Robust Driver Model for Vehicle Dynamic Simulations

2nd EUROPEAN HyperWorks Technology Conference

K plus Kompetenzzentrenprogramm

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Ein Kompetenzzentrum der
Graz University of Technology

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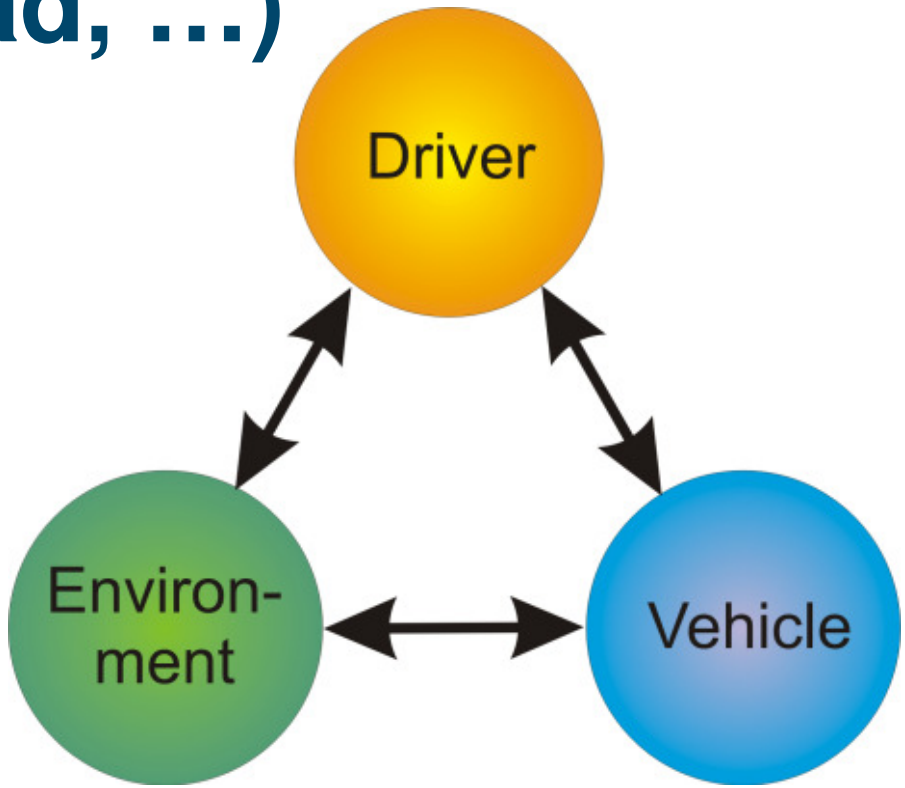
autosim
PROJECT PARTNER

