I will simulate the motion of a car going over a variable terrain (a flat surface for a boring example, a sinusoidal road for an entertaining example). The half-car model will be used in the simulation, where only one side of the car will be considered; the result is then identical to the motion of a motorcycle. The car's suspension system will consist of a spring and damper system at each corner of the car (2 corners in the model). The spring and damper will be connected to the middle of each wheel on the other end. The tires will be modeled using the same spring and damper system but with appropriately different spring constants and damping coefficients.

The body of the car is considered to be a slender bar with gravity acting on the center of mass (the center of mass can be changed by the user). The angle of the body with respect to a flat ground surface is one of the state-variables, so the torque on the body produced by the suspension components will be evaluated at each time step.

For now, the car is assumed to have constant velocity in the x-direction, which is parallel to the road. Only the velocity and accelerations in the y-direction are evaluated.

A test calculation for this system can be an evaluation of the equilibrium positions of the body and the wheels of the car as it rests on a flat surface. These can be calculated analytically by solving the static equilibrium equations for each component of the vehicle. They can be tested by dropping the car from some elevated height and observing the positions of the different components as they settle into steady-state values. If the simulation is accurate, the analytic solution will equal the long-term values of these positions.