

DEFINITION AND SELECTION OF THE PROPER FLEX COUPLING FOR AN EXHAUST SYSTEM

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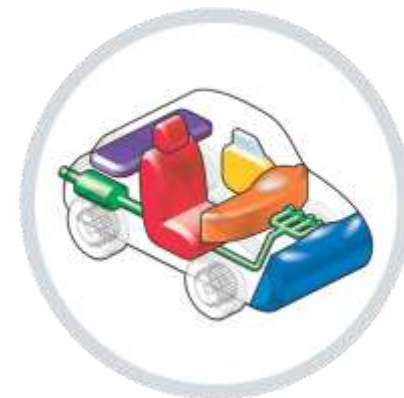
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1. Abstract
2. Introducing Faurecia
3. Problem Definition
4. Solution Analysis
5. Summary & Prospects for the future

- Currently the Automotive industry is exposed to an enormous pressure of competition, dealing with high levels of warranty claims, due to the aggressive time-frame for the development of new products in the market as well as the inappropriate simulation and experimental use of development procedures or methods to define and select properly vehicle components or sub-components.
- The present document has the objective to propose a CAE (Computer Aided Engineering) methodology to define and select the proper flex coupling for an Exhaust System under engine roll & road excitations.
- Road & Engine roll excitations are gotten from the Road Load Data Acquisition (RLDA) experimental campaign. This loads are used to design, develop and validation of exhaust system.
- Since the length of the exhaust flex coupling has an import role in the structural durability behavior of the complete exhaust system and their sub-components, is necessary to know the correct length before to build of prototypes for DV gate.
- The length of the flex couplings is deduced from the post processing of relative displacements between the inlet & outlet side of the flex coupling. Is presented a TCL scrip to speed up the relative displacements of the different lengths and compare them to select the proper one according the damage of the line. The information from the better will be provided to the Flex coupling Tier II supplier to determinate its fatigue life, and release a design more robust to be validated during experimental tests according the Durability workflow.

