“One Word: Simulink.”

Using Simulink/Matlab to Solve Ordinary Differential Equations

Jake Blanchard
University of Wisconsin
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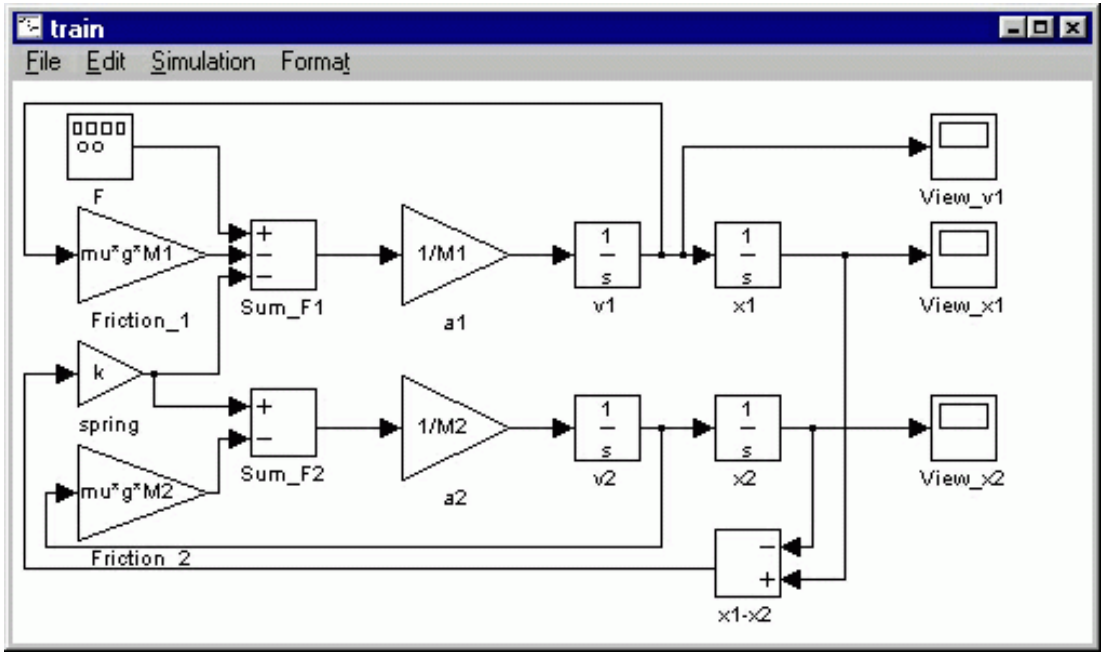
Introduction

- Matlab offers several approaches for solving initial value ordinary differential equations
- Runge-Kutta solutions are common (ode45, ode15s, etc.)
- Simulink is a Matlab add-on that allows one to simulate a variety of engineering systems
- We can use Simulink to solve any initial value ODE

Process

- Simulink offers a variety of components that are assembled graphically to provide a full system simulation



