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A new damage-mechanics-based model for rolling contact fatigue analysis of cylindrical roller bearing

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Abstract: The cyclic contact stresses in cylindrical roller bearings are evaluated through the explicit finite element analysis with rolling the roller instead of moving a constant contact pressure in the computational domain. A new damage evolution equation in terms of the amplitude of octahedral shear stress is proposed, which considers the non-proportional variation of stress, and the material parameters in which are easily obtained from torsion fatigue testing data. Numerical simulations of crack initiation, crack propagation, and spalling are performed. The simulation results are consistent with the previous experimental results. Furthermore, the coupling effect between the contact stresses and fatigue damage is investigated, and the effects of contact loading on the fatigue life are studied.

Keywords: Rolling contact fatigue; damage mechanics; explicit Finite element; crack initiation; crack propagation

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