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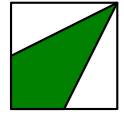
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***Low Cost Tools for Rapid Control  
Prototyping and Hardware-in-the-Loop  
Testing***

***OpenSim:ProcessMonitor***

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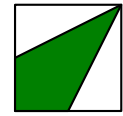
# Trends in Automotive Control System Development Practices



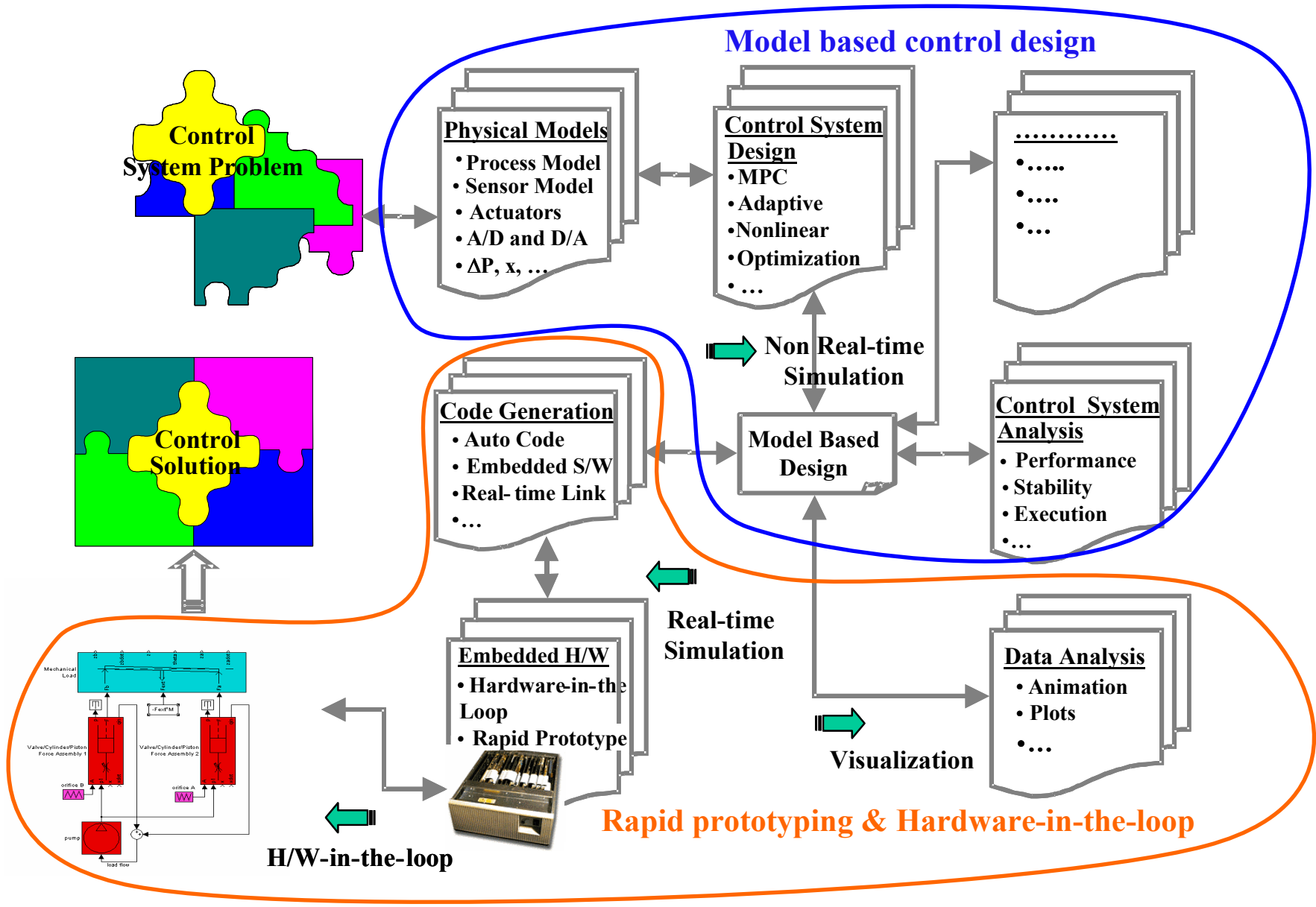
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- ➡ Tools to go rapidly and effortlessly from Off-line Simulations to Hardware-in-the-Loop (HIL) Testing and Rapid Control Prototyping (RCP) for ECU targets
- ➡ No coding (I/O drivers, Communications, etc ...)
- ➡ Low Cost, Scalable, environment using COTS components

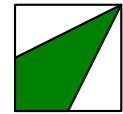
# Seamless Transition from Simulation to RCP and HIL Testing



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# Low Cost, Scalable, environment using COTS Components



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- ❖ Open-Architecture systems (PC104, EBX, etc) or ECUs directly