Introducing Faurecia

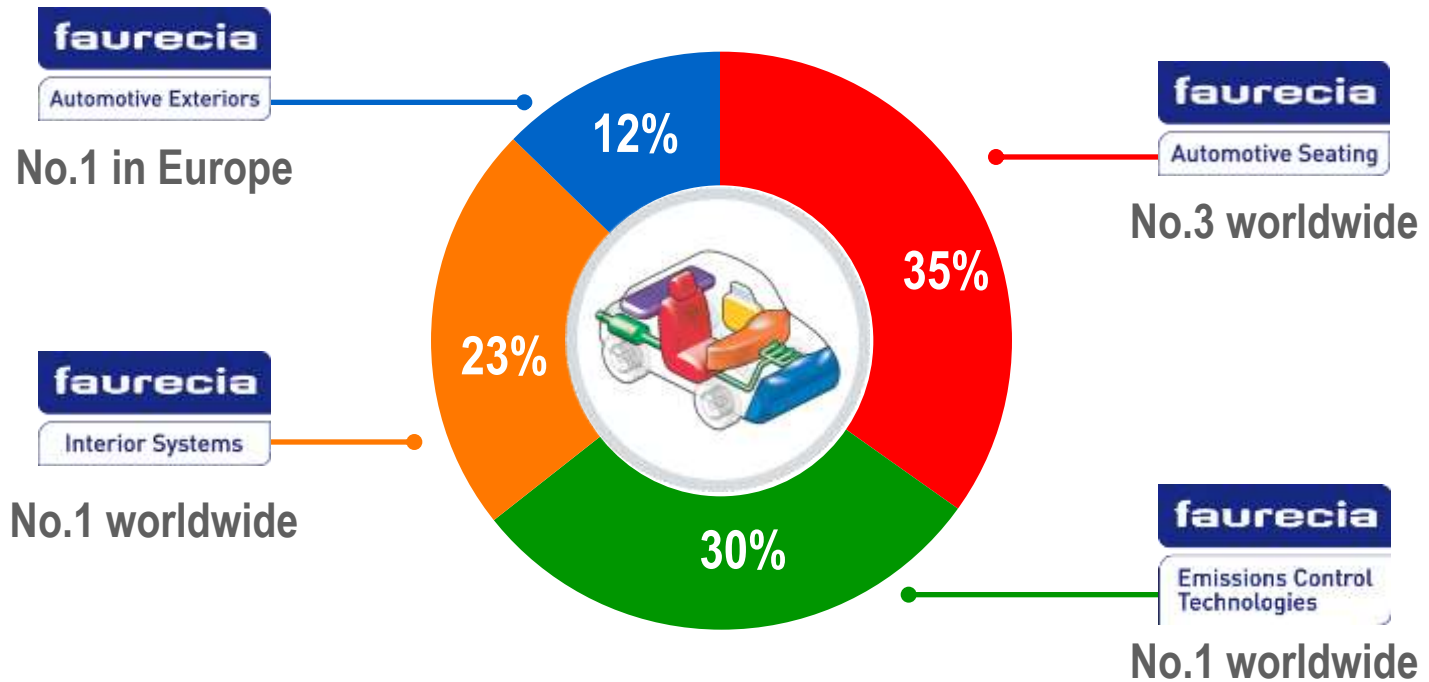


Leader in four core Business

faurecia

Emissions Control
Technologies

2009 sales by Business Group



Emissions Control Technologies

faurecia

Emissions Control
Technologies

13,000
employees

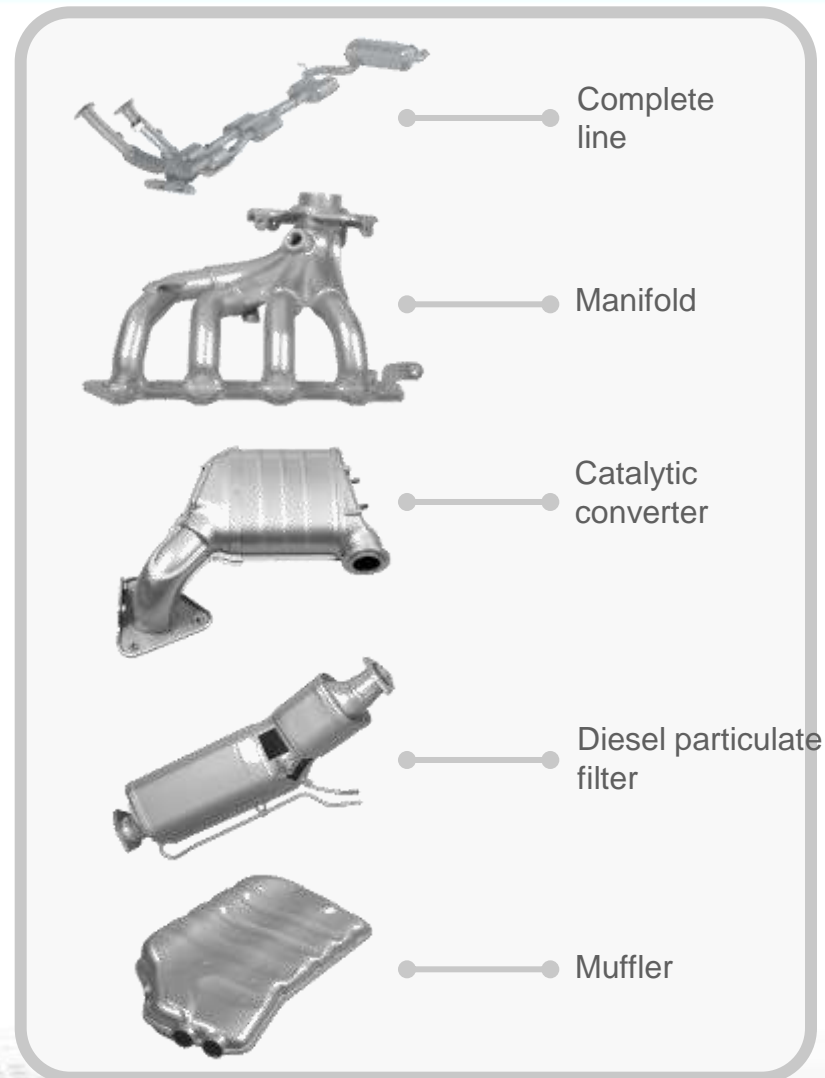
66
plants

12
R&D centers

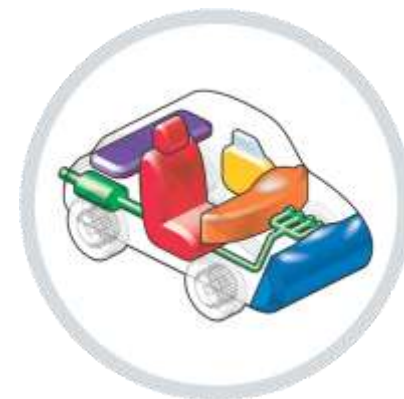
23
countries

Annual production figures:

