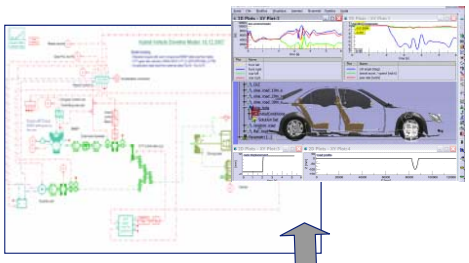
Revas

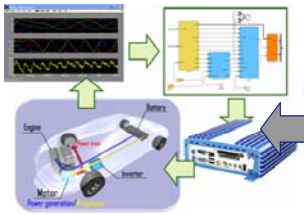
FLANDERS' DRIVE
PARTNER VOOR INNOVATIE EN ONTWIKKELING IN DE VOERTUIGINDUSTRIE

Project Set-up



LMS ENGINEERING INNOVATION

Vehicle dynamics server: state estimator



Rapid prototyping software platform

Active safety demonstrator

Innovative sensors

ON Semiconductor

Melexis
Microelectronic Integrated Systems

NXP
founded by Philips

With support of

Ford

GlobalVehicleDynamics

Active suspension

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FLANDERS' DRIVE

Objectives

Objectives …

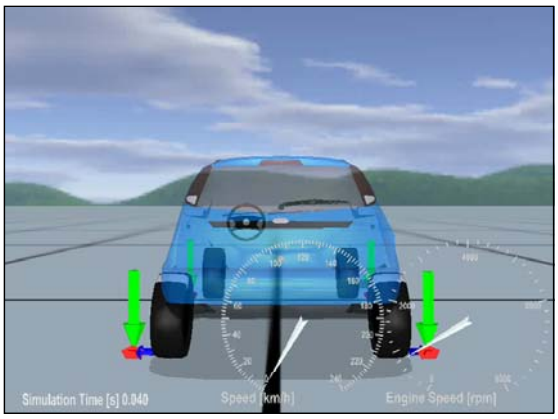
- Decrease vehicle movement to increase comfort and safety
- Safety should be maintained when active suspension system fails
- Balance between function/performance and energy consumption

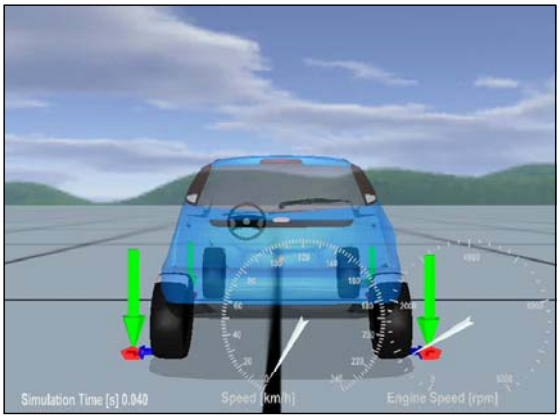
… developed in a short time

Simulation with system targets to generate force-velocity couples

Current situation (e.g. primary ride on road ISO 8608 Class D)

Defined heave, pitch and roll targets for primary ride





Also targets defined for secondary and NVH

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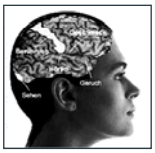
Safety Integrity and criterion

Analysis & Design



Drivers can/ cannot cope

Vehicle no longer controllable	10	NOT SAFE
System reaction dangerous	9	
	8	
	7	
System reaction disturbing	6	SAFE
	5	
	4	
System reaction noticeable	3	
	2	
	1	
Nothing noticed	0	

