EFFECTS OF ELASTIC DEFORMATION ZONE AT ENTRY AND EXIT ON A MIXED FILM LUBRICATION MODEL

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Keywords: mixed film lubrication, elastic deformation zone

ABSTRACT

Rolling oils are widely used in cold rolling to improve the surface quality of the metal products and to reduce the mill power consumption and roll wear. In practice, mixed film regime prevails in the roll bite, where the film is thin to allow metal to metal contact occurs at the surface asperities.

A strip rolling model under mixed film lubrication similar to Wilson and Chang's asperity flattening model has been developed, but with a more rigorous 2nd order average Reynolds equation, Tieu et al (1999). Convergent solution can be obtained for normal rolling speeds \(0<\omega_r<20\) m/s. The hydrodynamic effect at entry to the roll bite is considered by solving the Reynolds equation. Results from the mixed film lubrication model have shown good correlation with measurements of oil film thickness and rolling force on an experimental rolling mill.

It can be seen in the cold rolling of strip shown in Fig. 1 that there are thickness changes of strip at the elastic entry and exit zones which affect the lubrication within the plastic deformation zone. The elastic hump of entry and exit zone will be determined by the finite element method.

Another aspect considered in the paper is the thermal effects in the in the mixed film due to frictional heat at the contact and the plastic deformation heat. The thermal effect on viscosity will then be considered in the mixed film lubrication model.

REFERENCES