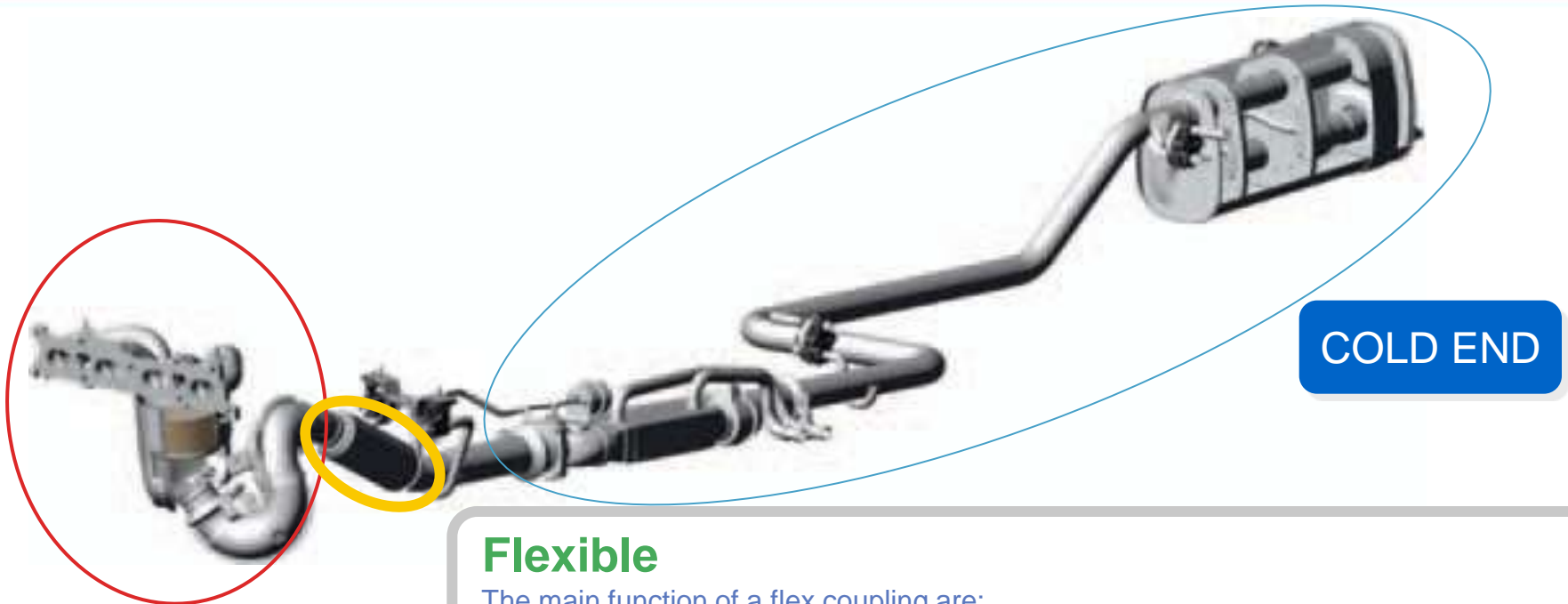
- Complete exhaust systems: 10 million units
- Manifolds: 3 million units
- Catalytic converters: 20 million units
- Diesel particulate filters: 3 million units
- Mufflers: 20 million units



Problem Definition



CONCEPTS



COLD END

HOT END

Flexible

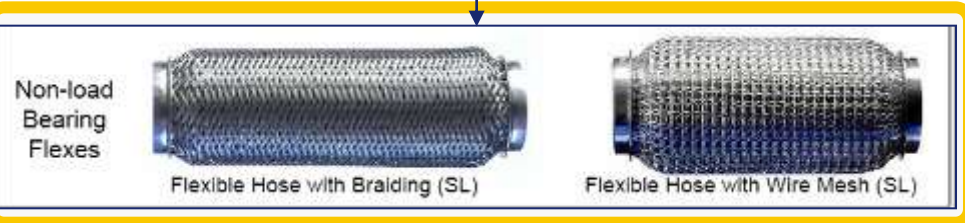
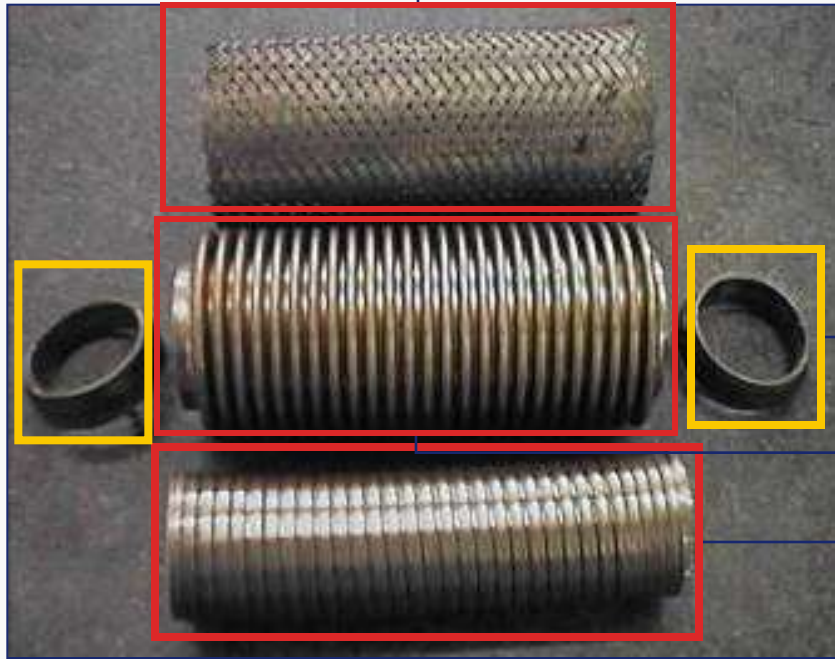
The main function of a flex coupling are:

1. Isolate high frequency engine vibrations
2. Reduce structure borne noise and vibrations
3. Decouple low frequency gross engine motions
4. Provide a leak free duct for the exhaust gas
5. Reduce the operating stresses and increase fatigue life of exhaust and engine system components as measured on a representative vehicle by the supplier
6. Possibly make vehicle assembly installation of the exhaust system easier where unavoidable build variations are present

