A Prototype Vehicle for Powertrain and Chassis Control System Tests

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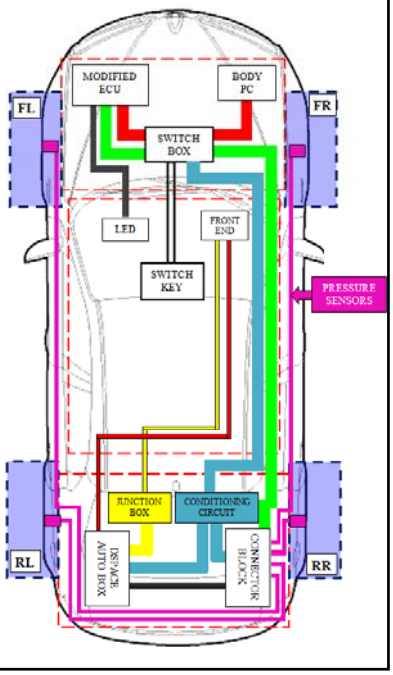
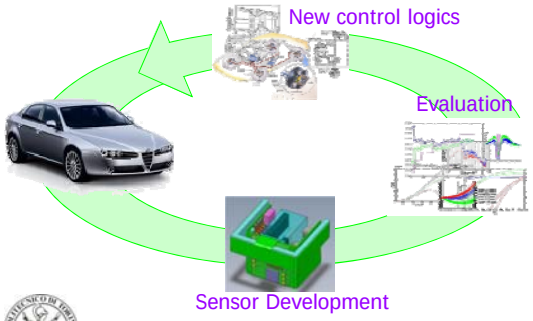
Introduction

- The main aim of the PV project is to test control strategies for active chassis systems
- The main objectives are;
  - Establish a procedure for real time data acquisition
  - Collection, storage and visualization of these data during the tests
  - Control of the system behavior via original algorithms
  - Vehicle dynamics real-time modeling of the PV to be used, instead of the real vehicle, during the HIL operating mode



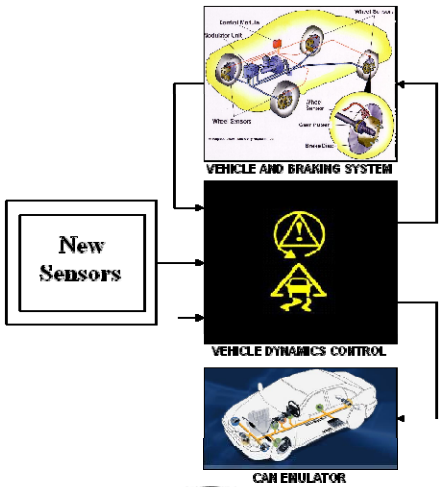
Introduction

- Testing and analysis of the active safety system control logic which is installed on the vehicle as normal production
- Testing and validation of new strategies for real-time dynamic control of the vehicle
- Comparing the obtainable vehicle dynamic performance and using control logics of normal production and the new ones



3

Software and Control



Software interfaces were developed for

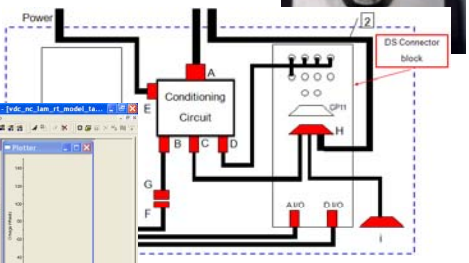
- Standard Vehicle with CAN data acquisition
- ABS test - dSPACE AutoBox
- ESC test - dSPACE AutoBox

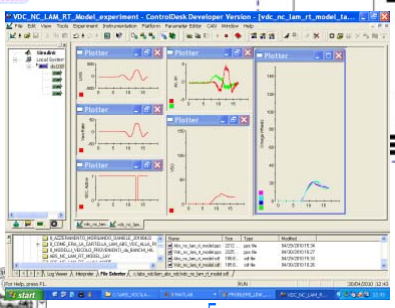
The main idea of the algorithm is to evaluate the values of the "New Sensors" and use this information to improve the performance of the "VEHICLE DYNAMIC CONTROL" in terms of vehicle handling and stability.

