

# On the Gap between Schedulability Tests and Automotive Task Model

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## Automotive Applications

- Increasing Complexity
- Limited Resources
- Timing Constraints
- Safety Requirements

## Timing Verification in automotive software design

- Performed Late after the implementation
- Addressed by means of measuring & testing
- No formal / systematic analysis
- No methodological support



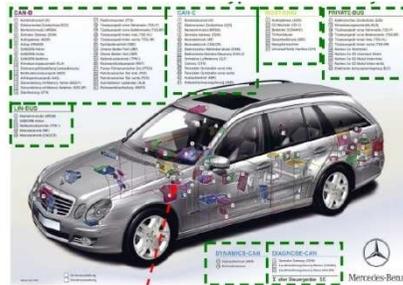
- Design mistakes detected late
  - High design cost
  - Long time-to-market

Necessity to integrate timing verification in the automotive development process

- Part of a study to define a methodological framework for a model-based scheduling analysis process for automotive applications
  - **Q.1:** how well scheduling analysis can be used as a verification technique for automotive applications.(tests and tools evaluation)
  - **Q.2:** how to integrate scheduling analysis in the model based development process ? (when/how?, confidence level, refinement,...)
  
- Paper work (Q.1): study the adequacy of available schedulability tests for automotive task model

# Automotive Task Model Characterization

## Automotive Task Model



### Dependant tasks

Use of shared resources, task chaining

### Arbitrary deadlines

Deadlines may be less, equal or greater than task periods

