Computational Science 2

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Seminar
Exercises

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Exercise 9 (09.07.2013):

Simulation of a wobbling plate

from ***An Introduction to Computer Simulation Methods***,
Chapter 17, Problems 17.13-14

a) Run the target class `FeynmanPlateApp`. Does your simulation confirm Feynman's observation of the wobbling plate in the Cornell cafeteria (ratio between wobble and spin 2 : 1)? Are the discrepancies between Feynman's description and the simulation due the fact that the wobble is not small or due to numerical inaccuracies? Justify your answer.

b) How well does the algorithm conserve energy and angular momentum?

c) Will a rectangular food tray wobble the same way as a plate?

d) Does the plate wobble if it spun about an axis close to a diameter rather than close to a line perpendicular to the flat side of the disk?

e) If the angular velocity vector coincides with a body's principal axis, the angular momentum and the angular velocity coincide. The body should then rotate steadily about the corresponding principal axis because the net torque is zero and the angular momentum is constant. Does the simulation show this result for all three axes if the moments of inertia are unequal? Perturb the angular velocity. Are rotations about the three principal axes stable or unstable? Check each axis. Repeat this simulation with a different set of moments of inertia.