4

Operative Modes

- SERIAL PRODUCTION (SP)
- SP LOGIC TESTING
- NEW CONTROL TESTING and MODE SWITCH
- SET UP
- TEST
- ACQUISITION
- DEMO
- RESET





5

Components

- Serial Production vehicle
- New Control or Logic Switch Environment
- Front-End
- CAN Data acquisition
- Braking System Sensors
- ESC Unit
- Half-shaft Torque Measurement System
- Emergency Button

6

New Control or Logic Switch Environment

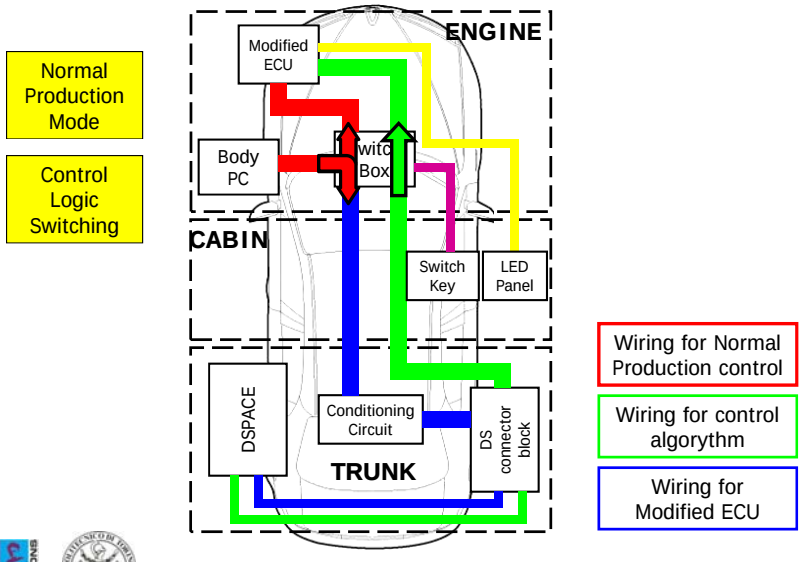
Dual Functionality Mode: The prototype has the capability to be either "normal production", that is behaving in the same way as the original unit, or in "direct control of the electro-valves". This second mode is used to implement new control logics and algorithms.

Signal Acquisition of Electro-valves: It's possible to perform experimental acquisition of the voltage applied to the valves in both functionality modes.

Safety Equipment: The prototype unit can be disabled at any time by the driver of vehicle or a passenger by pressing a safety button located on the dashboard.

7

New Control or Logic Switch Environment



8

CAN Data Acquisition

The real-time hardware platform where the new control algorithms are implemented. These algorithms can be executed individually or simultaneously, depending on the operating mode of the prototype vehicle.

9

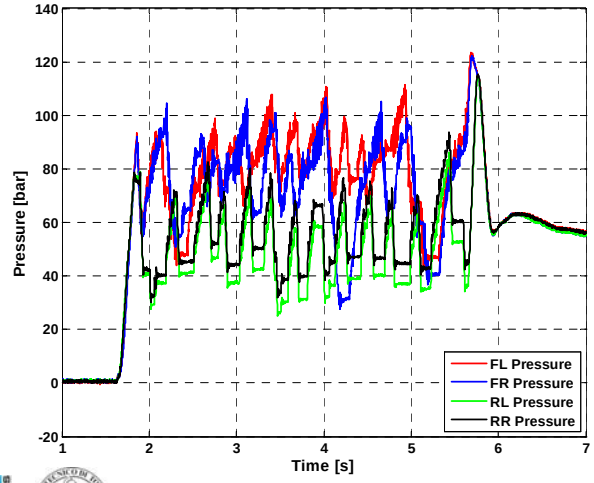
Half-Shaft Torque Measurement System

Two identical telemetry systems have been installed on the vehicle with the aim of transmitting half-shaft torque signals from rotating shafts to stationary receivers.

10

Testing and Results (1)

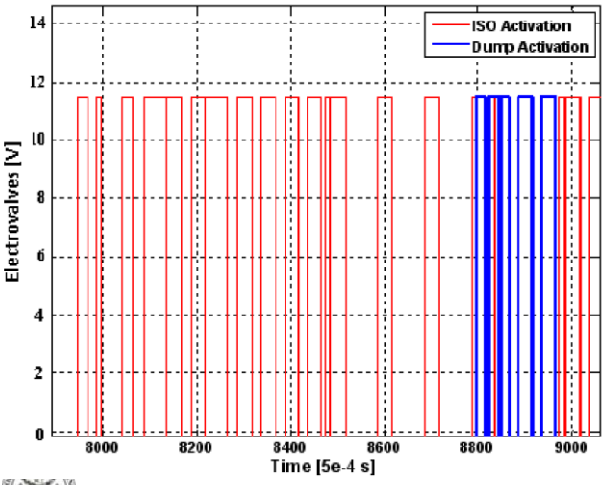
Calliper pressures are represented during an emergency braking from 100 to 0 km/h.



