



DIMEAS

Dipartimento
di Ingegneria
Meccanica e
Aerospaziale

ScuDo

Scuola di Dottorato - Doctoral School

WHAT YOU ARE, TAKES YOU FAR

**PhD in Mechanical Engineering
XXXV cycle – Scholarship without topic**

Dynamic analysis of a scaled vehicle State of the activity and next steps



Supervisor
Prof. Alessandro Vigliani

PhD candidate
Angelo Domenico Vella

Target

Study of the vehicle dynamics on a scaled model:

- modal behaviour in function of its main elastic and dissipative characteristics
- scalability in vehicle dynamics



Approach

Analysis of the single components and the entire vehicle by experimental and numerical techniques

Inertias

Evaluation of sprung and unsprung mass

- weights
- centre of mass
- moments of inertia



Study of the elastic and dissipative components

Shock absorbers

Identification of the damping versus the stroke and the oil viscosity



Springs

Measurement of the nominal stiffness

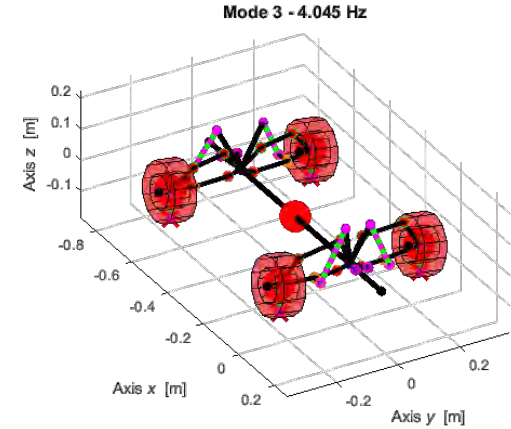
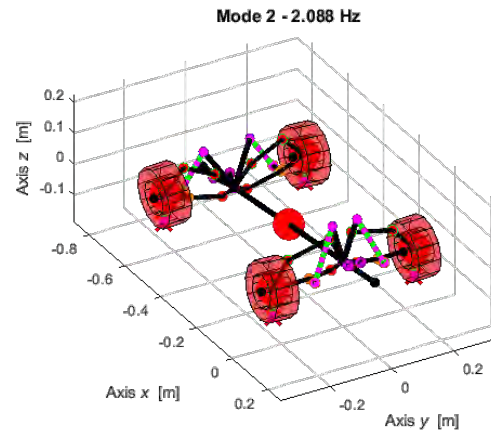
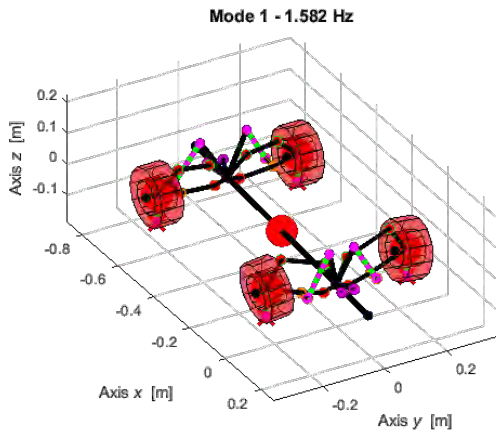