- ↳ Multiple Vendors

- ↳ Increased competition

- ↳ Lower prices

- ❖ “No-Frills” interfaces

- ↳ ✓ Cost less

- ↳ ✓ Easy to use

- ❖ Lower unit (per test stand) costs

- ↳ Easier to replicate setups

- ↳ Better utilization of resources

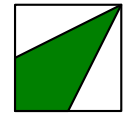
- ❖ Easily upgradeable systems minimize product obsolescence risk

- ❖ “Smarter” approaches to design – Model Based Design



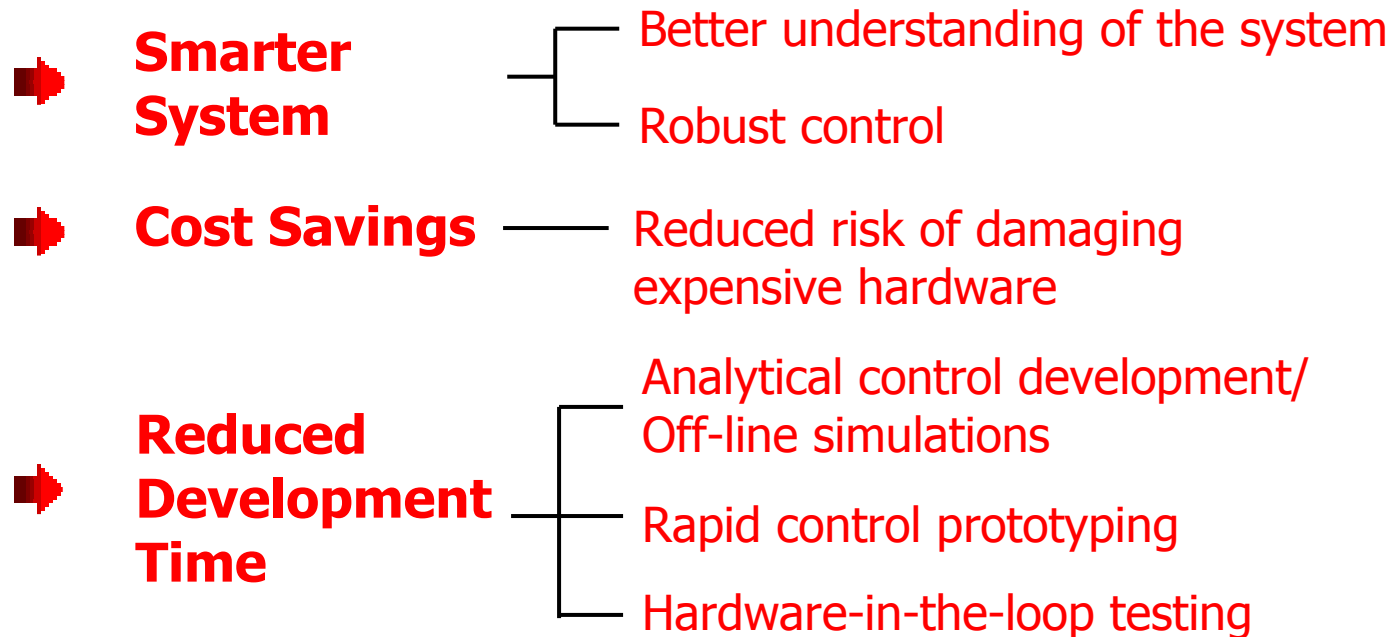
Picture courtesy [www.pc104.org](http://www.pc104.org)





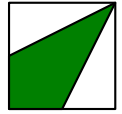
# Benefits of Model Based Control Design

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Tools - **MATLAB/Simulink/Stateflow/...**, the industry standard in physical modeling