11

Testing and Results (1)

The supply voltage of ISO and DUMP electro-valves in the emergency braking manoeuvre.



12

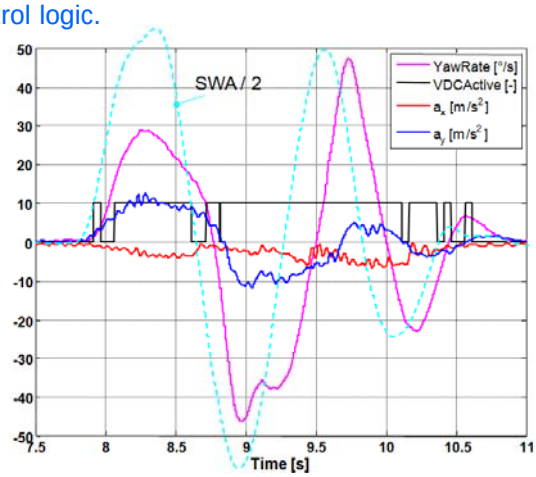
Testing and Results (2)

Double step steer maneuver

13

Testing and Results (2)

Double step steer maneuvers, using the normal production ESC control logic and a new control logic.

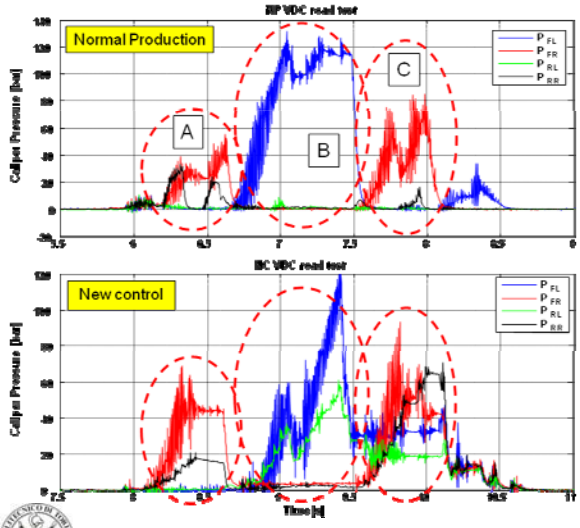


(initial vehicle speed = 110 km/h;
steering wheel angle: from -110° to +110°;
clutch: disengaged;
road/tire coefficient of friction μ ~ 1)

14

Testing and Results (2)

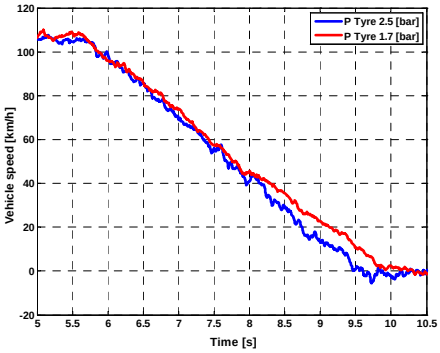
Brake calliper pressures during a double step steer manoeuvre



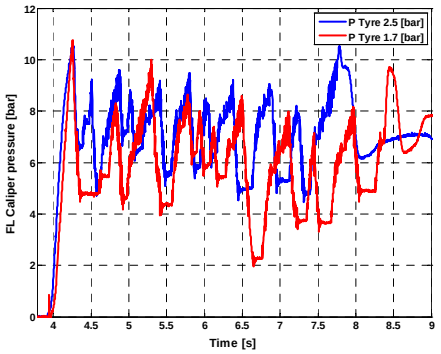
15

Testing and Results (3)

The sensitivity of the vehicle dynamic behaviour in relation to some modifiable vehicle parameters



Vehicle speed during emergency braking with active ABS



Brake pressure in the front left caliper

16

Conclusions

- The equipped vehicle according to normal production
- New active chassis systems or powertrain control logics
- HIL test vehicle
- Investigate the influence of some modifiable vehicle parameters, such as the tire inflation pressure, on ABS performance.
- Support vehicle concept modelling activities

Thanks for your attention!

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