Embedded Systems

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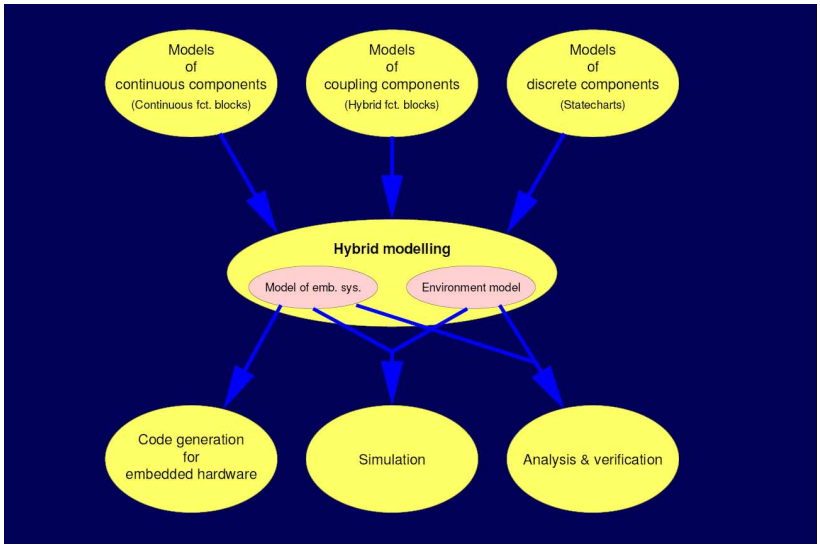
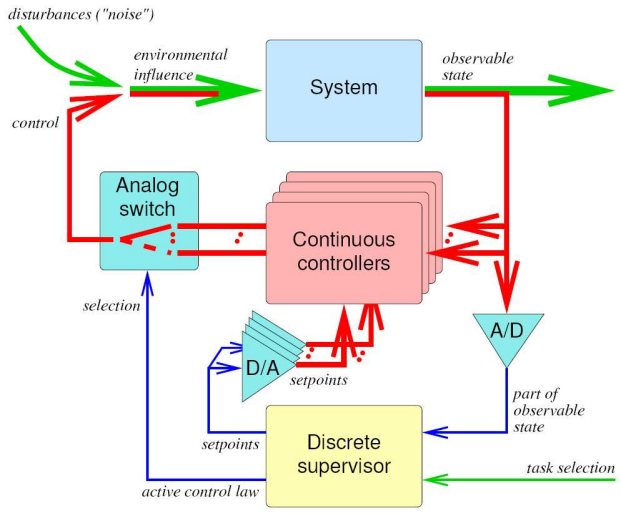
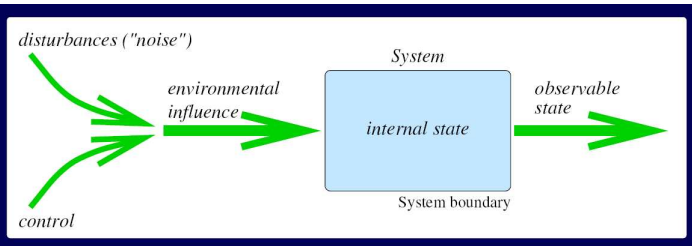
Co-Modelling of Embedded System and Environment



Mode-Switching Control

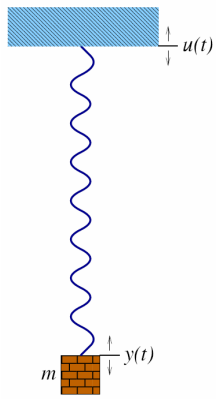


Dynamical Systems

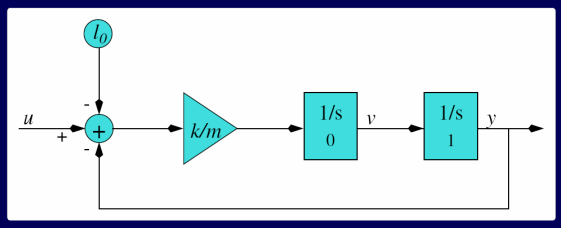


- Time is continuous: $\mathbb{R}_{\geq 0}$,
- internal state is a bunch of real-valued (or complex-valued) functions of time: $\vec{x}(.) : \mathit{Time} \rightarrow \mathbb{R}^n$,
- observable state is a time-invariant function (usually projection) thereof,
- environment influence is a bunch of real-valued (or complex-valued) functions of time: $\vec{u}(.) : \mathit{Time} \rightarrow \mathbb{R}^m$.

