A model for elastohydrodynamic collision of spheres in liquid
JOHN WELLS, Ritsumeikan Univ., J.T. JENKINS, Cornell Univ. — We pursue a reduced-order model of normal “elastohydrodynamic” collision between two spheres in incompressible liquid (Wells 1993; Proc. Powders & Grains ’93, “W93”). W93 assumed a “quasi-Hertzian” surface depression profile, yielding the first reduced-order model ODEs for this problem. Trajectories and coefficients of restitution agreed well with simulations (Davis, Serayssol, & Hinch, 1986; J. Fluid Mech 201; “DSH86”). To avoid numerical integrations such as those in W93, Lian et al. (1996, J. Fluid Mech 311) assumed additionally that the gap inboard of a certain radius was constant, leaving only the centerline gap as an unknown. Then introducing an adjustable constant, they recovered coefficients of restitution close to DSH86. The present work extends W93 and Lian et al. to achieve, without adjustable constants, the analytical character that until now was only afforded by perturbation approaches (DSH86) wherein centerline deformation is assumed to be much smaller than the gap.

John Wells
Ritsumeikan Univ.

Date submitted: 10 Aug 2009