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Frictional Contact with Wear Diffusion

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A quasistatic problem of frictional contact, with wear, between a deformable body and a moving foundation is considered. The material is assumed to be viscoelastic and nonlinear. The contact is modeled with normal compliance condition and the associated law of dry friction. The wear takes place on a part of the contact surface, and its rate is described by the Archard differential condition. The main novelty in the model is the diffusion of the wear particles over the potential contact surface. Such phenomena arise in many applications and, in particular, in orthopaedic biomechanics where the wear debris spread out and cause the degradation in the effectiveness of joint prosthesis and implants. A weak formulation of the model, which is a coupled system with an evolutionary variational inequality, a wear rate production ordinary equation and a nonlinear evolutionary variational equation. it is proved that, under a smallness assumption on some of the problem data, there exists a unique weak solution for the model.

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