http://www.engin.umich.edu/class/ctms/simulink/model/model.htm

An Example

- Consider a model for a damped, forced oscillator

$$\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 4x = 5\cos(2t)$$

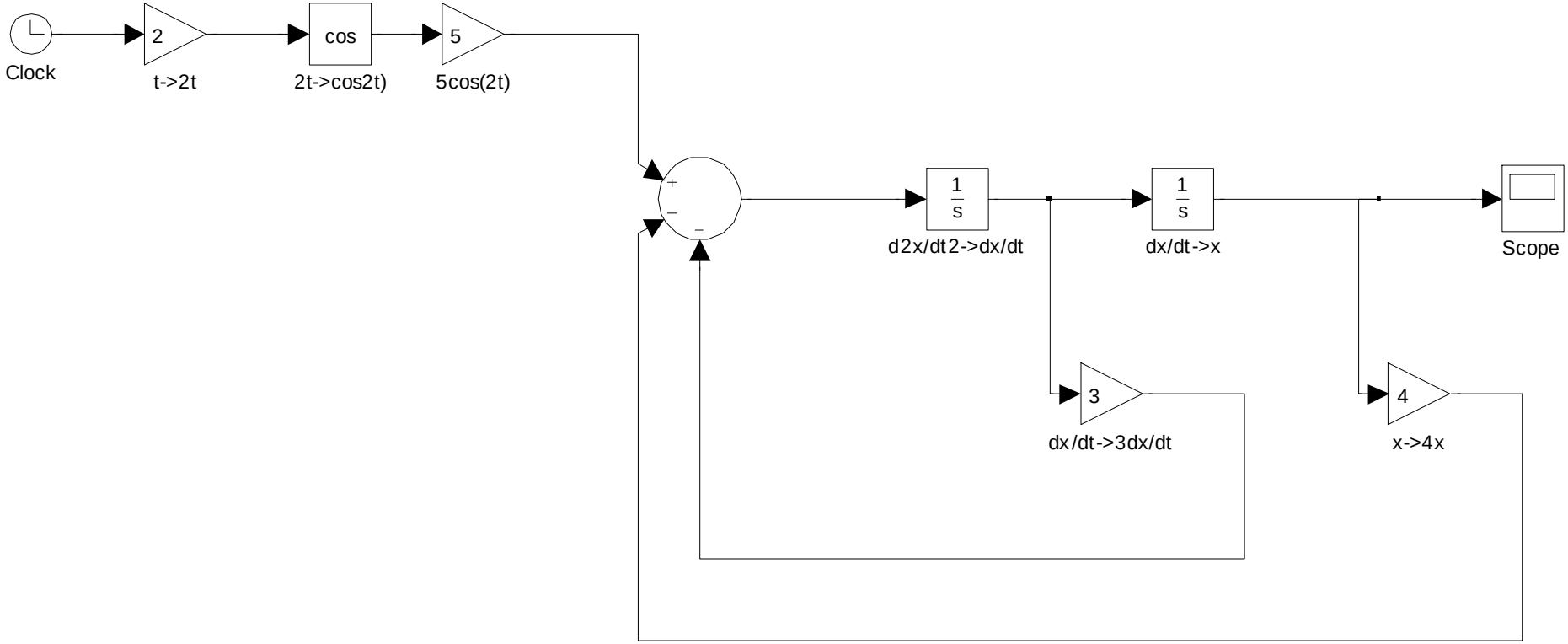
$$x(0) = 0$$

$$\frac{dx}{dt}(0) = 0$$

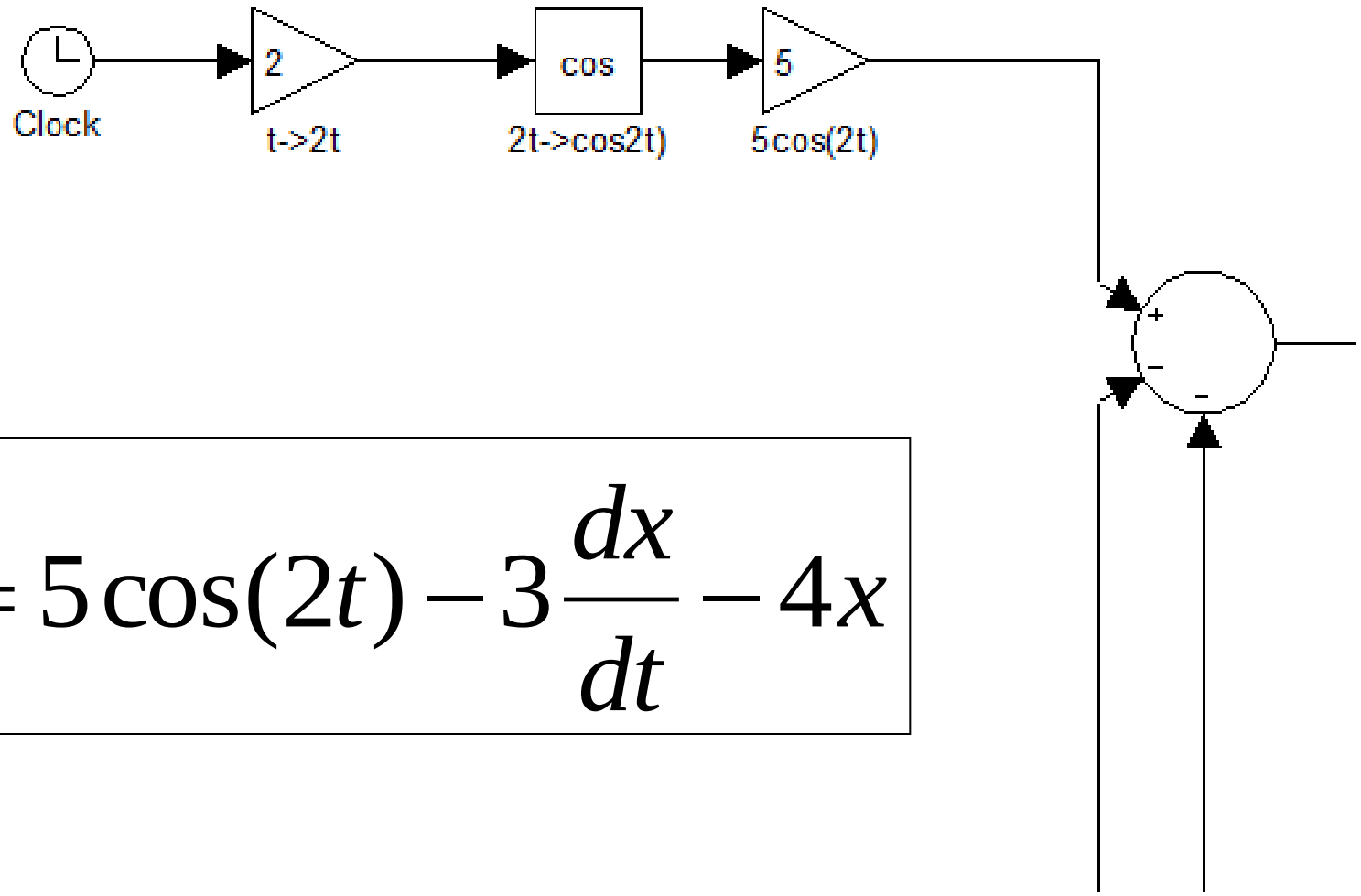
Preparation

$$\frac{d^2x}{dt^2} = 5\cos(2t) - 3\frac{dx}{dt} - 4x$$

