

## **An Investigation of Certain Dynamic Instabilities in Dry Sliding – Activities**

The objectives of this investigation of dynamic dry sliding friction were twofold. The first objective was to determine the effects of surface layers and surface roughness on the dynamic stability of sliding. The second objective was to determine the effects of dynamic instabilities on observed friction phenomena. The basic configuration which was investigated is shown in Figure 1, in which two elastic bodies are pressed against each other and are in sliding contact along their interface. This configuration was altered to include surface layers on one or both bodies, to include surface waviness, and to include a separation zone.

The activities included two related areas. The first area was the determination of the effects of surface layers (elastic properties, density, and thickness) and surface roughness (amplitude and wavelength) on the magnitude of the dynamic instability in dry sliding. The analysis was of the dynamic motion of the elastic bodies with a Coulomb frictional interface. The methods used were integral transform techniques, Fourier series analysis, and the numerical solution of singular integral equations. Secondly, *the effect of dynamic instabilities on observed friction* was investigated by analyzing interface stick-slip, separation pulses, radiated body waves, and incident body waves, on friction. These analyses also used dynamic elasticity with simple Coulomb friction along with the methods of integral transform techniques and the numerical solution of singular integral equations.

The material which resulted from this work was presented at:

"Dynamic Instabilities in the Sliding of Two Layered Elastic Half-Spaces," *World Tribology Congress*, London, UK, September 8-12, 1997.

"Two Elastic Half-Spaces in Relative Sliding Without Slipping," *1998 ASME/STLE International Tribology Conference*, Toronto, Canada, October 25-28, 1998

"Self-Excited Oscillations and Interface Stick-Slip in the Sliding of Two Elastic Half-Spaces With Constant Friction," *13<sup>th</sup> U.S. National Congress of Applied Mechanics*, Gainesville, Florida, June 21-26, 1998.

"The Sliding of an Elastic Half-Space Against a Rigid Surface With Friction Reduction Due to Incident Dilatational Waves," *ASME 17<sup>th</sup> Biennial Conference on Mechanical Vibration and Noise*, Las Vegas, Nevada, September 12-16, 1999.

"Friction Reduction in the Sliding of an Elastic Half-Space Against a Rigid Surface Due to Incident Dilatational Waves," *1999 STLE/ASME Tribology Conference*, Kissimmee, Florida, October 11-13, 1999.

"Contact Modeling – Forces," *Tribology of Information Storage Devices 99*, Santa Clara, California, December 6-8, 1999.

"Elastic Waves Induced by the Frictional Sliding of Two Elastic Half-Spaces," *20<sup>th</sup> International Congress of Theoretical and Applied Mechanics*, Chicago, Illinois, August 27-September 2, 2000.

"Elastic Waves Induced by the Frictional Sliding of Two Elastic Half-Spaces," *27<sup>th</sup> Leeds-Lyon Symposium on Tribology*, Lyon, France, September 5-8, 2000.

Seminars were presented at: MIT, Harvard, Cornell, University of Rhode Island, Boston University, Northeastern University (Mechanical Engineering, Civil Engineering, Mathematics, and Physics Departments) and the US Army Natick Research Lab.

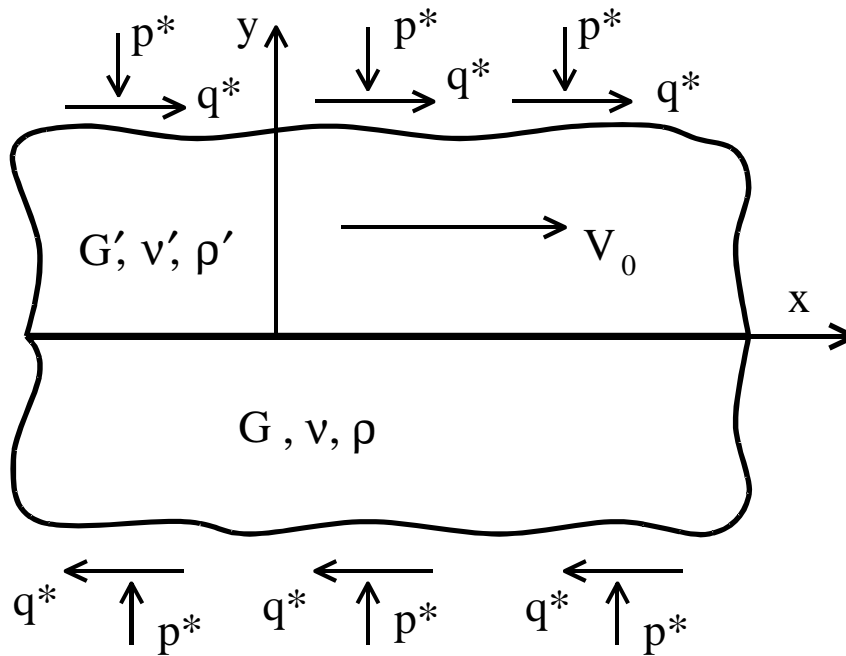


Figure 1. Two elastic half-spaces in sliding contact.