Continuous Simulation

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Continuous simulation

- Continuous Simulation refers to a computer model of a physical system that continuously tracks system response according to a set of equations typically involving differential equations.

Wikipedia

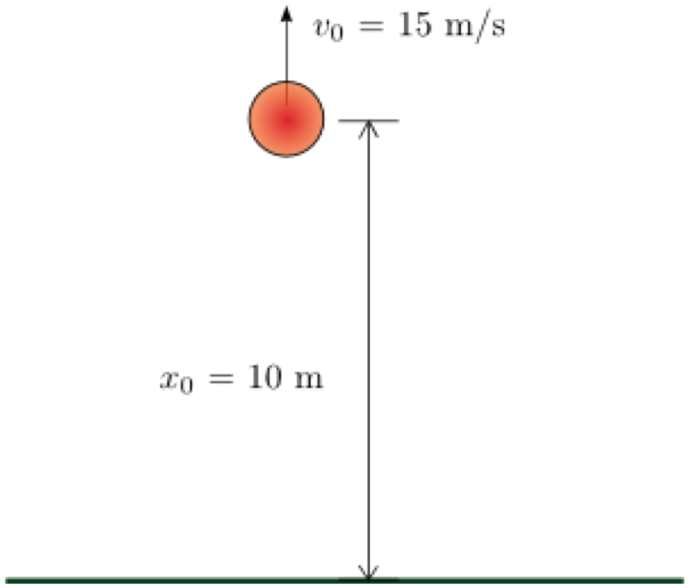
Difference between discrete event simulation and continuous simulation:

- **Discrete event simulation** is appropriate for systems whose state is discrete and changes at particular time point and then remains in that state for some time. An example of such a system is the number of customers in a post office: The number of customers is discrete (integer) and the number of customers only changes when someone enters the post office or finishes its business at the counter.

- **Continuous simulation** is appropriate for systems with a continuous state that changes continuously over time. An example of such a systems is the amount of liquid in a tank and or its temperature. Such a system can be described by differential equations. Continuous simulation is a technique to solve these equations numerically.

Joachim Arts, University of Luxembourg

Example Continuous simulation: Bouncing Ball



$$\frac{dv}{dt} = -g$$

$$\frac{dx}{dt} = v$$

Boundary conditions:

