# Elastohydrodynamic analysis in a multi-physics finite element environment

# Elastohydrodynamic Analysis in a Multi-Physics Finite Element Environment

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## 1. Introduction

Elastohydrodynamic Lubrication (EHL) modelling has received much attention in recent years. The main goal is to understand the tribological characteristics under high contact loads. COMSOL Multiphysics 5.2 package offers advanced coupling between the deformation of bodies and lubricant behaviour. With this type of coupling; an accurate representation of EHL can be made as shown by Fillot et al [1]. This also facilitates the simultaneous calculation of sub-surface stresses field which has significant importance from durability point of view. This cannot be tackled directly using already presented finite difference EHL models in the literature. This paper presents an initial piezo-viscous, compressible EHL model based on the finite element formulation taking into account the sub-surface stress field.

## 2. Methodology

An approach similar to Fillot et al [1] is adopted for defining the contact problem. This is shown in figure 1. Additionally, figure 2 shows the equivalent setup in COMSOL.

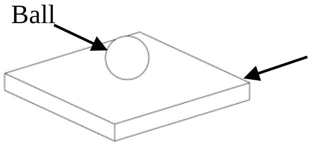


*Figure 1: Contact Model*

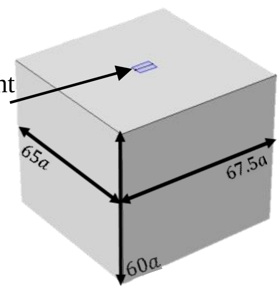


*Figure 2: Equivalent Model in COMSOL.*

Instead of using the PDE module found in Fillot et al model [1], the current model uses the built-in ‘Thin-Film Flow, Shell’ module. [4] based on the Reynolds equation.

## 3. Results

Results presented in figure 3 shows the contour plot of the sub-surface stresses along the centre-line of the computational domain under piezo-viscous and compressible flow conditions.

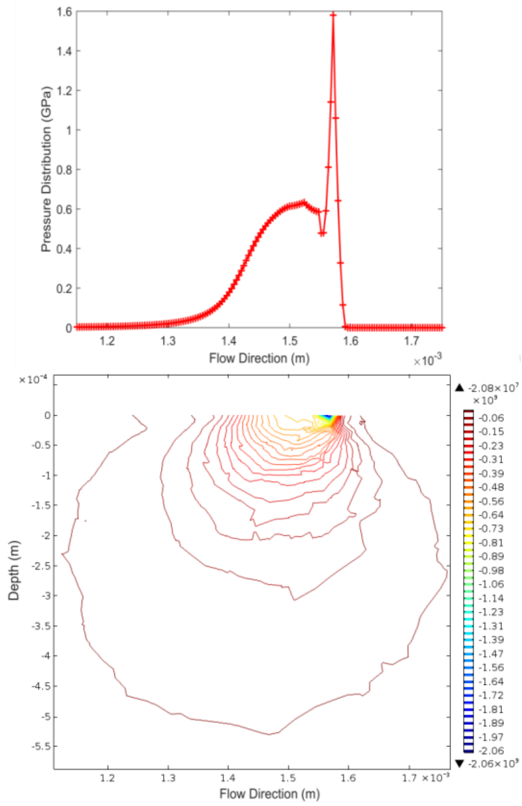


*Figure 3: Pressure distribution and sub-surface stresses along the centre-line of the contact and sub-surface stresses.*

This result show advanced coupling between the two modules, generating realistic results.

## 4. Acknowledgement

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## 5. References

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[3] ROELAND, C.J.A., 1966. Correlation aspect of the viscosity–temperature–pressure relation of lubrication oils (Doctoral dissertation, Ph. D. thesis, Delft University of Technology, Netherlands).

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