# OpenSim:ProcessMonitor

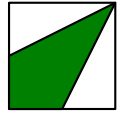


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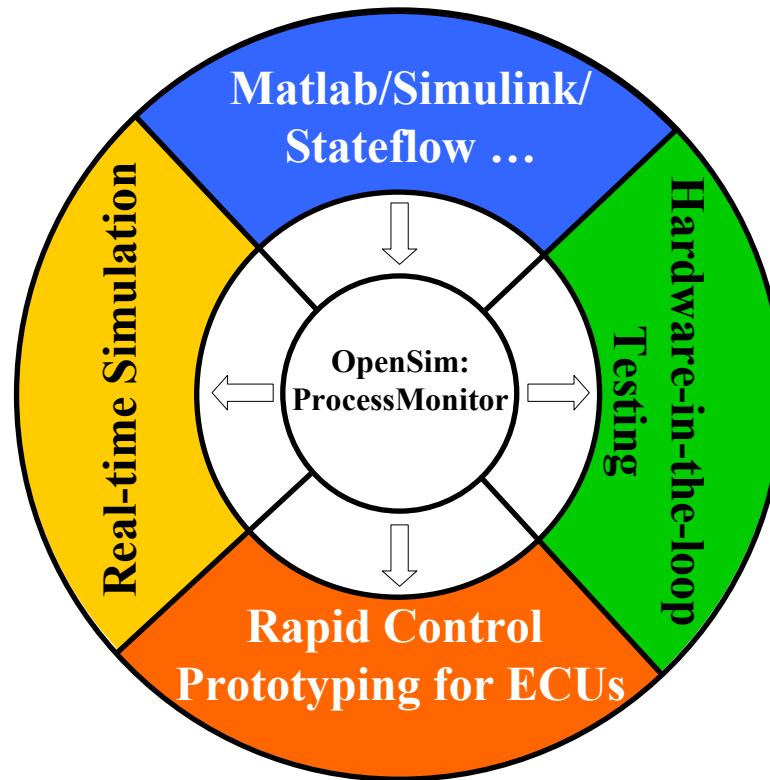
## ❑ Monitoring system developed by Pathway Technologies Inc

- Intuitive tree view of signals and parameters
- Real-time visualization and tuning for faster “in-process” development
- Data collection on the host PC for post-processing
- Control model download and target execution
- Wide variety of virtual instruments with a Drag ‘n Drop interface
- Distributed architectures available
- Can be run from a remote location

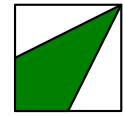
# OpenSim:ProcessMonitor



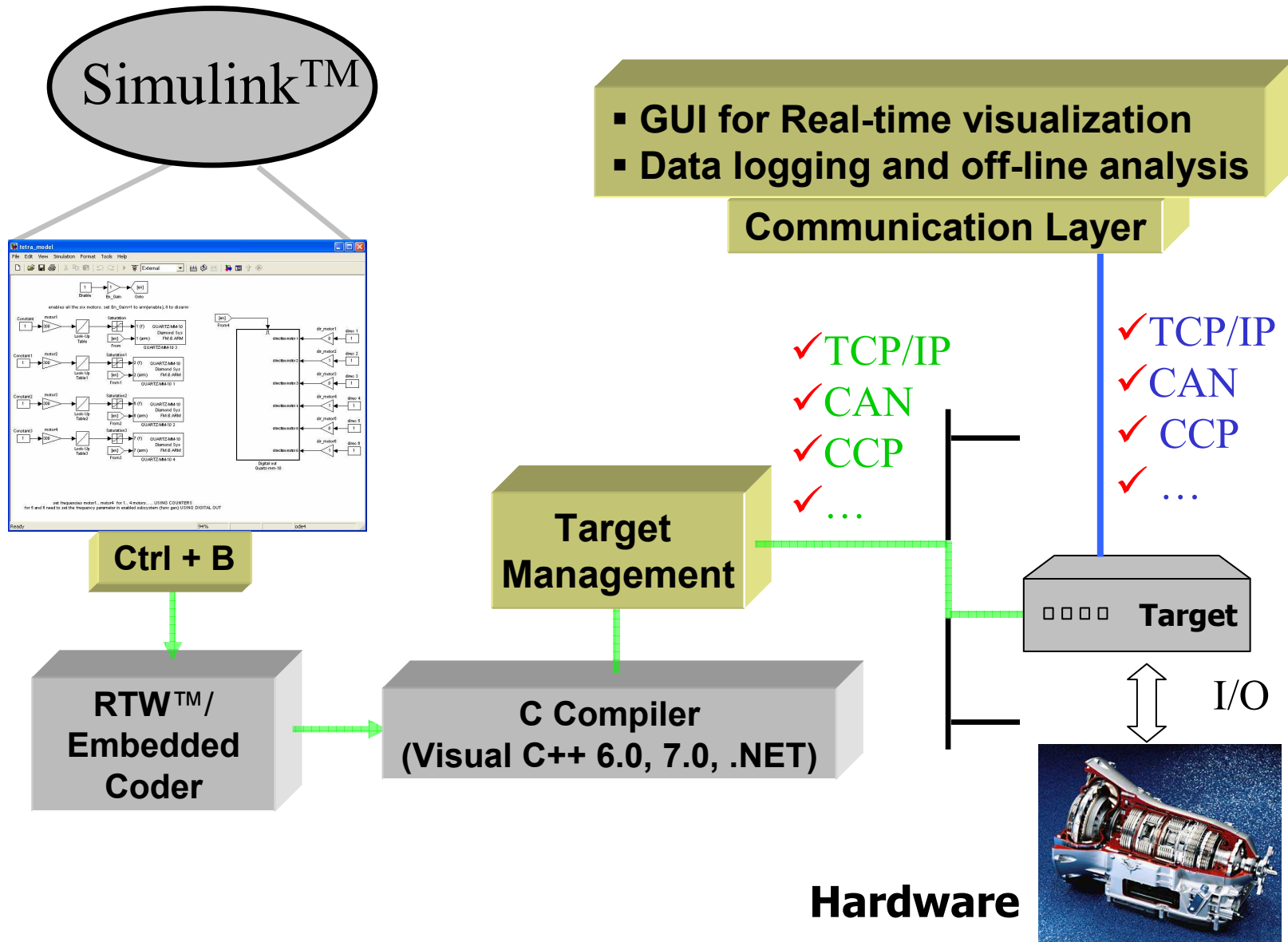
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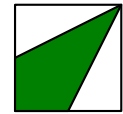
# OpenSim:ProcessMonitor Architecture



