Recent Developments in Contact Processes

Meir Shillor
Department of Mathematics and Statistics
Oakland University, Michigan, USA
email: shillor@ oakland.edu

January 8, 2004

We describe four recent models and mathematical results for processes involved in dynamic or quasistatic contact. These include friction, wear or adhesion.

The first model deals with the dynamic frictional contact between a viscoelastic body and a rigid foundation, [1]. Contact is described by the Signorini condition and friction by a regularized version of the coulomb law. The friction coefficient is assumed to depend on the relative slip speed with a possible jump at the onset of sliding. The existence of the unique solution was established for a Lipschitz friction coefficient (without a jump), and just existence when it has a vertical segment at zero relative slip speed, by using the recent theory of set-valued pseudomonotone operators developed in [2].

The second model, [3], deals with dynamic frictionless contact between a viscoelastic body and a reactive obstacle when an adhesive is present on the contact surface. Moreover, the damage of the material due to tension or compression was taken into account. The existence of the unique solution was established and a regularity result, which is close to optimal, was obtained.

The third model deals with quasistatic frictional contact when the wear of the contacting surface is taken into account, and the wear debris migrate or diffuse on the contact surface, following [4]. The migration of the debris can cause the deterioration of the system, in particular in biomechanical systems.

The fourth is a model describes the braking of a rigid rotating wheel with a thermoviscoelastic beam, [5]. The wear of the beam was taken into account. It is a simplified model aimed at parameter identification for the processes.

References

[1] K.L. Kuttler and M. Shillor, *Dynamic contact with Signorini's condition and slip rate dependent friction*, preprint, 2003.

[2] K.L. Kuttler and M. Shillor, *Set-valued pseudomonotone maps and degenerate evolution inclusions*, Comm. Contemp. Math., **1**(1999), 87–123.

[3] K.L. Kuttler, M. Shillor and J. R. Fernandez, *Existence and regularity for dynamic viscoelastic adhesive contact with damage*, preprint, 2004.

[4] M. Shillor, M. Sofonea and J.J. Telega, *Quasistatic viscoelastic contact with friction and wear diffusion*, Quart. Appl. Math., to appear.

[5] J. Bajkowski, J. R. Fernandez, K. L. Kuttler and M. Shillor, *A thermoviscoelastic beam model for brakes*, Euro. J. Appl. Math., to appear.