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Contact Optimization Problems Associated with the Wear Process

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The optimal shape design of contact surfaces has usually been aimed at controlling the contact pressure distribution. However, a much wider class of contact optimization problems can be formulated by maximizing contact force or displacement, torsional moment, or minimizing the rate of dissipation. A special class of optimization problems is considered, namely, the minimization of wear rate depending on both normal pressure and slip velocity. The specific modified Archard wear rule is assumed. The illustrative examples demonstrate the evolution of wear process toward their steady states. It is demonstrated that the wear dissipation power at the contact surface is minimal in the steady state of the wear process and in many cases corresponds to the uniform wear rate. The discretization of the contacting bodies was performed by the displacement based on p-version of finite elements assuring fast convergence of the numerical process and accurate specification of geometry for shape optimization, or by half space Boussinesq solution. It is assumed that the displacements and deformations are small, the material of the contacting bodies are elastic.

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