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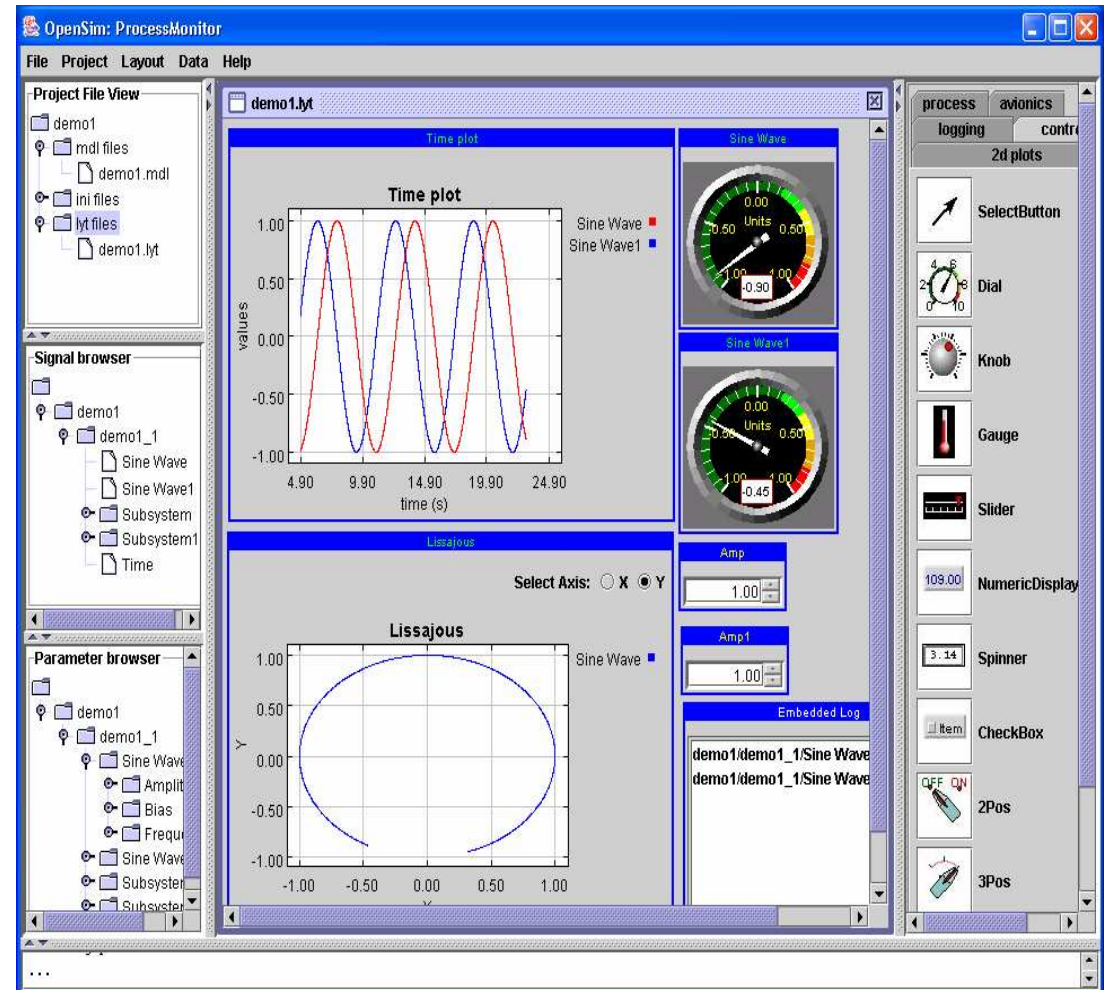