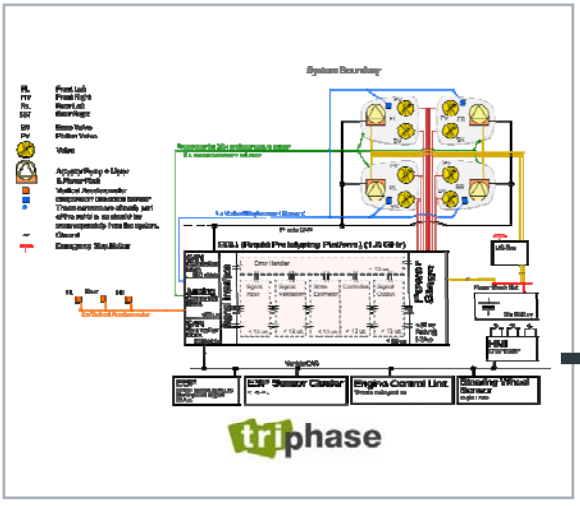
Source: IZVW / Audi AG

Safety criterion

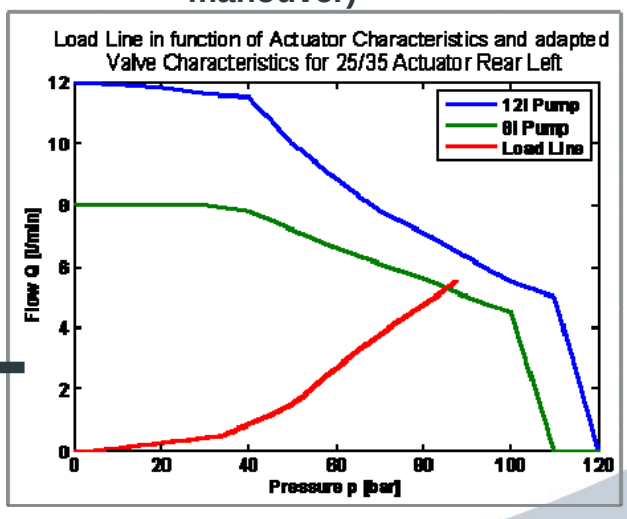
Architecture

Analysis & Design

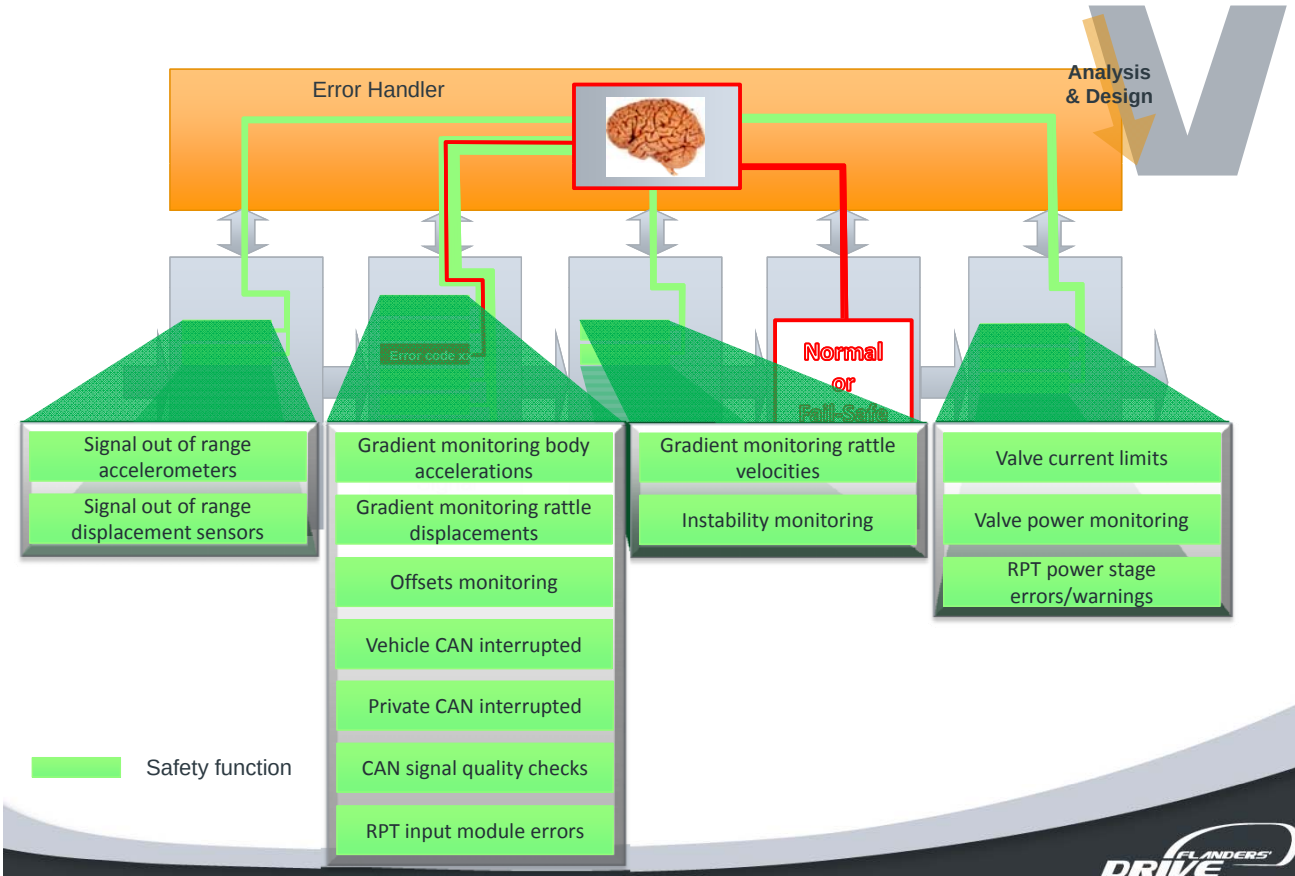
Electrical and software architecture



Hydraulic analyses (e.g. slalom manouver)



