reynolds equation

EXPERIMENTAL SETUP

The experimental approach is based on a pin on disc configuration[2]. It reveals that surface patterns that might lead to a significant reduction of the friction coefficient in one case do not yield beneficial behavior under different operating conditions. Figure 1 shows one example where the optimal texture shape for a certain temperature becomes less effective when the operating conditions change.

NUMERICAL ANALYSIS

The numerical approach is based on the Reynolds equations. In a first step the validity of the Reynolds equations for the film flow over circular dimples as used in the experimental study is thoroughly analyzed in comparison to results of full Navier-Stockes simulations. Since this check reveals that the Reynolds equations in which nonlinear effect are taken into account through the model proposed by Arghir *et al.*[3] yields reasonable results, simulations that resemble the experimental pin-on-disc scenario are set up. The macroscopic pin geometry measured in the experiment reveals a non-uniform gap height between pin and flat surface. The numerical finite volume mesh is set up in such a way that the same dimple shapes and patterns are reproduced as in the experiment. Cavitation and compressibility effects will be subsequently considered[4].

RESULT AND CONCLUSION

The numerical results confirm the experimentally observed trend that an optimal dimple diameter appears to exist for different operating conditions. In addition, the experimentally observed trend that different sliding directions for non-symmetrical dimple arrangements yield different results in terms of the friction coefficient is also found numerically. The fact that the numerical model is able to capture the experimentally observed trends correctly suggests that the model can capture the underlying flow physics. Therefore, the conference presentation will focus on the analysis of the generated flow fields.

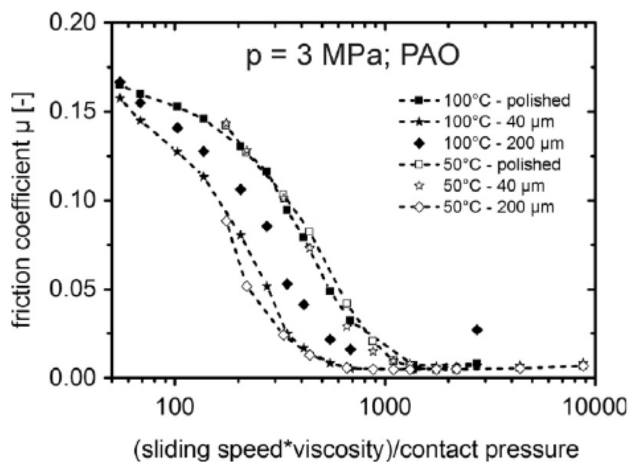

Fig.1 Friction coefficient plotted against the Stribeck parameter for a texture made by dimples with different diameters, from [2]).

REFERENCES

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