Simulation of Vehicle Dynamics

- Vehicle
- Environment (Road, …)
- Driver



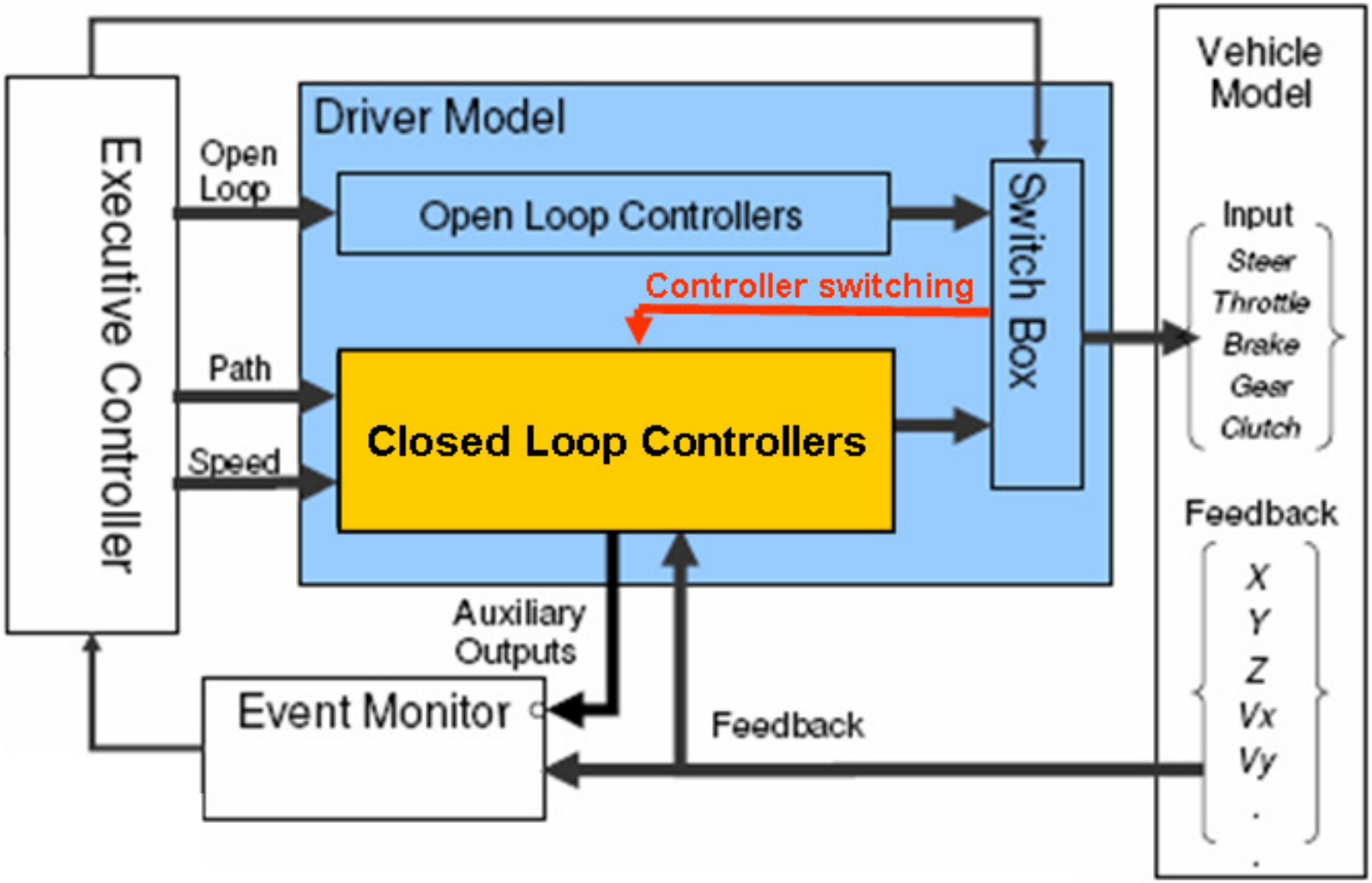
Different challenges

- Chassis
- Engine and drivetrain
- Advanced driver assistance systems
- Investigations of distraction of the driver
- …

