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A Simple Model to Account for the Locking Effect Between Two Rough Surfaces under Cyclic Loading

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A contact between two rough surfaces subjected to normal and shear loads is an unavoidable source of energy dissipation. The latter is associated with frictional losses caused by shear micro-displacements along the interface. It has been observed in experimental studies at Sandia National Laboratories that the loss of energy undergoes certain evolution when contact is subjected to cyclic loading. It manifests itself in the form of a gradual decrease approaching a steady state as cycling progresses. This behavior has a repeatable character after the contact is re-established and subjected to cycling again. In the present work a simple model is developed that suggests a hypothesis that two rough surfaces brought into contact tend to lock up with a number of cycles resulting in a reduction of a total energy loss. A multiple asperity contact model is introduced to capture this phenomenon. Asperities are assumed to change their contact type under cyclic loading from being normal to being inclined.

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