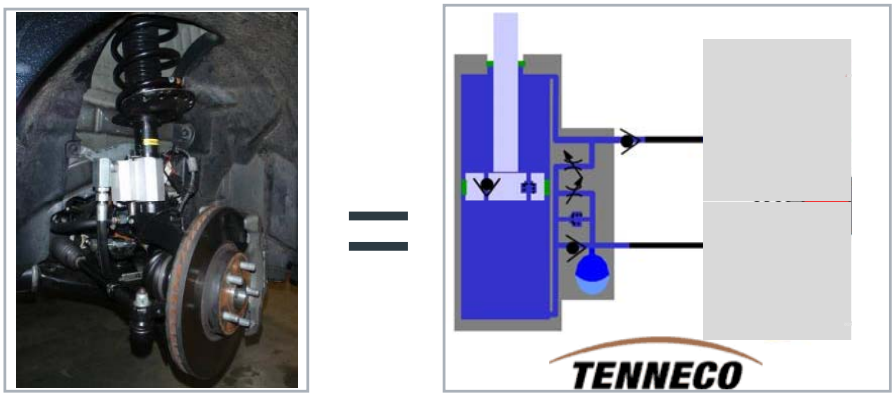
Safety functions in software architecture



Key Components

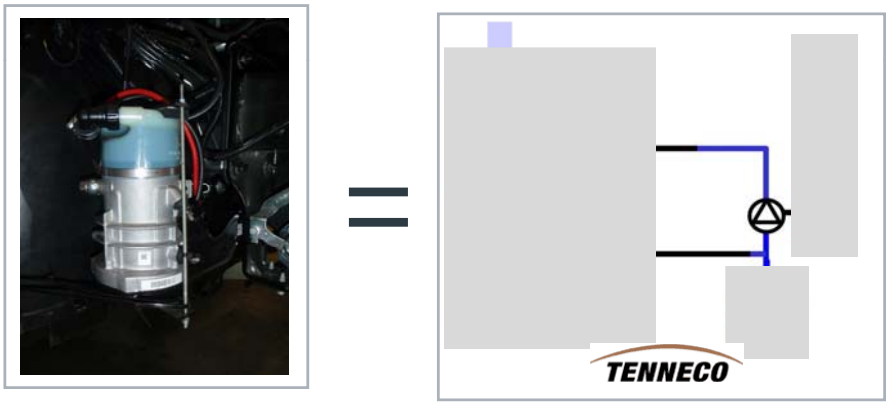
a. The hydraulic actuator in the suspension

Safety is maintained when system fails.