# OpenSim:ProcessMonitor GUI

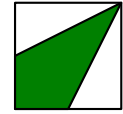


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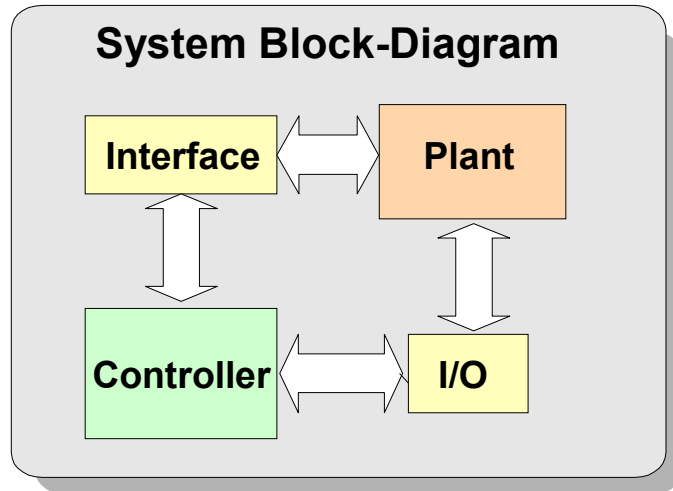
- GUI for Real-time visualization
- Data logging and off-line analysis



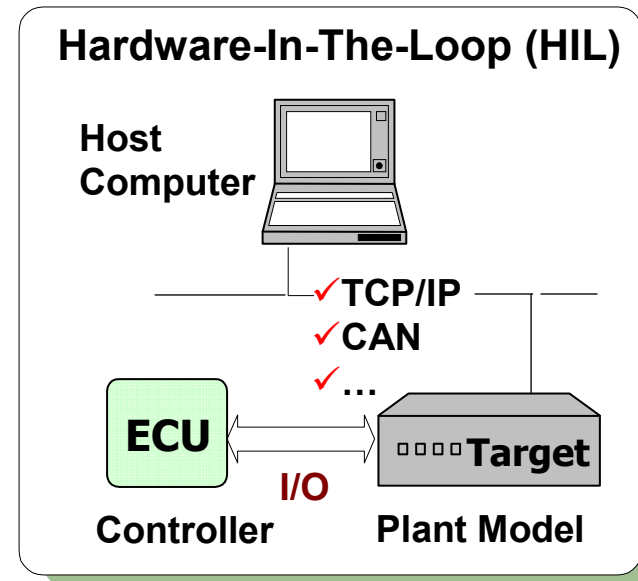
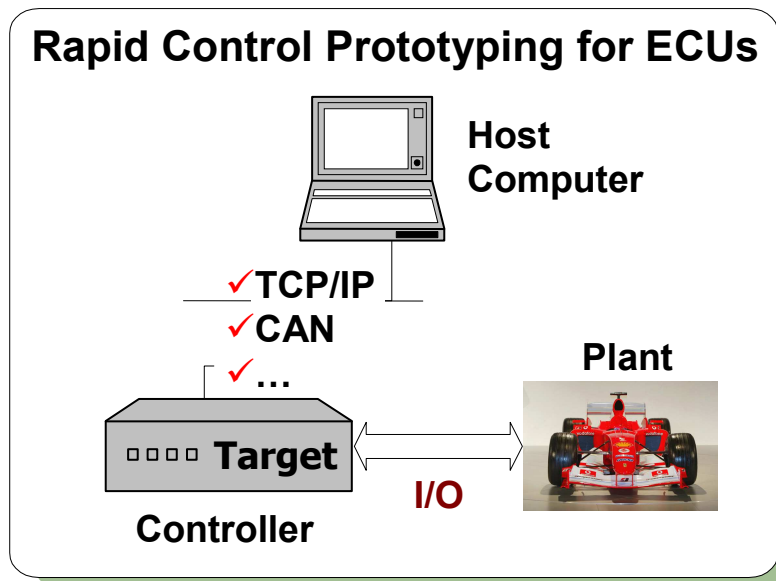
# Rapid Prototyping with OpenSim:ProcessMonitor



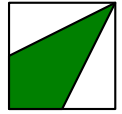
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Seamlessly move from Matlab/Simulink to Hardware platform without having to write a single line of code



# Target Support in OpenSim:ProcessMonitor

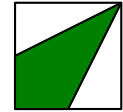


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- ✓ xPCTarget, Mathworks
- ✓ MPC555, Motorola
- ✓ MPC565, Motorola
- ✓ Custom ECU targets
- ✓ ...

# Benefits of RCP



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## Benefits

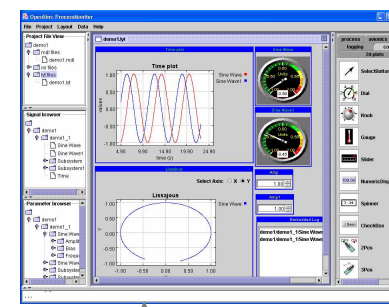
- Integrate actual hardware components in controller testing
- Automatic code generation dramatically reduces develop-test-refine cycle time
- Realistic load testing leads to finer control

