Center for Embedded Systems
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On the Verification of Formal Methods for Digital Embedded Control Systems

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Project Overview

Modelling and checking of specifications and requirements

(i) specifications and requirements are constantly being changed/refined at least in the initial design phases;

(ii) conflicts/incompatibilities in the design can be found at an earlier stage;

(iii) reliability, performance and quality assurance standards are maintained throughout the design development

Problem

Amount of requirements can be huge.

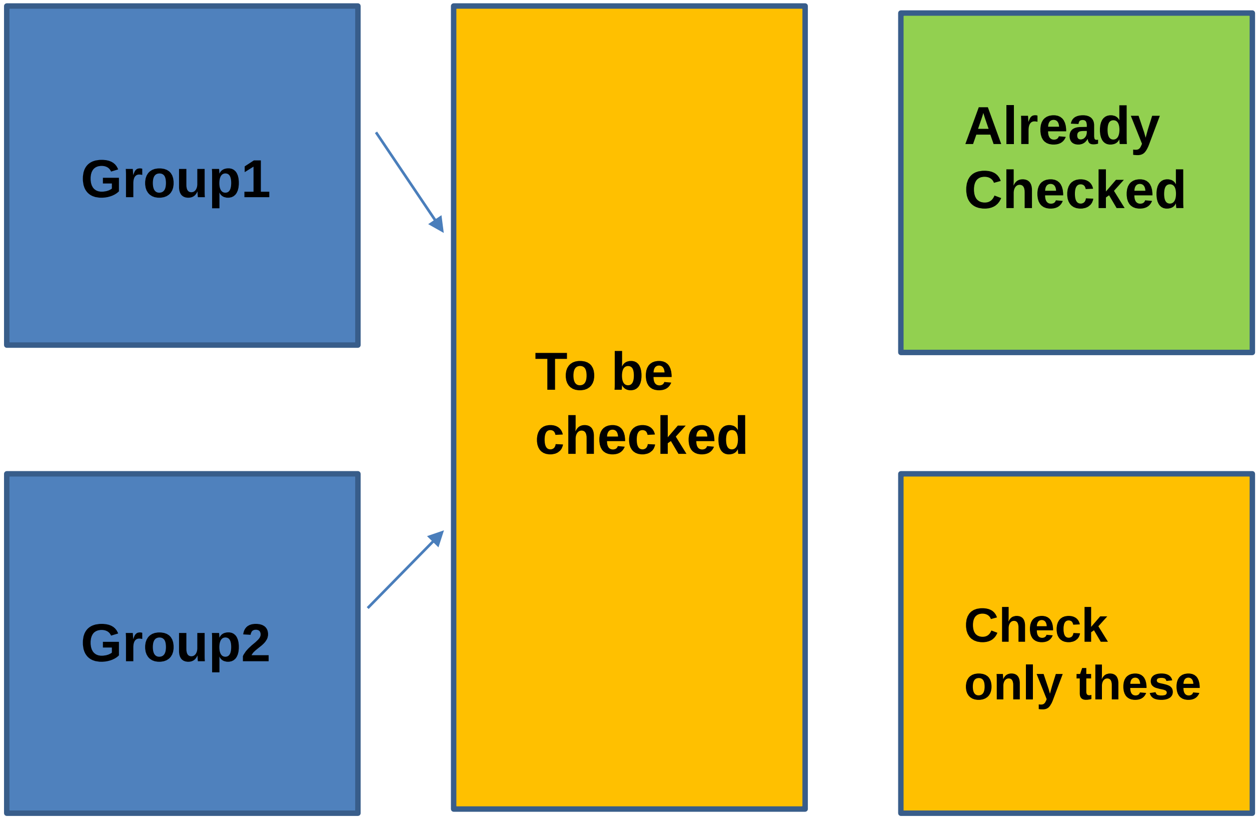
How to cope with the capabilities of existing solvers/checkers.

Approach

- Start from formal specification of requirements of a digital embedded control system (such as VDM, Z, SPARK)
- Investigate Existing Theorem Provers/Solvers/Checkers
- Develop procedures to make consistency check more scalable.
- Check the scalability on industrial case studies (avionics, automotive applications).

Approach

Incremental Verification/Consistency Check



Group1

Group2

To be checked

Already Checked

Check only these

Novelty

- Novelty

Formal design verification/consistency check is not well studied in terms of scalability.

This project will provide methodologies and results on specific industrial cases.

Project Tasks/ Deliverables

	Description	Date	Status
1	Exploration of the capabilities of existing theorem provers/ solvers that can work in conjunction with Formal Methods.	Q1	Not yet started
2	(Same as 1)	Q2	Not yet started
3	Development of scalable procedures.	Q3	Not yet started
4	Extensive experimentation for scalability analysis.	Q4	Not yet started

Deliverables:

- **Methodology for automatic verification/validation/consistency check of a large amount of formal requirements.**
- **Application of the approach on industrial case studies.**

Theorem Provers/SMT solvers

- ABsolver
- Prover9 / Mace4
- MathSAT
- Alt-Ergo
- SNARK
- PVS
- TPS
- Vampire
- E
- veriT
- Z3

Example

- Reaction1(A,B: SensorVal)

  post ((A >100) & (B <= 10))

- Reaction2(A,B,C: SensorVal)

  post (((A >100) | (B>2) | (C>10)) & ~ Reaction1(A,B))

- Reaction3(A,B: SensorVal)

  post ((A >150) & (B>4) & (B<=8))

- Reaction4(A,B,C: SensorVal)

  post ((C>10) &(~(A>100) | ~(B>2)))

- **Reaction3 incompatible with 1 and 2**
- **Reaction4 compatible with 1 and 2**

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