# Chain dynamics

1. Derive equations of motion of the array of non-elastic balls under gravitational force. Originally, the balls are located in the equilibrium points (local minima of the potential energy) at the surface $y = -0.5x + \sin(x)$. The dissipation $D$ of a collision is $D = q\,[V_+ - V_-]^2$ where $V_+$ and $V_-$ are the velocities of the colliding balls and $q$ is a coefficients.

Model the dynamics; consider different scenarios for two and three balls. Generalize.

2. Describe the dynamics of a bouncing rectangle, assuming that impact energy loss is (i) proportional to the kinetic energy of the impact, (ii) proportional to the speed $V$ of the impact. Derive the equations, simulate the motion.

3. Derive the chain reaction conditions (the threshold conditions) of the fall of domino's chain, assuming that dominos are of increasingly larger size as in the video: $www.youtube.com/watch?v = y97rBdSYbkg$. Simulate the model.

4. Describe Voellmy model and of avalanche dymanics. Discuss the assumptions and generalizations. Simulate.
$www.igsoc.org : 8080/journal/29/102/igs_journal_vol29_issue102_pg350{-}352.pdf$,
$www.avalanche.org/moonstone/zoning/avalanche\%20dynamics.htm$

5, 6. Derive equations of a steady state fall of a domino chain. Estimate the speed of the wave. Use appropriate simplifications.
http://arxiv.org/pdf/0707.2618v1.pdf ( Domino Waves. C.J. Efthimiou, M.D. Johnson)
experiments: www.academia.edu/1118359 (DEMONic Dominoes, measuring the speed of the domino effect by Ron Larham )