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# Multiscale Modeling and Simulation of Rolling Contact Fatigue

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## Abstract

A hierarchical multiscale method is proposed in this paper to study the rolling contact fatigue with the consideration of lubricant effects. This multiscale model consists of a molecular model of lubricant and a continuum model of rolling contact components. At the nanoscale, molecular dynamics is employed to model the lubricant and to calculate the friction coefficient at the rolling contact surface. At the macroscale, the finite element method is used to conduct stress analysis of the rolling contact component so that the fatigue life can be predicted. The calculated friction coefficient is passed from the molecular model to the continuum model in the proposed multiscale model. The effect of fluctuating load on the rolling contact fatigue life is also studied in this paper. The objective of this paper is to develop a new multiscale framework which connects the nanoscale and the macroscale. It shall be noted that a commonly used

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