## Tools

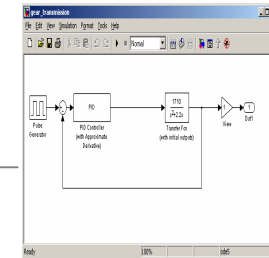
Real-time workshop/Embedded Coder for automatic code generation

xPC Target, MPC 555, MPC565, Custom ECU, etc for prototyping platform

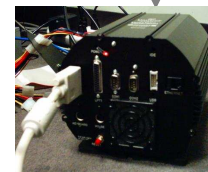
OpenSim for real-time visualization, tuning and data collection



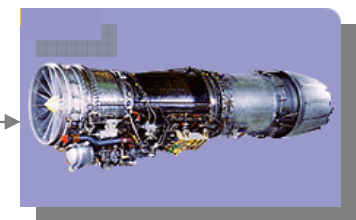
OpenSim



Real-time workshop

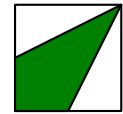


xPC Target



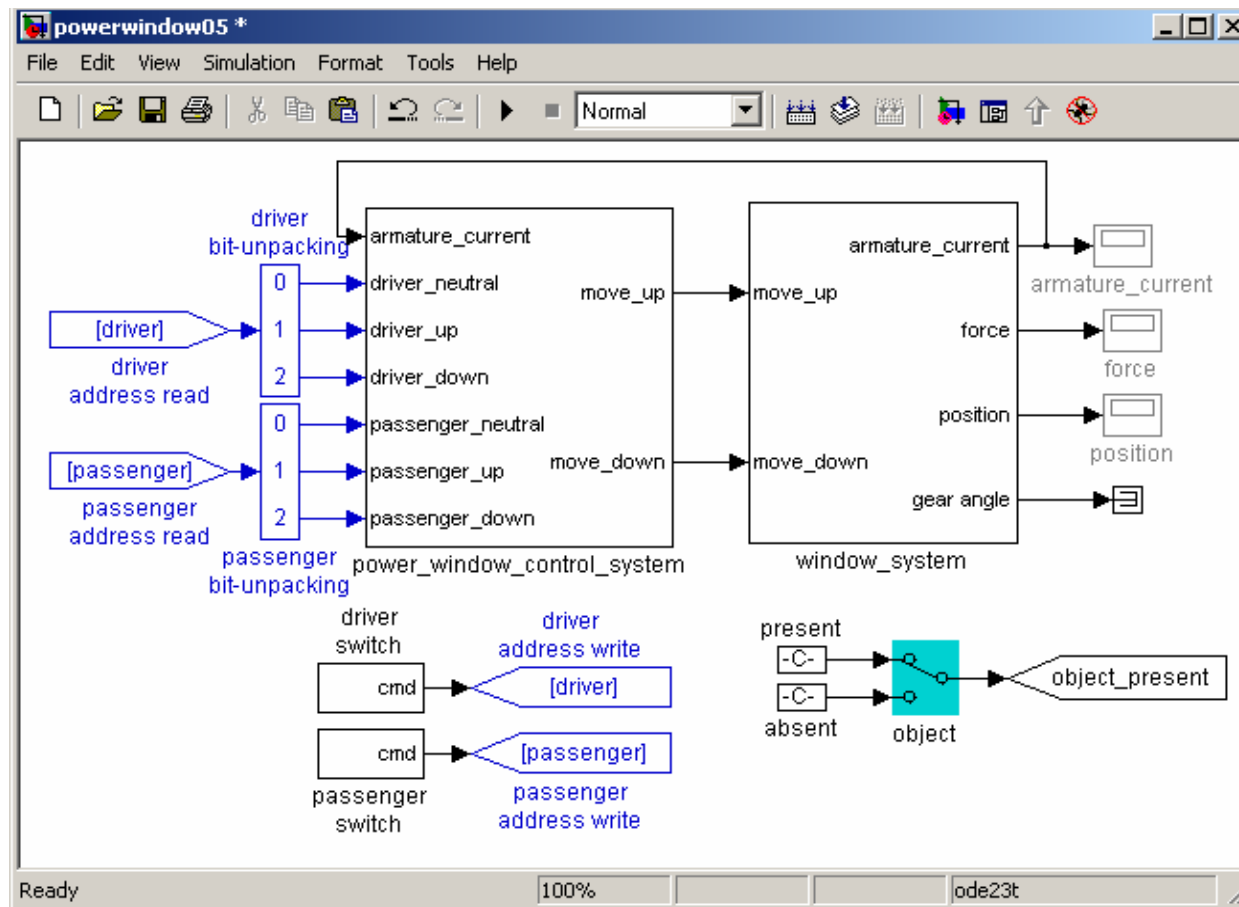
Hardware

# Six Steps to Rapid Control Prototyping with OpenSim:ProcessMonitor

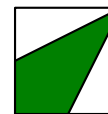


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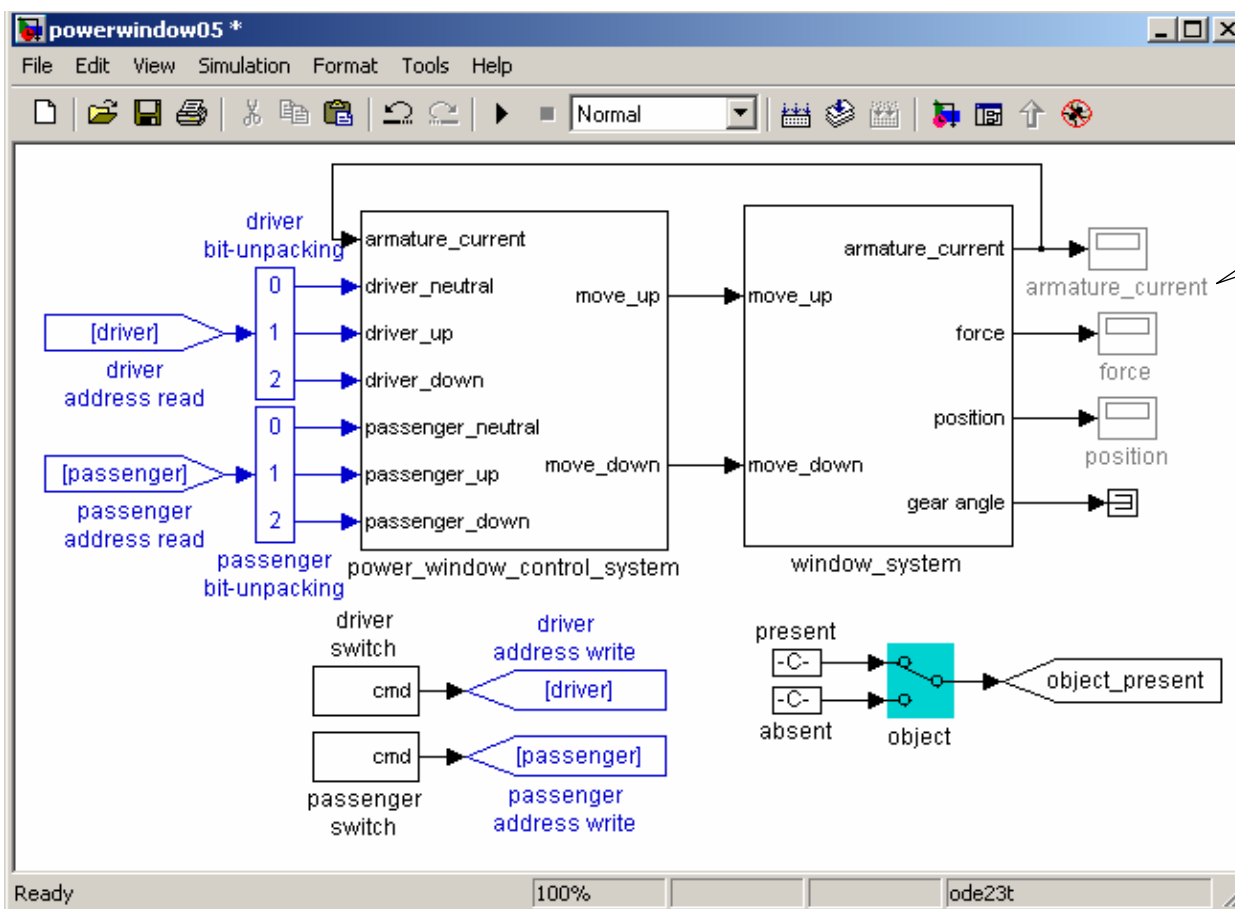
Step 1: Open your Simulink model or locate the dlm or flash file. If using a dlm file, go to Step 4 else go to Step 2.



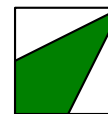
Reference: Power Window Control example from Simulink Demos, Matlab/Simulink software



# Step 2: Press 'Ctrl + B' and the target selection GUI will pop up



Reference: Power Window Control example from Simulink Demos, Matlab/Simulink software

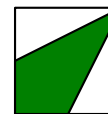


Step 3: Use the target selection GUI to select a target to build & download the code to and specify the parameters for communication between the host and the target

