LUBRICATED CONTACT MODEL FOR COLD METAL ROLLING PROCESSES

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Numerical method for calculating lubricated contact pressures and friction in cold metal rolling is presented in this study. Lubrication and friction are important factors in metal forming processes, since unoptimised frictional parameters can result in lower productivity of the rolling machinery and deteriorate surface quality of the product. In order to have a good representation of the contact phenomena in lubricated metal rolling processes, interaction between surface roughness and lubricant flow has to be taken into account [1]. Due to changes of lubricant thickness during the rolling process, lubricant flows in three different local regimes [1]: hydrodynamic, mixed and boundary regime. Ability to treat all three lubrication regimes is required.
Surface roughness effects, lubrication regimes treatment and lubricant properties variations are all implemented in the model. In order to calculate contact pressures and frictional forces, modified Reynolds lubrication equation [2] is used. Finite Area Method [3] is used to discretize Reynolds lubrication equation over a curved surface mesh. Implemented model is used by the solid contact boundary condition for a large strain elastoplastic deformation solver developed by Cardiff and de Jaeger [4] in OpenFOAM framework. Numerical model is validated by simulating sheet rolling process.

References

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