Model-Based Design in der Lehre

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Model-Based Design
Project-Based Learning

- Project Objectives
- Structure the Project
- Apply the acquired Knowledge
- Implement the Solution
- Test the Solution on a real H/W
- Document Work and Results
- Correction and get the Grade
Project Objectives
Structure the Project

1. Project Objectives
2. Structure the Project
3. Apply the acquired Knowledge
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6. Document Work and Results
7. Correction and get the Grade
Modeling: Algorithmic Solution

- Implement Fundamental Principles
- Explore Full Range of Motion
- Ask ( & Answer ) “What if …?”

MuPAD

Figure 6.1: Orientation for the Slotted Link v. Time

Figure 5.2: Angular Velocity v. Orientation for the Slotted Link
Modeling: Component-Based

Inverted Pendulum on a Sliding Base

See File > Model Properties > Callbacks > PlotOutFcn for definition of parameters.
Modeling: Multi-Disciplinary Breadth

- Electromechanical System
- Control Design
- Control Implementation

Group 1

Signal Builder

PID Controller

Group 1

Signal 1

PID(s)

DC Motor

Inverted Pendulum

Scope

Resistor
Inductor

Rotational Electromechanical Converter

Motor Inertia

Shaft

Friction

Housing

1 V+

2

3

4 V−
Controller Design

- Electromechanical System
- Control Design
- Control Implementation
Test the Implementation
Low Cost Hardware Connectivity

- Run models on low cost hardware
- Avoid writing driver blocks
- Avoid installation issues
- Deploy smoothly
>> targetinstaller
Team Collaboration with Simulink Projects
Automatically Run Tests And Document Results

- Design Change
- Test
- Document
- Evaluate Results

HEV Model

Simulation 1

Simulation 2

Plots and Results

Screenshots

C and MATLAB Code

HEV Test Report

Chapter 1. System Level

1. Drive Cycle 1

Figure 1.1. Speeds From Drive Cycle 1

- Pass
- Fail

MATLAB EXPO 2013
RWTH Aachen University Prepares Students for Careers in Industry

Challenge
Prepare students to enter industry with practical engineering skills

Solution
Integrate MathWorks tools into engineering curricula and enable access campus-wide

Results
- Students equipped to meet industry needs
- Increased flexibility for students and faculty
- Research efforts accelerated

“MathWorks tools enable us to extend the range of topics that we can introduce. It would not be possible to teach modern control systems and theory if our students did not have access to tools like MATLAB and Simulink to complete exercises.”

Dr. Dirk Abel
RWTH Aachen University
Student Version
R2013a

- MATLAB
- Simulink
- 10 add-on products
  - Control System Toolbox
  - Signal Processing Toolbox
  - DSP System Toolbox
  - Statistics Toolbox
  - Optimization Toolbox
  - Image Processing Toolbox
  - Symbolic Math Toolbox
  - Simulink Control Design
  - Data Acquisition Toolbox
  - Instrumentation Control Toolbox

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