Introduction

More and more complex electronics and software:
- To enable innovation
- To decrease costs
- To fulfill legal needs (e.g. CO2 emission) etc.

How to ensure consistency among different views?
ISO/IEC/IEEE 42010 Conceptual Model of an Architecture Description

Architecture description language (ADL)
Architecture framework
Architecture Framework for Automotive Systems (AFAS)

**Stakeholders**
- Functional architect
- E/E architect
- System engineer
- Requirements engineer
- System integrator
- Software engineer
- Tester

**Concerns**
- Drivability
- Performance
- Dependability
- Safety
- Traceability
- Consistency
- Testability

**Viewpoints**
- Usability
- Operational
- Functional
- Software
- Hardware
- Deployment

**Views**
- Use case view
- Feature
- Functional view
- Software
- Hardware
- Topology
- Allocation
- Timing

**Model Kinds**
- Feature
- Structural
- Behavioral
- Mapping
Architectural correspondence
Correspondence Rules

(a) Absence

\[ \text{absence}_{rel_i} (A, B) \iff rel_i^+ (A, B) \land \neg rel_i^+ (A, B) \]

(b) Divergence

\[ \text{divergence}_{rel_i} (A, B) \iff \neg rel_i^+ (A, B) \land rel_i^+ (A, B) \]
Semantic differences between dependency and composition refinements
Consistency Semantics
Evaluation

- Adaptive Cruise Control
Consistency checking tool

A consistency-checking for automotive architectural models:
Evaluation on Adaptive Cruise Control
ACC system model

- ACC is split into:
  - ACC_UI (SW)
  - ACC_Controller (HW)
- SW-model is made in IBM Rhapsody
- HW-model is made in Matlab Simulink
ACC hardware models

- 3 Hardware models
  - Radar model
  - Powertrain model
  - ACC model
- Hardware models are unit tested in Matlab
System integration

- Software
- Hardware
Evaluation

Test interface (windows PC)

Serial interface

Freescale board
Conclusion and Future work

• Automotive Architectural Views defined
• Automotive architecture consistency rules defined
  IBM Rhapsody tool plugin developed
• Need to formalize other correspondence rules
• Need to support consistency between automotive
  ADLs (e.g. between SysML and MATLAB/Simulink, Stateflow)
Input/Output ports of a SimulinkBlock is updated after importing both updated Simulink model and the newly generated code (only updated Simulink MDL file is not enough).
Contact for comments and collaboration:

**Tel:** +31(0)402475052  
**Email:** y.dajsuren@tue.nl  
**Address:**  
Eindhoven University of Technology  
5612 AZ Eindhoven, The Netherlands