COMPONENTS (BOM)



Outer braid or Outer wire mesh

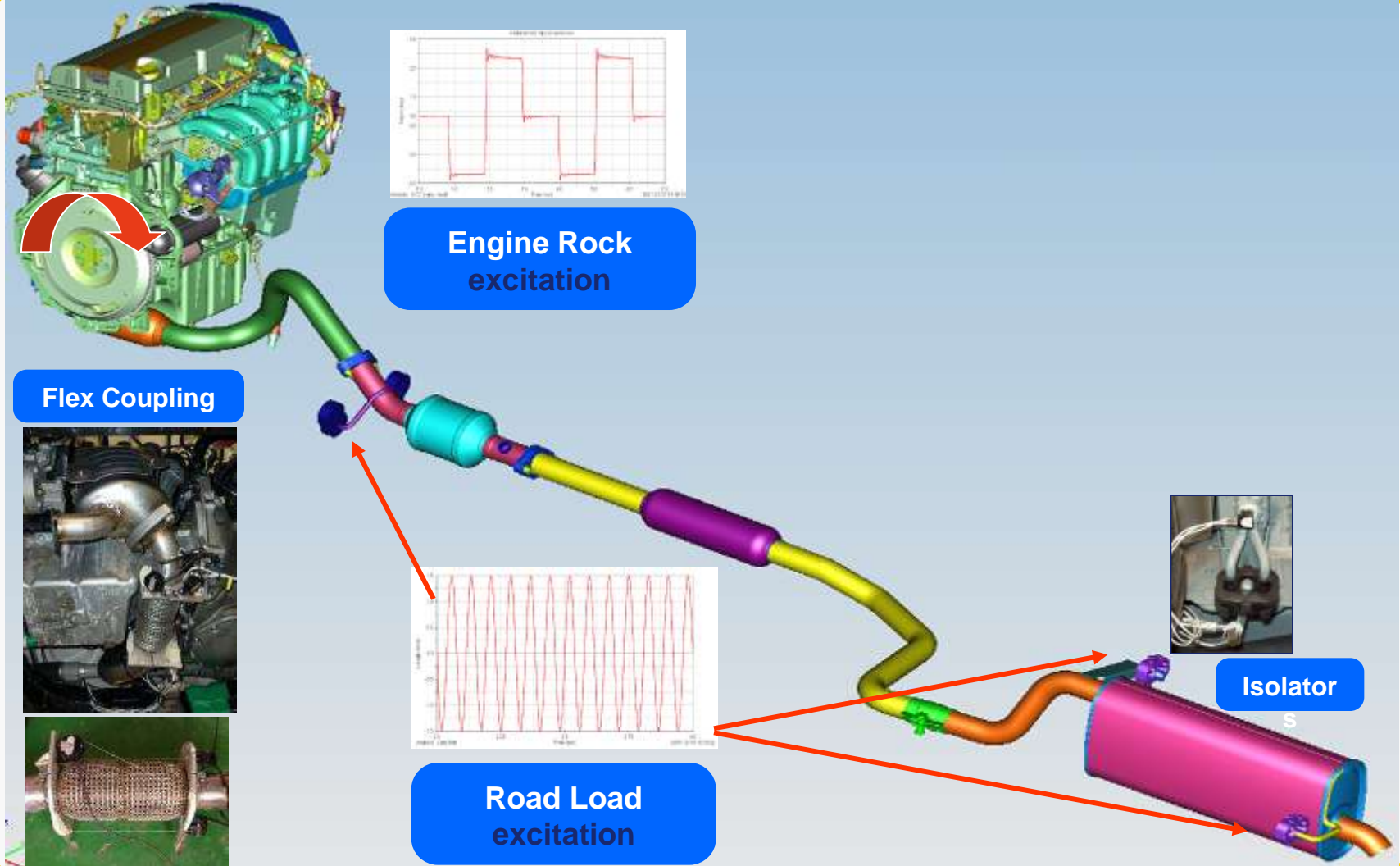


Endcaps

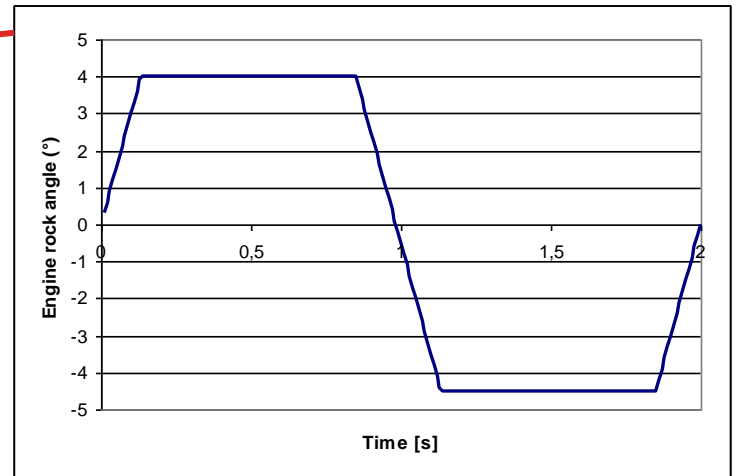
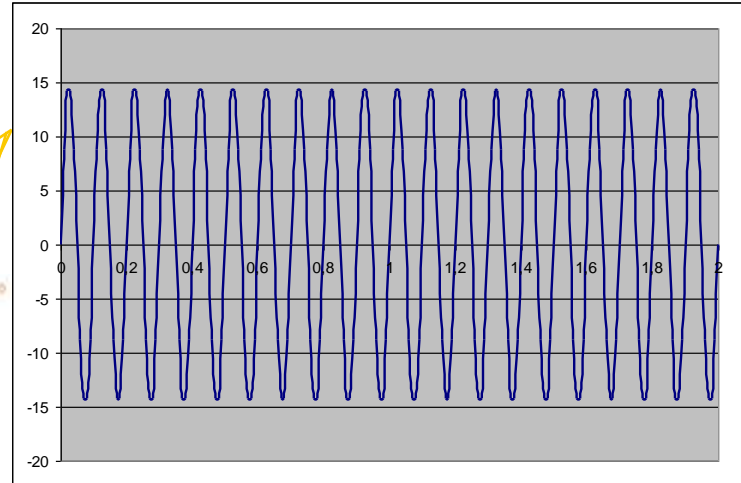
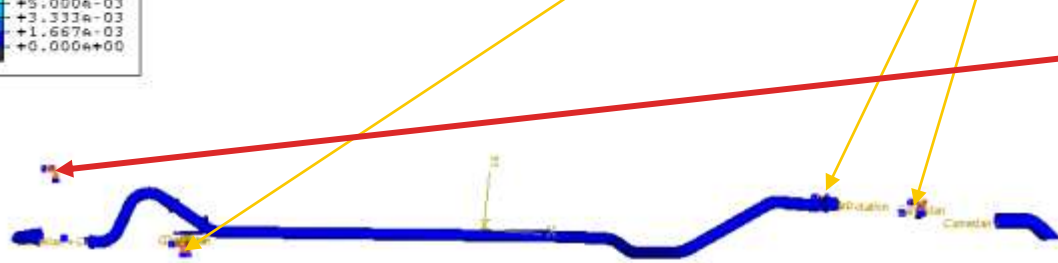
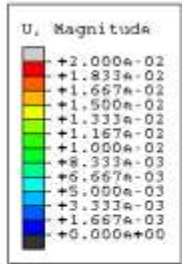
Bellows

Interlock or Innerbraiding

Engine Rock & Road load (0-20 Hz)



Engine Rock & Road load (0-20 Hz)

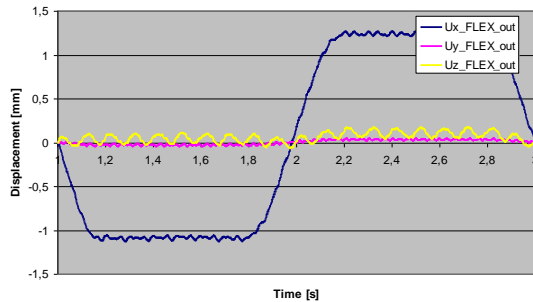


Engine Rock & Road load (0-20 Hz)