### Heterogeneous recurrences

Time-triggered vs. event-triggered  
Timing vs. engine-synchronous tasks

### Offset/Variable offsets

Task offsets can be static or vary with engine speed

### Changing execution profile

Tasks activated/deactivated according to engine speed

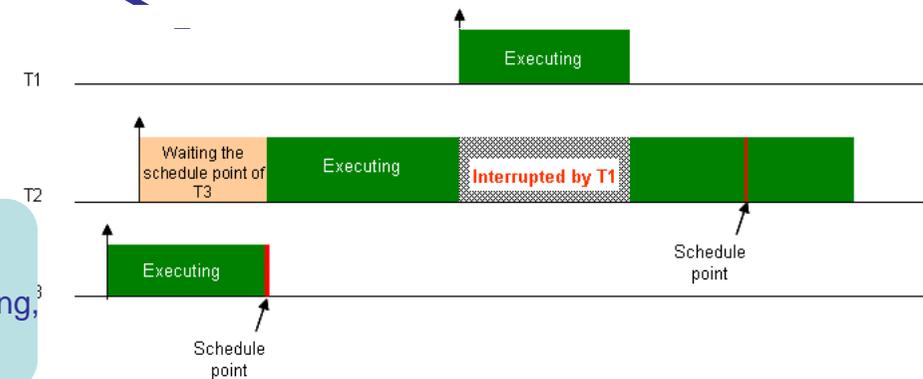
### Preemptive vs. cooperative tasks

### Self-suspending tasks

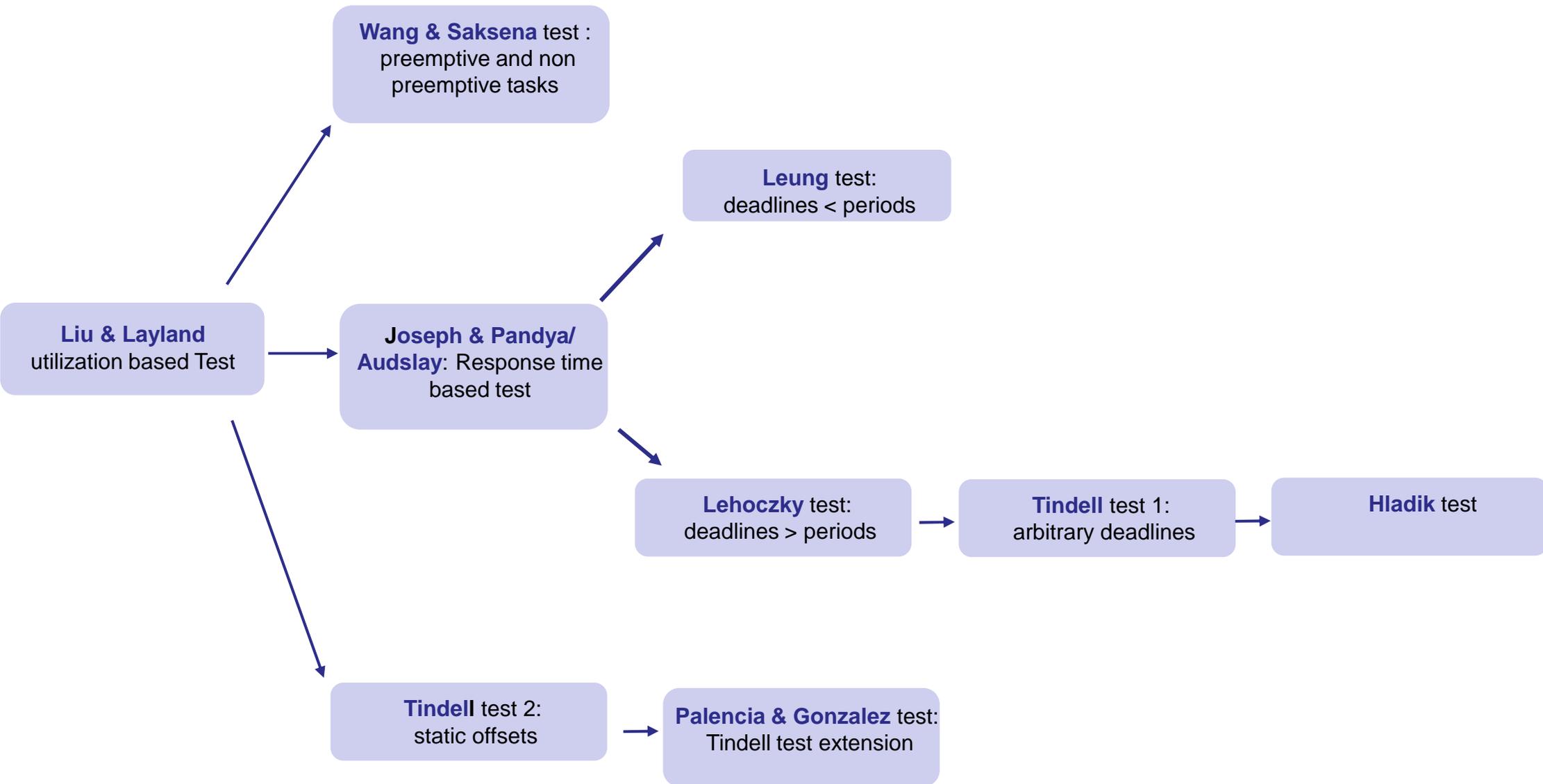
Task suspension to wait for events

### System overheads

Task activation/termination, scheduling, resource locking/unlocking



# Fixed Priority Schedulability Tests Overview





- ❑ Cooperative tasks can be covered using the Wang and Saksena technique for non-preemptive tasks: preemption threshold concept brought at task section level
- ❑ Self suspending tasks can be covered using the notion of transaction defined by Tindell
- ❑ The Hladik test covers the most needed features except the variable periods and variable execution times → Possibility to define a new test based on the extension of this one
- ❑ Possibility to use the “probabilistic” test for tasks having variable periods that is defined by Burns,

- ❑ We characterized the features that should be satisfied by schedulability tests to enable scheduling analysis for automotive applications
- ❑ We evaluated a set of schedulability tests against these features
- ❑ There is need to combine some of these test to cover all automotive features