Εισαγωγή στο Simulink

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Simulink Applications
Simulink

Simulink is a software package for modeling, simulating, and analyzing dynamical systems

• Block diagram editing
• Nonlinear simulation
• Hybrid (continuous and discrete) models
• Asynchronous (non-uniform sampling) simulation
• Fully integrated with MATLAB, MATLAB toolboxes and blocksets.
Simulink

- Accurately design, implement, and test:
  - Control systems
  - Signal Processing systems
  - Communications systems
  - Embedded systems
  - Physical systems
  - other Dynamical systems
Launching Simulink
Simulink Library Browser
Finding Blocks
Getting Help

- Context sensitive help
- Simulink documentation
Demo

- Working with a simple model
- Changing block parameters
- Labeling blocks and signals
- Running a simulation
- Defining parameters with MATLAB variables
- Saving/opening a model

\[ y = 4 \times \sin(t) - 10 \]
How Simulink Works

- Engine provides variable-step and fixed-step ODE solvers
- Block Diagram representation of dynamic systems
- Blocks define governing equations
- Signals are propagated between blocks over time
Simulink Solvers

- **Solver?**
  - Determines solution at current time step
  - Determines the next simulation time step

- **Solver options:**
  - Fixed-Step
    - Ode1
    - Ode2
    - Ode3
    - Ode4
    - Ode8
  - Variable-Step
    - Ode45
    - Ode23
    - Ode113
    - Ode15s
    - Ode23s
    - Ode23t
    - Ode23tb
Creating Subsystem

- Context menu → Create Subsystem
- Subsystem ports
- Inside a subsystem
Subsystems

Why?
- Reduce blocks displayed in a model window
- Keep functionally related block together
- Establish hierarchical block diagram
‘Continuous’ Library
Continuous systems: Time-Domain Representation using Integrator Block

\[ \dot{x}(t) = 3x(t) + u(t) \]
Continuous systems: Frequency-Domain Representation using Transfer Function Block

\[ \dot{x}(t) = 3x(t) + u(t) \Rightarrow \frac{X(s)}{U(s)} = \frac{1}{s - 3} \]
Demos for Continuous Systems

- Double Mass-Spring System
- Single Hydraulic Cylinder Simulation
- Thermal Model of a House
- Two Cylinder with Connecting Rod Simulation
Discrete Systems

- System that takes an input sequence of samples and outputs a sequence of samples
- Sampling

\[
\begin{align*}
y[k] &= 0.1x[k] + x[k - 1] \\
x[k + 1] &= -0.5x[k] + u[k]
\end{align*}
\]
‘Discrete’ Library
Discrete system example

- Second order FIR filter

\[ y[k] = \frac{x[k] + ax[k - 2]}{2} \]
More on Simulink

- **Simulink Tutorials:**
- **Demos and Webinars:**
- **Documentation:**