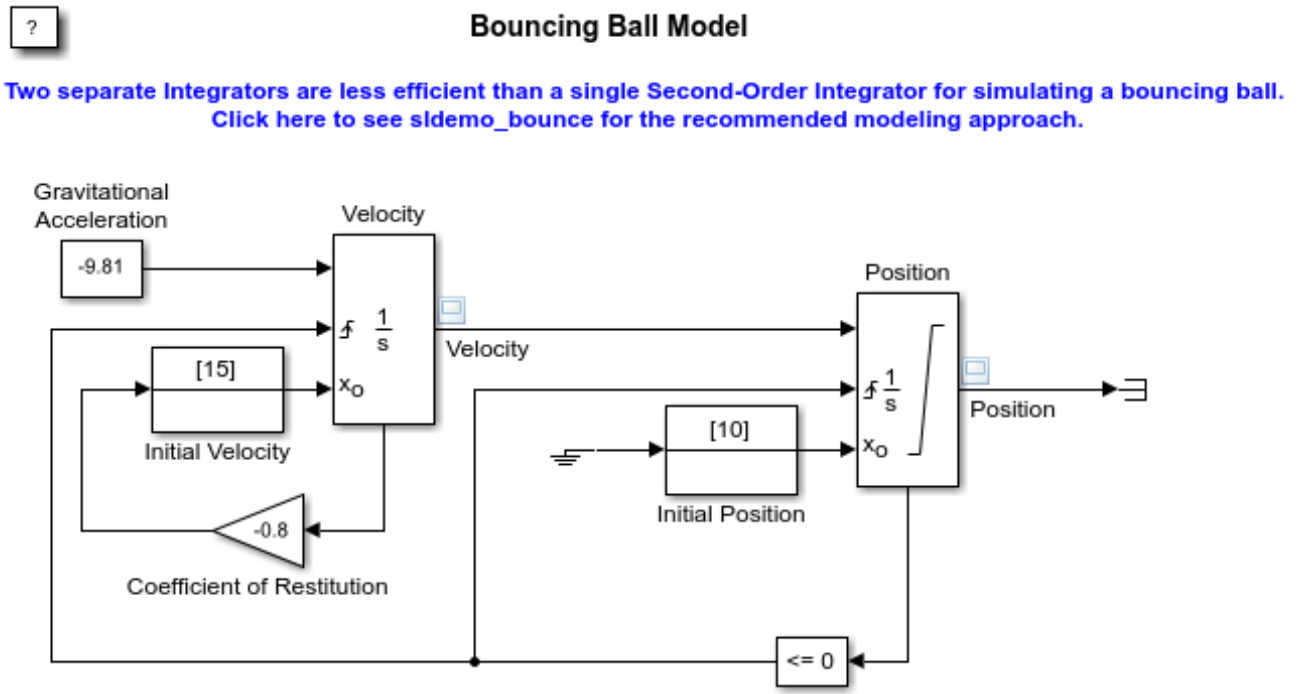
$$x_0 = 10[m]$$

$$v_0 = 15[m/s]$$

$$g = 9.81\ [\frac{m}{s^2}]$$

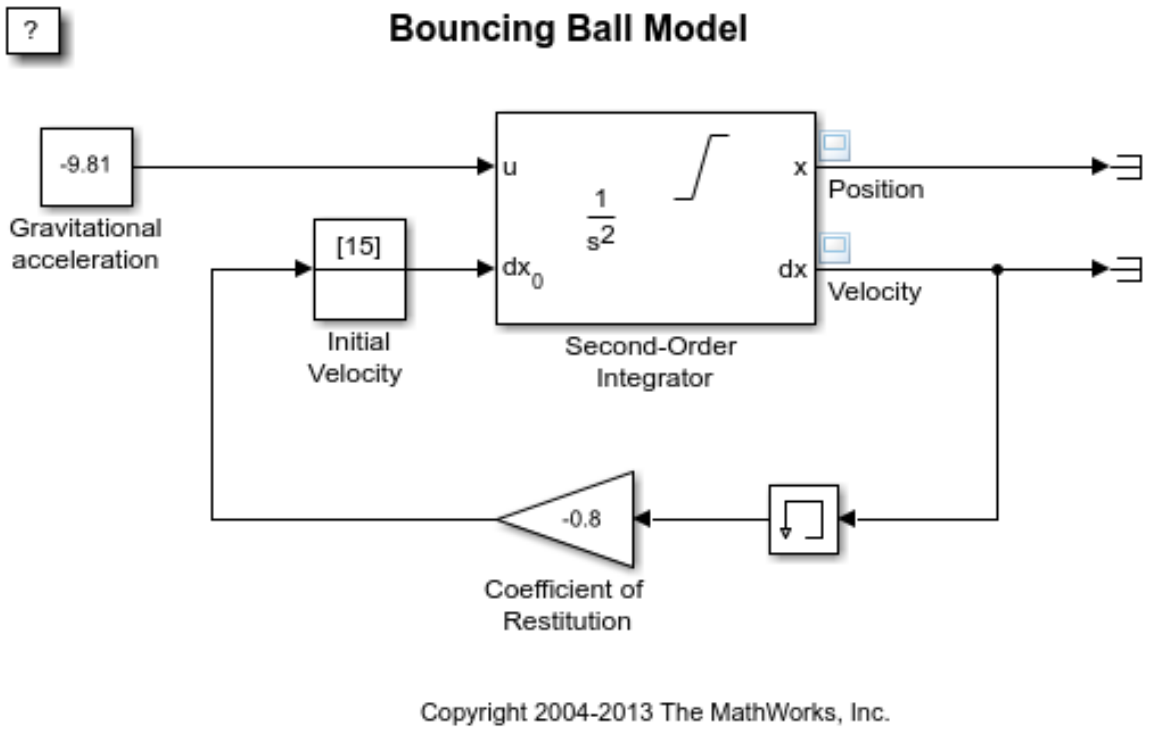
And : $v^+ = -kv^-,\ x = 0$

Two integrator model



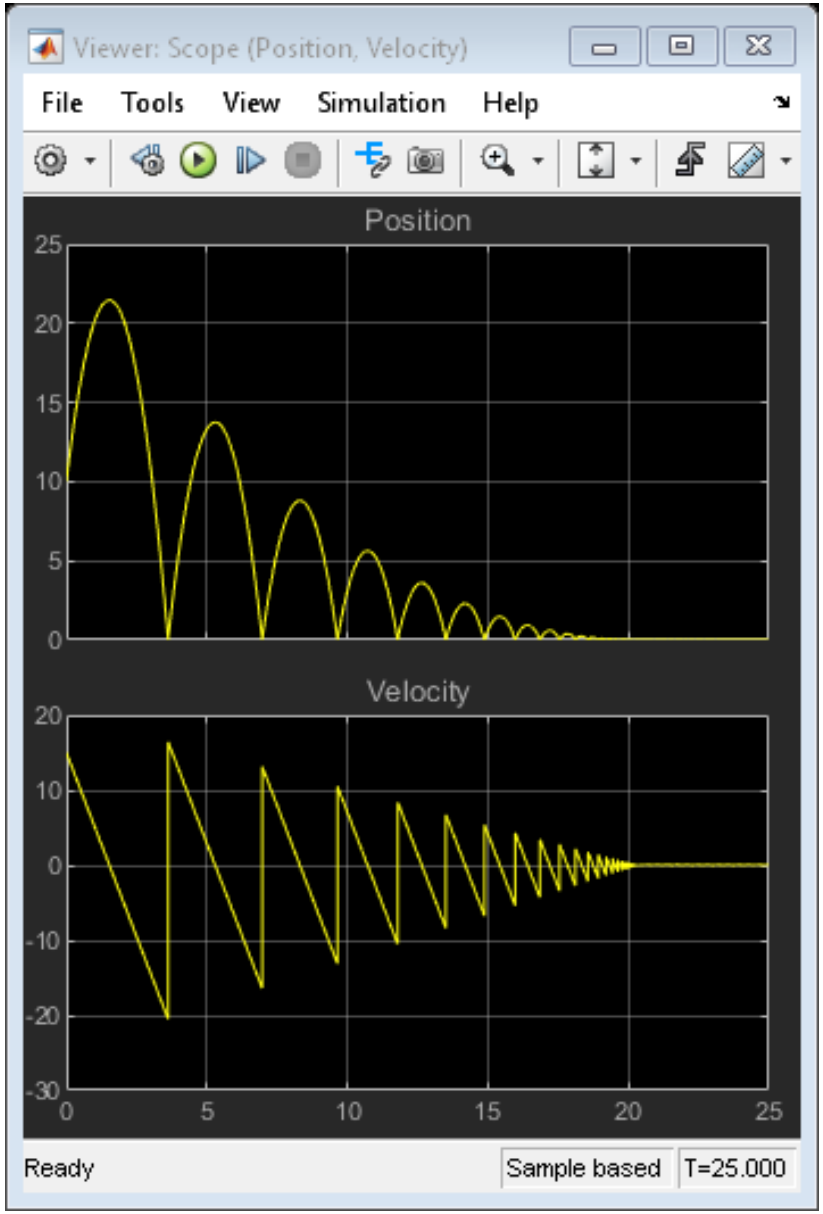
The state port of the position integrator and the corresponding comparison result is used to detect when the ball hits the ground and to reset both integrators.

Second order integrator model



Simulink model: sldemo_bounce

Output:


Viewer: Scope (Position, Velocity)
File
Tools
View
Simulation
Help
Position
25
20
15
10
5
0
Velocity
20
10
0
-10
-20
-30
0
5
10
15
20
25
Ready
Sample based
T=25.000

Tools to combine discrete and continuous simulations?

- Simulink
- Many more