Collaborative Modelling and Co-simulation

Tools and Techniques for Designing Embedded Systems

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Programme

1. Introduction
2. Co-modelling and co-simulation

Break

3. Real-time control and 20-sim
   Tool installation and 20-sim practical

Lunch

4. VDM-RT for Co-simulation
   Co-modelling practical

Break

5. Industrial Applications and Cyber-Physical Systems
   Round-up Discussion

Introduction

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Background

- Computers become smaller, more capable, ubiquitous
- ~6.8 billion mobile phone accounts
- Look at automobiles:
  - 80 processors & >100M LOC in a high-end vehicle
  - Recall costs immense
    - Toyota's 2010 recall of 430,000 vehicles because of hybrid braking system software
    - Brand loyalty: 55% → 39% if you experience 3+ problems

80s

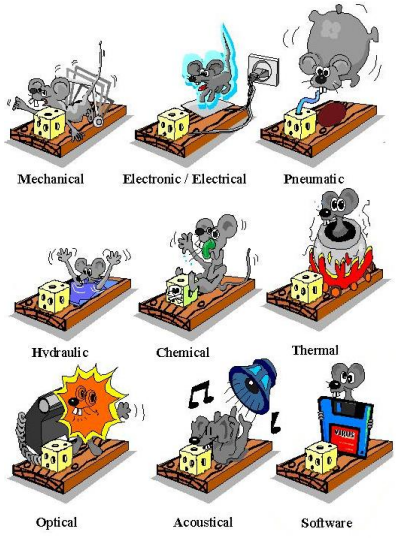
90s

00s

10s

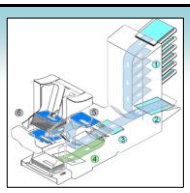
Background

Background



- Problem decomposition into disciplines
- Concurrent engineering required to improve time to market
- … but important properties are multidisciplinary
- … and so weaknesses are exposed late (integration)
- So: how to cross the boundaries between disciplines?

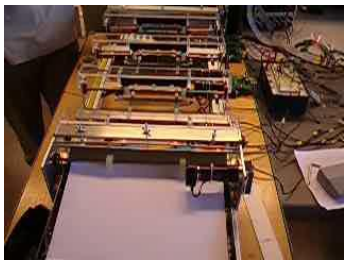
Background: Co-modelling



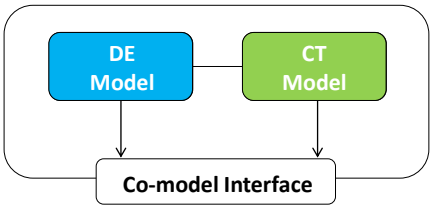
Software:
- Discrete
- Complex logic

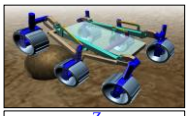
Mind the Gap!

Physics:
- Continuous
- Numerical

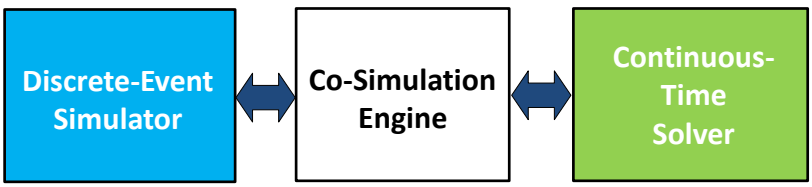


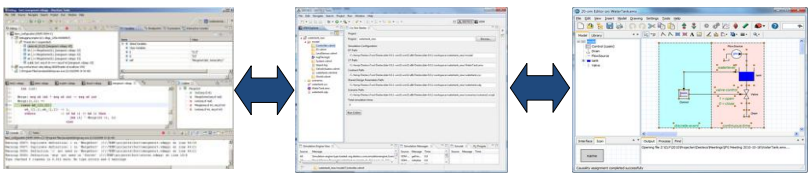
Co-model



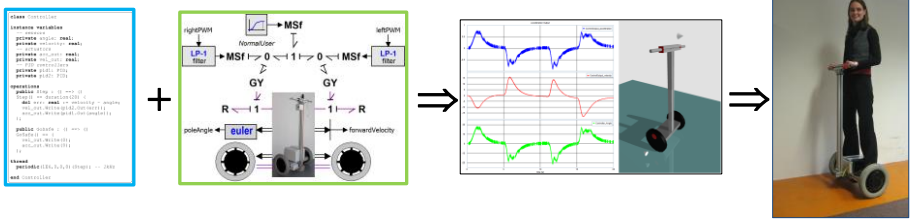


Background: Co-simulation

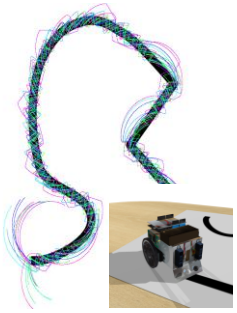




Co-model Support



- Products: tools (Crescendo) method guidelines (notably fault modelling)
- Automated Co-model Analysis (sweeps, ranking)
- Reduced design iteration/cost in transport, machine design, high-speed paper processing and baggage handling!



DESTECS: Design Support and Tools for Embedded Control Systems

EU FP7 INFSO-ICT-248134 (Jan 2010 – Dec 2012)

Océ	Dutch Space	Vestas
Airbus	ESA	Grundfos
Nokia	FKI Logistex	Volvo
Siemens	Darwind	Bang & Olufsen
Martin Group	ASML	MBDA
Atlas Copco	Assembleon	Terma

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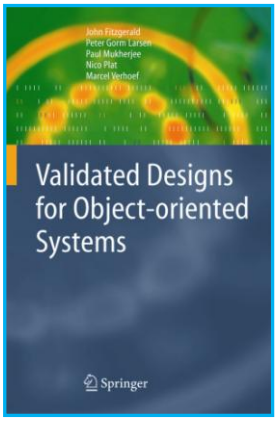
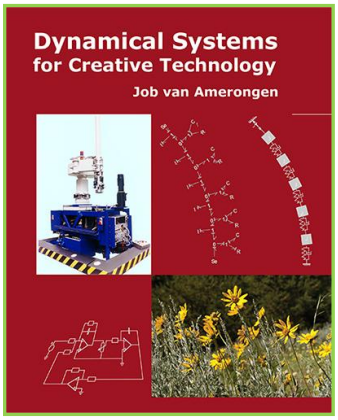
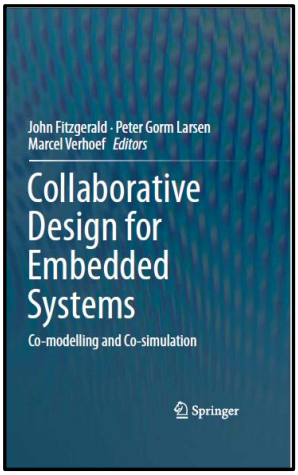
Reference Books



Baseline Discrete Event Modelling



Baseline Continuous Time Modelling



Co-Modelling