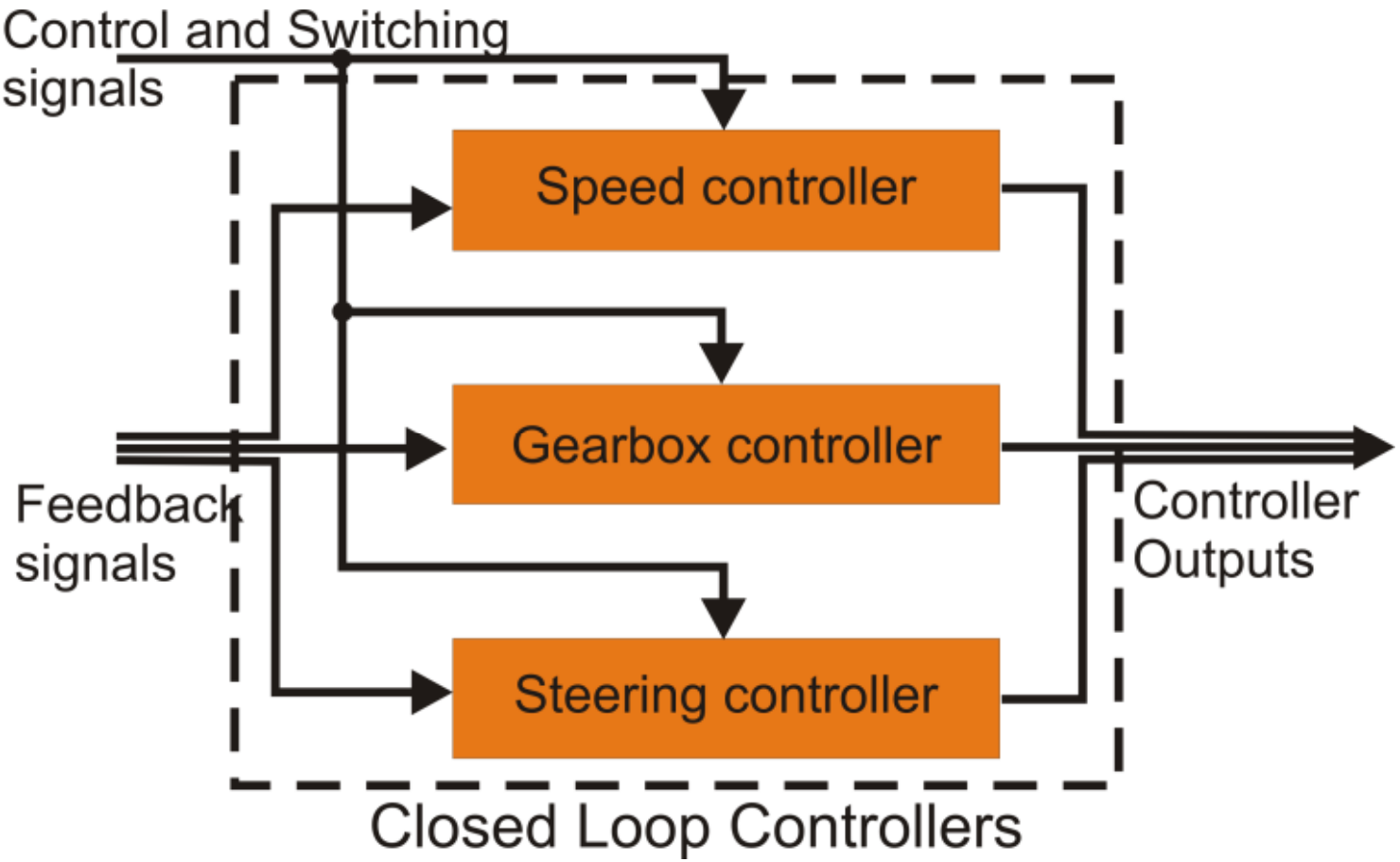
Different models

- Open and Closed Loop
- Lateral – Longitudinal
- Driving Styles
- Traffic
- Human behavior
- …

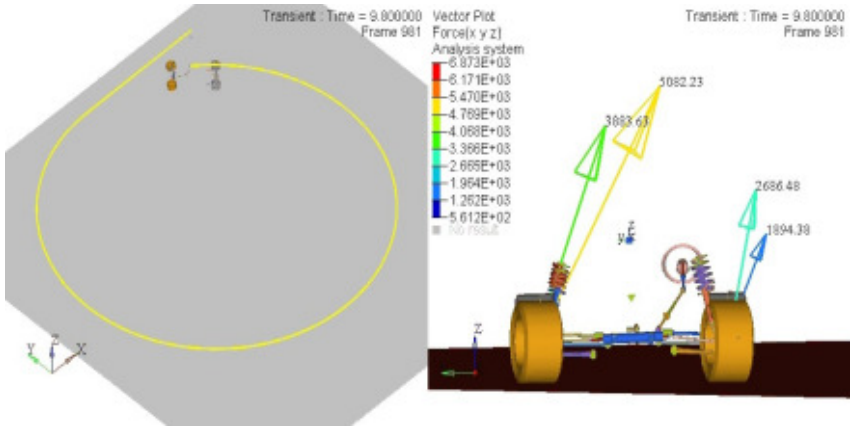
Environment



Structure


Control and Switching signals
Speed controller
Gearbox controller
Steering controller
Feedback signals
Controller Outputs
Closed Loop Controllers

- Define Use Cases
- Derive Requirements
- Define Architecture of the driver
- Develop Driver
- Prototype Implementation in MotionSolve



- **Basic Use Cases**
  - Straight-line acceleration
  - Steady-state circular driving
  - ...
- **Advanced Use Cases**
  - Starting from a stand-still
  - Three point turn
  - Driving over rough road

Phase 1 – Initialization

The vehicle is driven with a given pedal and steering angle in a steady-state condition. After 10 seconds this phase ends. The pedal and steering angle are chosen to meet the path and speed of the second phase.

Steering controller: open loop control

Speed controller: open loop control

End condition: duration(time) 10s

Phase 2 –Taking control

The driver must take control over the vehicle already moving in steady-state condition with out disturbing the steady-state condition.

Steering controller: path

Speed controller: velocity

End condition: duration(time) 10s

Phase 3 - Braking

The driver controls the vehicle on the defined circle and brakes the vehicle at a constant deceleration.

Steering controller: path

Speed controller: acceleration

End condition: velocity < $v_{end\text{-}condition}$

Requirements derived from Use Case Brake in Turn

- Switching from open to closed loop without disturbing steady state conditions
- Steering controller: path
- Speed controller: velocity, acceleration
- Switching from velocity to acceleration control
- …

Steering Controller

- Lateral acceleration
- Path (path {x,y,z} as function of the distance)

Speed Controller

- Velocity
- Longitudinal acceleration
- Lateral acceleration

Gear-shift controller

Controller Parameters

- intuitive
- manageable

Time-continuous Controller

Switching of Controllers

Driving in Reverse - Stop and Go

Driving over rough road

Expandable

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Thanks for your attention!