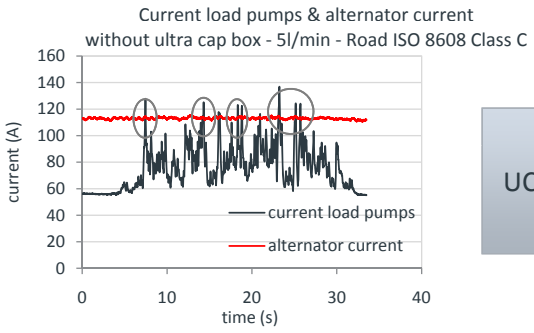
Analysis & Design

b. The hydraulic power pack determination

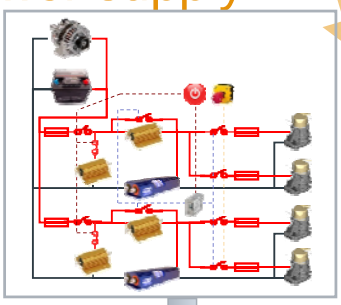


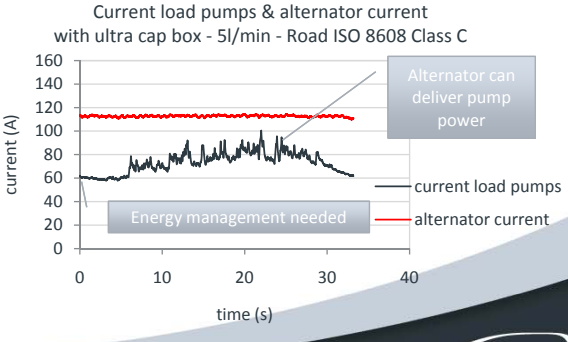
Analysis & Design

c. Ultracap limits effect on power supply

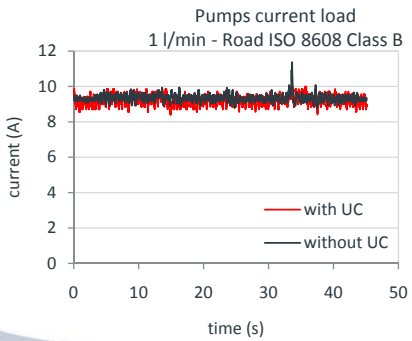


UC needed





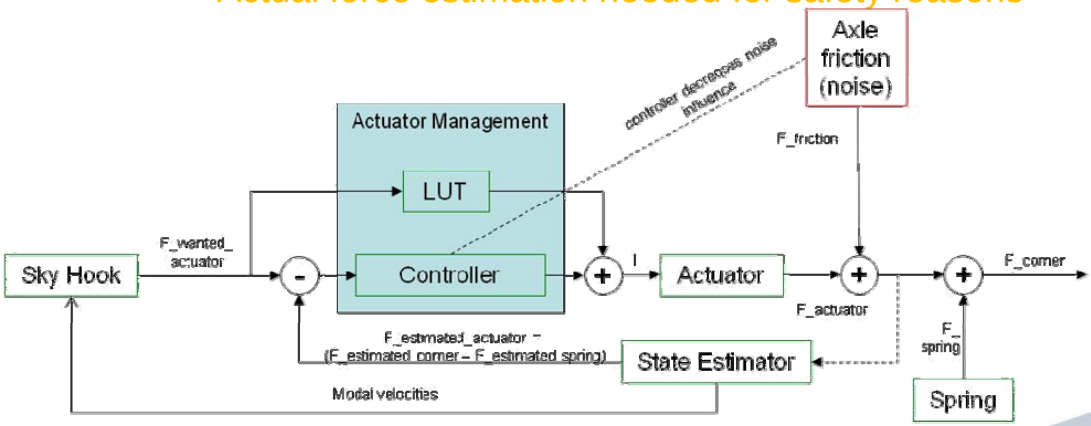
With integrated energy management



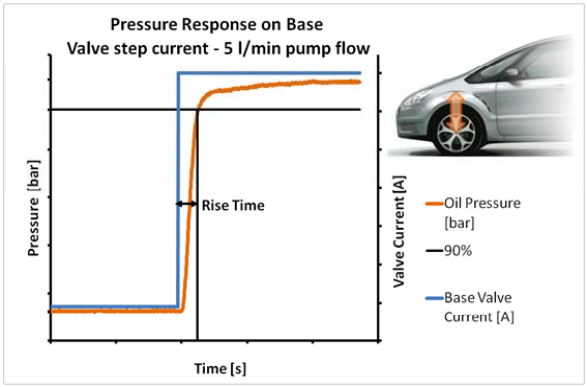
Analysis & Design

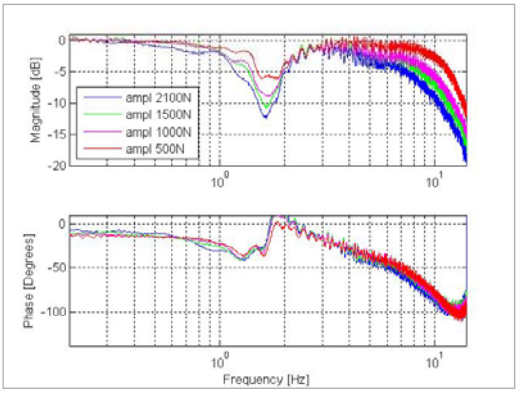
d. The state estimator

- Estimation of wheel forces via wheel displacements and accellero's
- Derivation of modal velocities as input for sky hook control
- Reduction of needed sensors
- Actual force estimation needed for safety reasons



Implementation & Testing





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Successful outdoor road test on rough road

Current situation

Normal suspension

New Vehicle behavior

Active suspension in same vehicle type and same road section

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