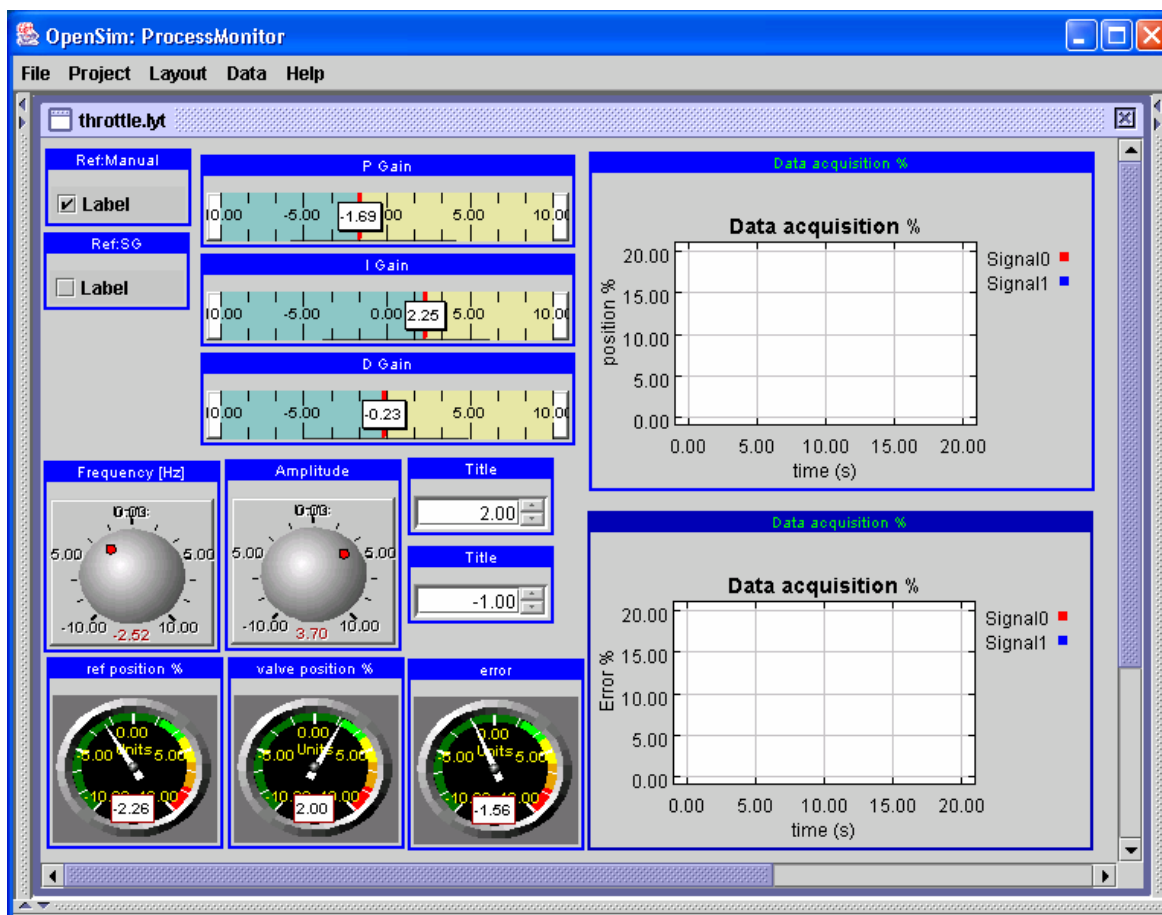
The screenshot shows a Windows-style dialog box titled "SelectTargetsParts\_sp". At the top, there are three dropdown menus: "Model" set to "sensorlabdemo", "Targets" set to "xPC Target", and "Status" set to "Target Not Selected". Below these is a section titled "xPC" containing a table of configuration parameters:

Host Target Communication	
Target IP Address	TCP IP
Target Port	10.25.26.8
Subnet Mask	22222
Gateway	255.255.255.0
Target Driver	255.255.255.255
Target Bus Type	NE2000
Target ISA Mem Port	ISA
Target ISA IRQ	0x320
xPC Proxy Computer Name	5
	Pathway_1

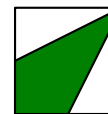
At the bottom of the dialog, there are two checked checkboxes: "Generate Messages" and "Save configuration on exit". To the right of these are four buttons: "View Partition", "Set Target", "OK", and "Cancel". The status bar at the very bottom of the window displays the word "Ready".



Step 4: Launch the monitoring GUI and prepare a custom virtual display by selecting from the library of widgets provided with OpenSim:ProcessMonitor



If using a dlm file, download model to the target by using the pulldown menu

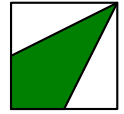


Step 5: Launch the communication layer

Step 6: Start model execution

Monitor your system, tune parameters, log data for post processing, etc

# Seminars, Training and Consulting



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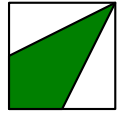
- ✓ We offer product demos, training, and free seminars at our Detroit sales office in Livonia, Michigan

## Seminar topics include

1. Rapid control prototyping with OpenSim & Matlab/Simulink
2. Rapid control prototyping for ECUs
3. Model based design of distributed embedded systems
4. Hardware-in-the-Loop Simulation and Testing with OpenSim

We also offer consulting services in the area of control system design, software development for real-time applications, ECU design and development, analytical modeling and product development

# Contact Information



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