The Simulink Model



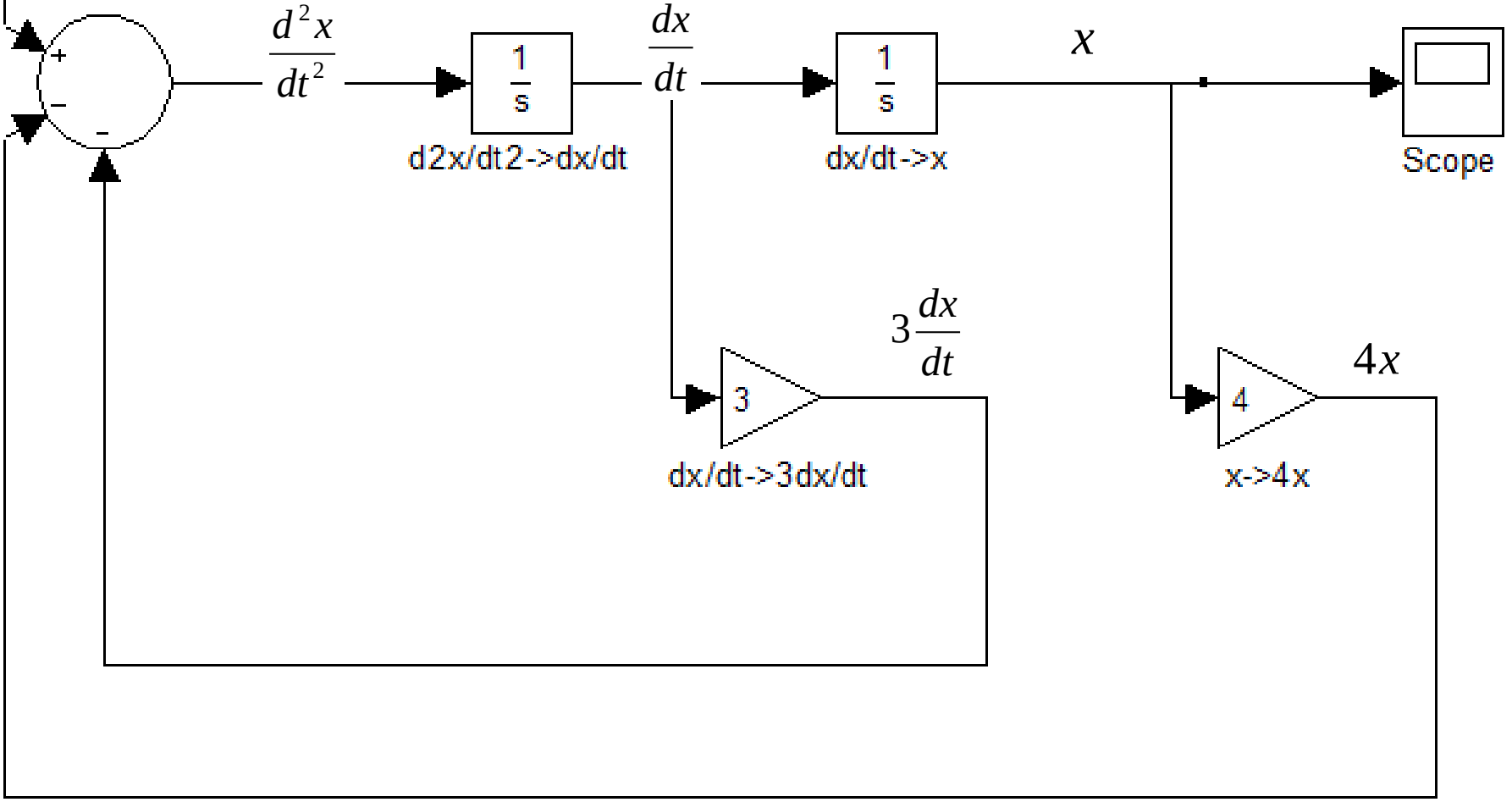
The Simulink Model



$$\frac{d^2x}{dt^2} = 5\cos(2t) - 3\frac{dx}{dt} - 4x$$

The Simulink Model

$$\frac{d^2x}{dt^2} = 5\sin(2t) - 3\frac{dx}{dt} - 4x$$



Initial Conditions

- The ICs are set in the integrator blocks
- Right click the block and open "Integrator Parameters"
- This sets value of output variable from the integrator block

Demo