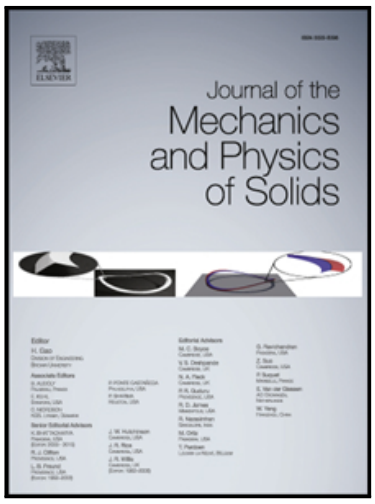

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A Crystal Plasticity Assessment of Normally-loaded Sliding Contact in Rough Surfaces and Galling

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Abstract

An investigation of rough metal to metal contacting surfaces under normal load and undergoing sliding has been carried out with explicit representation of measured surface profiles within a crystal plasticity finite element formulation in which grain size, texture and slip properties are incorporated. A new metric called plastic reach has been introduced for contacting surfaces which reflects both the magnitude of the local surface asperity plasticity and its spatial reach. This quantity has been shown to obey a power law relationship with the applied normal load for sliding contact which in turn has been related to a hazard function. In this way, a new methodology to predict the galling frequency that follows a Weibull distribution has been established. Additionally, a quantitative definition of galling for the class of metal on metal contacting surfaces is considered. The predicted galling frequency distribution for a 316 stainless steel has been compared with independently experimentally measured galling frequencies showing qualitative agreement of the distributions. An assessment of confidence limits has also therefore been provided for the modelling methodology.

Keywords: galling, rough surfaces, sliding contact, crystal plasticity

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