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MULTISCALE MODELLING OF ELASTOHYDRODYNAMIC TILTED-PAD BEARINGS: A METAMODEL APPROACH

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Elastohydrodynamic Lubrication (EHL) refers to the contact of two surfaces in relative motion under fully flooded conditions, pressure generated in the lubricant generates deformation of the bodies and this is coupled to determine a total load carrying capacity. In such contacts the size of surface topography and film thickness are of a similar order of magnitude and this therefore has a role in describing the phenomena. However the length scales associated with surface topography and the contact region are disparate and in order to model such effects authors have developed homogenisation based methods.

Recently the Heterogeneous Multiscale Methods (HMM) have been employed to study the problem. This has allowed the effects of micro-EHL to be explored and coupled into the macro-scale EHL problem. Fundamental to this is the separation of scales and periodicity applied at to simulations describing surface topography. de Boer [1] outlines a method for coupling the scales of the problem using Moving Least Squares metamodels to calculate flow factors. This was further used to optimise surface topographical features to produce the minimum possible coefficient of friction in an EHL contact [2]. This research focuses on the metamodelling approach of [1, 2] to explore more complex 3D titled-pad bearing geometries than have previously been investigated. The means by which the scales of the problem are coupled is complicated by an increase in the number of design variables. Additionally the choice of Design of Experiments and how this evolves with the solution procedure is vital to the accuracy of the approach.

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