KEYNOTE SPEAKERS

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The Role of Bulk Flow Model and CFD Analyzes in Today's Lubrication

The theory of lubrication is developed around a Reynolds equation that expresses the mass conservation balance of a thin film of fluid in equilibrium under the effect of pressure and viscous friction. This model is faulty if the convective inertia forces are significant as in situations where speeds are high and viscosities low. At first glance, it appears that taking into account convection effects can only be handled by solving the complete equations, that is to say by CFD. However, a model that takes the analysis further was proposed fifty years ago and has since been used with some success. This is the model of visco-inertial flow in thin film or "bulk flow model". This model has undergone two apparently independent developments that will be presented. The most important problems that could be solved will also be presented, i.e. static and dynamic characteristics of dynamic annular seals and hybrid bearings.

The last three decades have seen the use of CFD spread to countless problems including lubrication. On the other hand, it is recognized that the implementation of these approaches is not always simple and must be justified by the difficulty of the problem and the expected result. Thus, the presentation discusses the place of CFD in lubrication. Several aspects are discussed with examples. First is the use of CFD as the only tool to solve a problem. Second is the coupling of CFD with the bulk-flow model to supply the latter with information on pressure and speed variations which normally it escapes. Third is the contribution of CFD to the investigation of phenomena difficult to simulate experimentally on the scale of the thin film such as the flows of multiphase fluids or the taking into account of surface tensions. The presentation is completed by some thoughts on the near future of these models in lubrication.