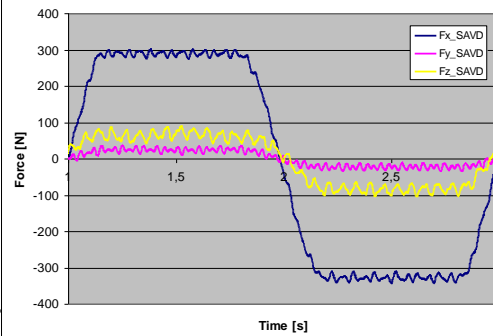
Engine Rock & Road excitation

- Results

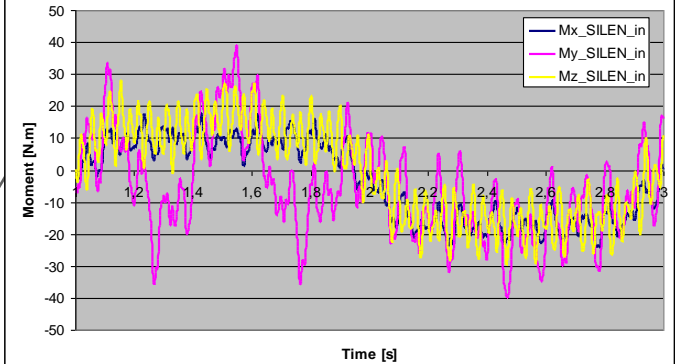
Displacement FLEXIBLE out



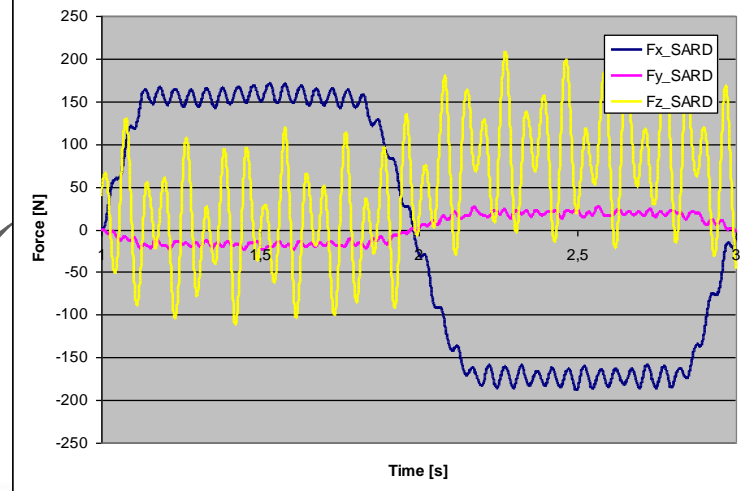
Force ISOLATORS



M MUFLER in

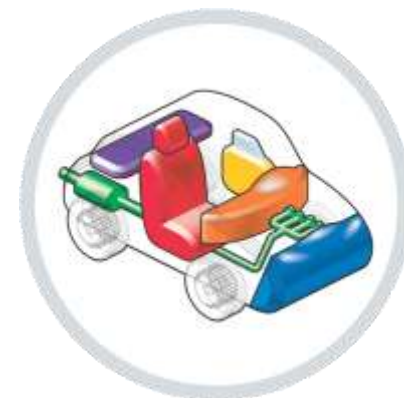


Force ISOLATORS

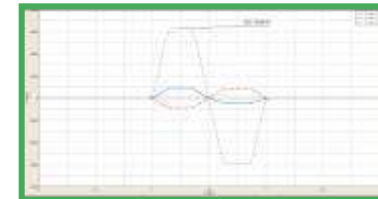
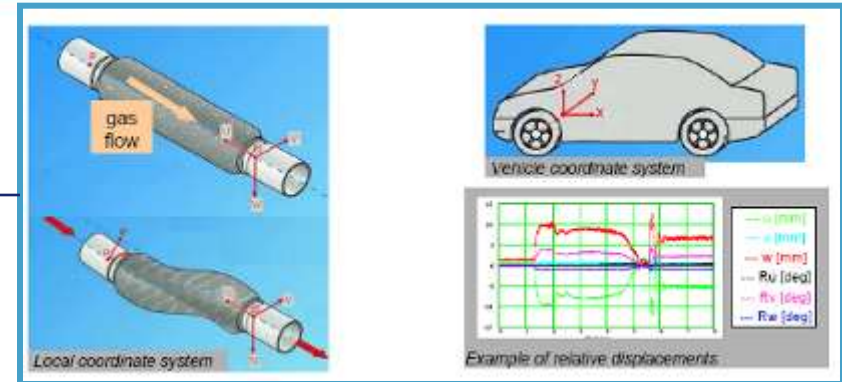
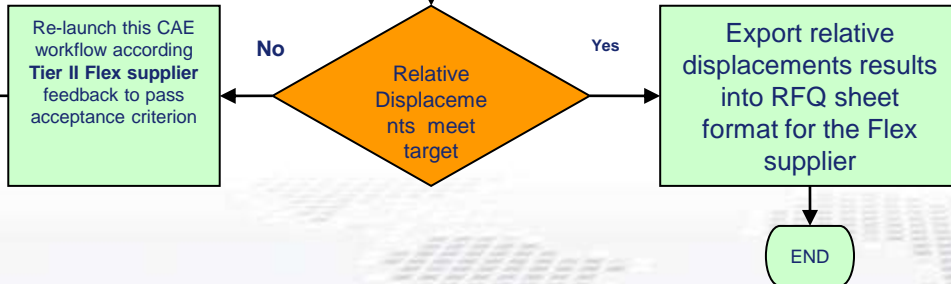
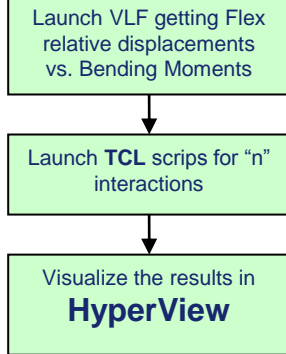
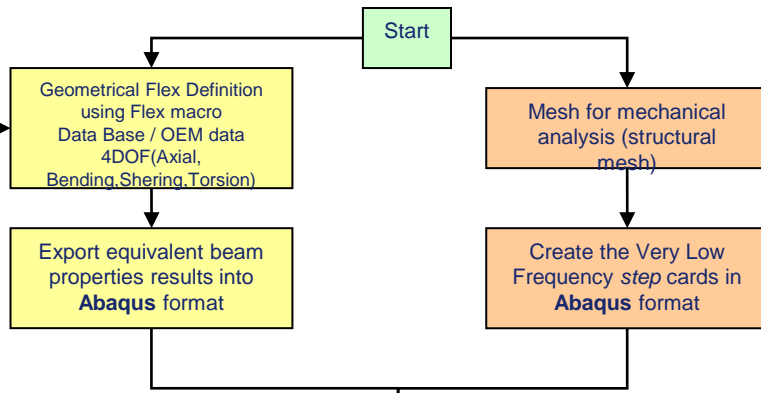


Necessary to Change of Flex length to see impact in Bending moments...