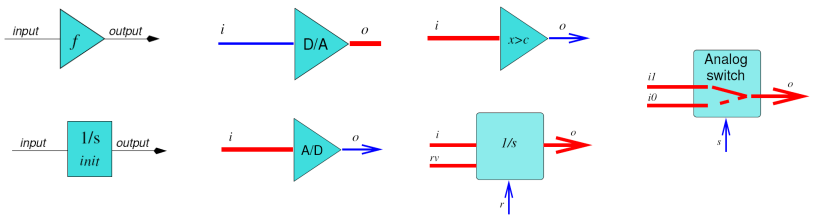
Example:
Spring-Mass System with Disturbance



- **DE:**
$$\begin{aligned} \dot{y}(t) &= v(t), & y(0) &= 1 \\ \dot{v}(t) &= \frac{k}{m}(u(t) - y(t) - l_0), & v(0) &= 0 \end{aligned}$$
- **After integration:**
$$\begin{aligned} y(t) &= 1 + \int_0^t v(z)dz \\ v(t) &= 0 + \int_0^t \frac{k}{m}(u(z) - y(z) - l_0)\,dz \end{aligned}$$
- **Functional block model:**

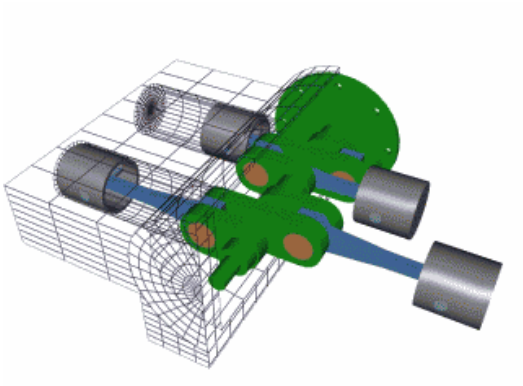


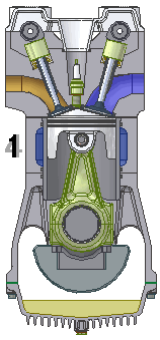
Dynamics of Networks

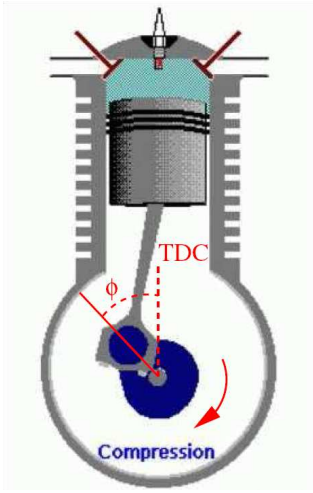


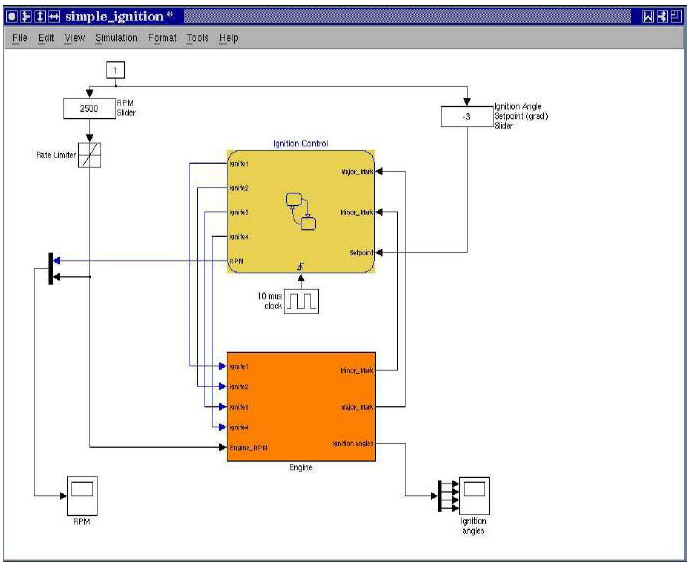
1. The individual blocks impose relations between their input and output waveforms.
2. These relations are adequately covered by the aforementioned characteristic equations of the various basic blocks.
3. Consequently, the dynamics of a network of basic blocks coincides to (solutions of) the conjunction of the characteristic equations of the entailed blocks.

Project: Ignition Controller








simple_ignition
File Edit View Simulation Format Tools Help
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2500
RPM Slider
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Ignition Angle Setpoint (grad) Slider
Rate Limiter
Ignition Control
rpm1
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rpm3
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RPM
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Minor_Mark
Setpoint
10 ms clock
Minor_Mark
Major_Mark
Ignition Angle
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Engine
RPM
Ignition angles