Tyres

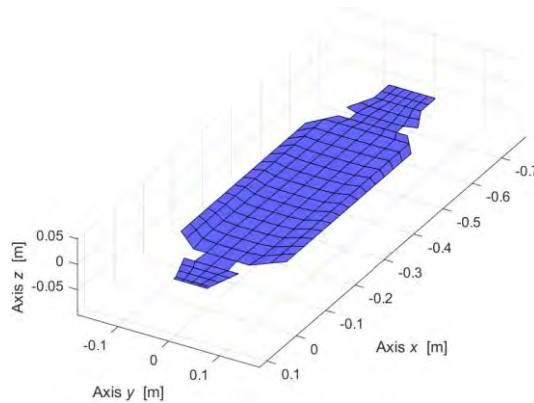
Static identification of the stiffness



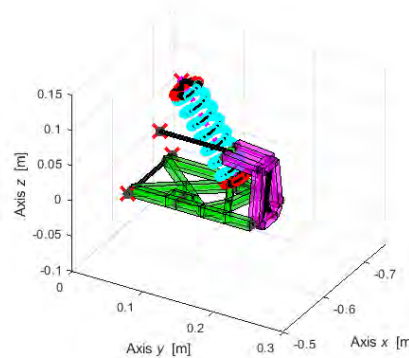
Lumped parameter model



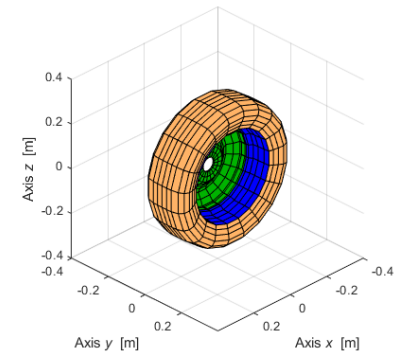
FEM model



Frame



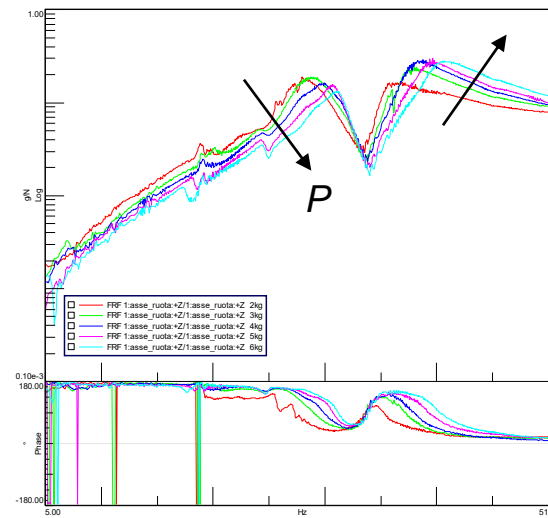
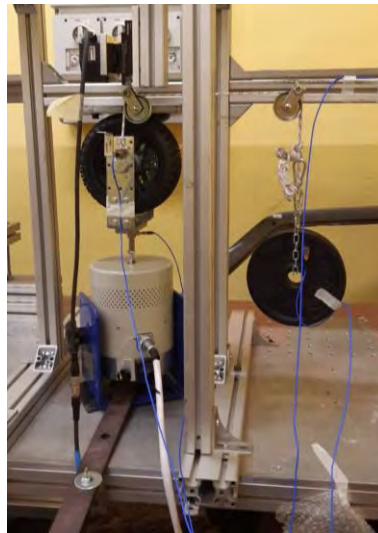
Front and rear suspensions



Tyres

Current activity

- Dynamic characterisation of the tyres to identify the stiffness and the damping coefficient for different vertical load



Next steps

- Experimental modal analysis for different spring, damper and tyre configurations
- Upgrading of the FEM model and validation
- On-road tests

Other activities and publications



Hard skill course	Duration
Automotive transmission	20h
Progettazione dei veicoli terrestri	20h
Optimization methods for engineering problems	30h
TOTAL	70h

Soft skill course	Duration
Communication	5h
Project management	5h
Public speaking	5h
Time management	2h
TOTAL	17h

- 12h of tutoring for Motor Vehicle Mechanics course
- EU project – Smart Tailored L-category Electric Vehicle in hEterogeneous urbanuse cases
- Galvagno, E., Dimauro, L., Mari, G., Velardocchia, M., & **Vella, A. D.** (2019). Dual Clutch Transmission Vibrations during Gear Shift: A Simulation-Based Approach for Clunking Noise Assessment (No. 2019-01-1553). SAE Technical Paper.
- **Vella, A. D.**, Vigliani, A., Tota, A., & Lisitano, D. (2020). Experimental Ride Comfort Analysis of an Electric Light Vehicle in Urban Scenario (No. 2020-01-1086). SAE Technical Paper.
- **Vella, A. D.**, Lisitano, D., Tota, A. & Wang, B. (in print). Analysis of heavy commercial vehicle cornering behavior through a multibody model. International Journal of Mechanics and Control (accepted for publication).

Thanks for your attention