SOLUTION ANALYSIS



Engine Rock & Road load (0-20 Hz)



Data for the life-time prediction (pre-development)

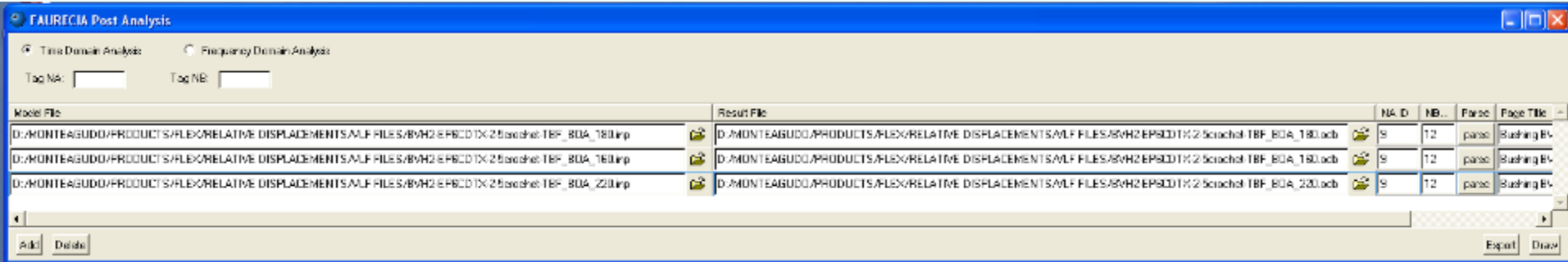
Case1 : if the relative movements of the decoupling element (inlet to outlet) are known :

Movements in installed condition (local coordinates system)

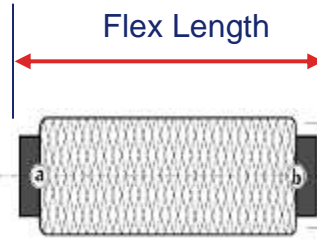
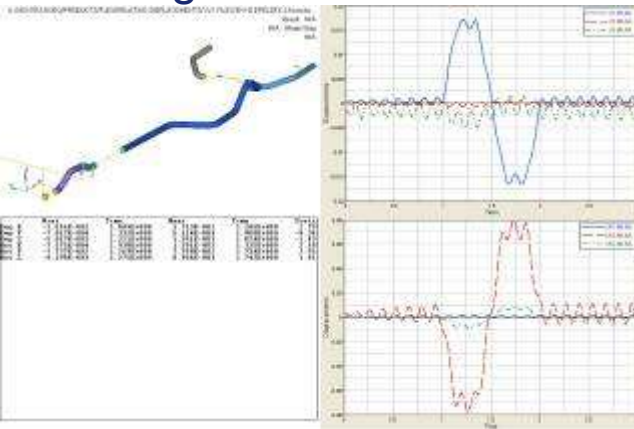
	outlet (O)	inlet (P')				
		Maneuver A	Maneuver B	Maneuver C	Maneuver D	
u	0					mm
v	0					mm
w	0					mm
Ru	0					degree
Rv	0					degree
Rw	0					degree

local coordinate system :

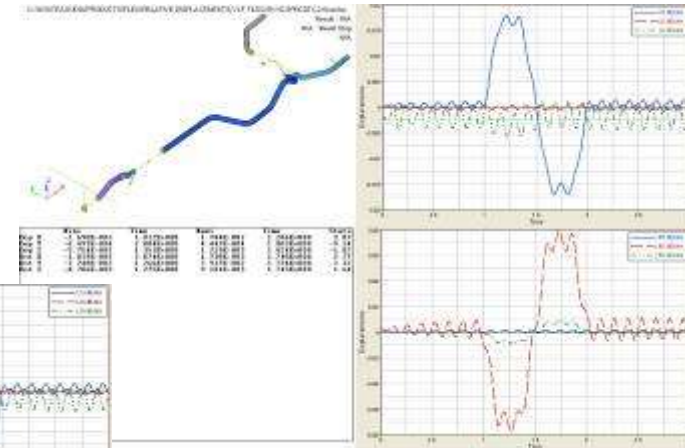
Faurecia scrip



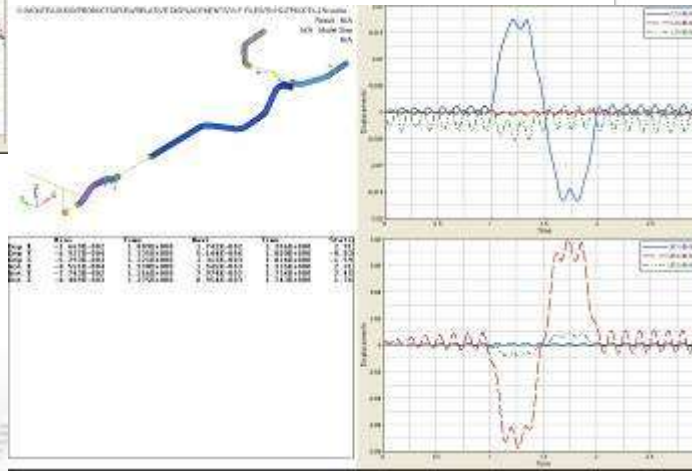
Length : 160 mm



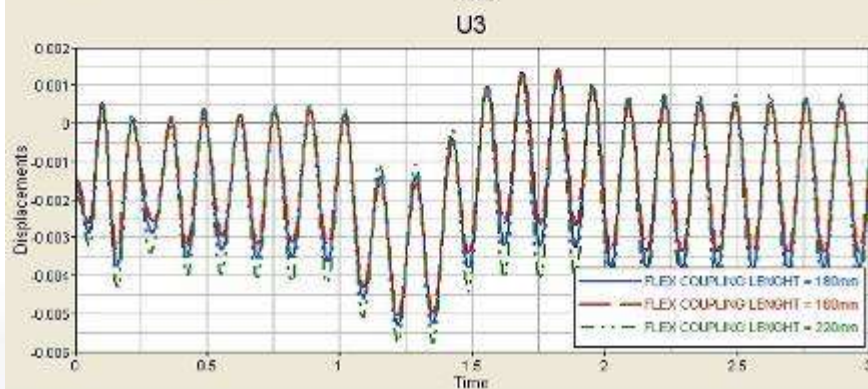
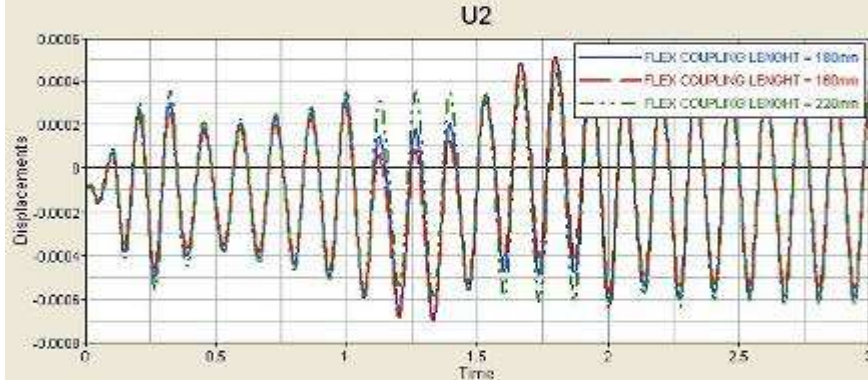
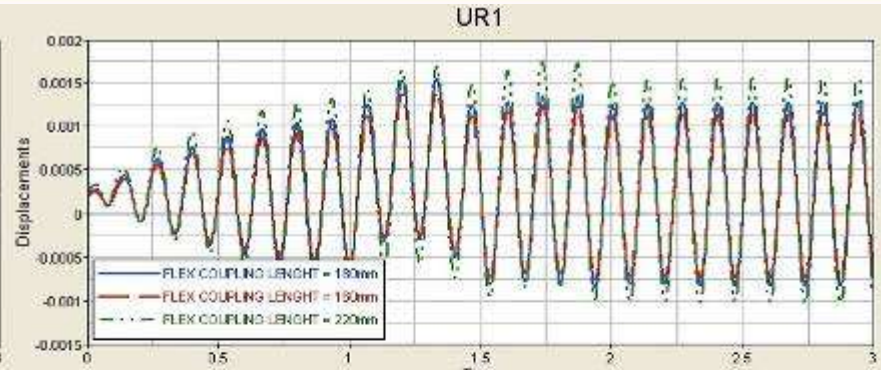
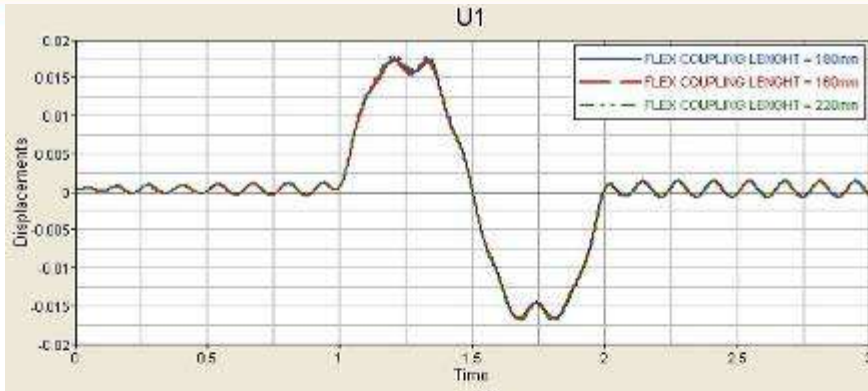
Length : 220 mm



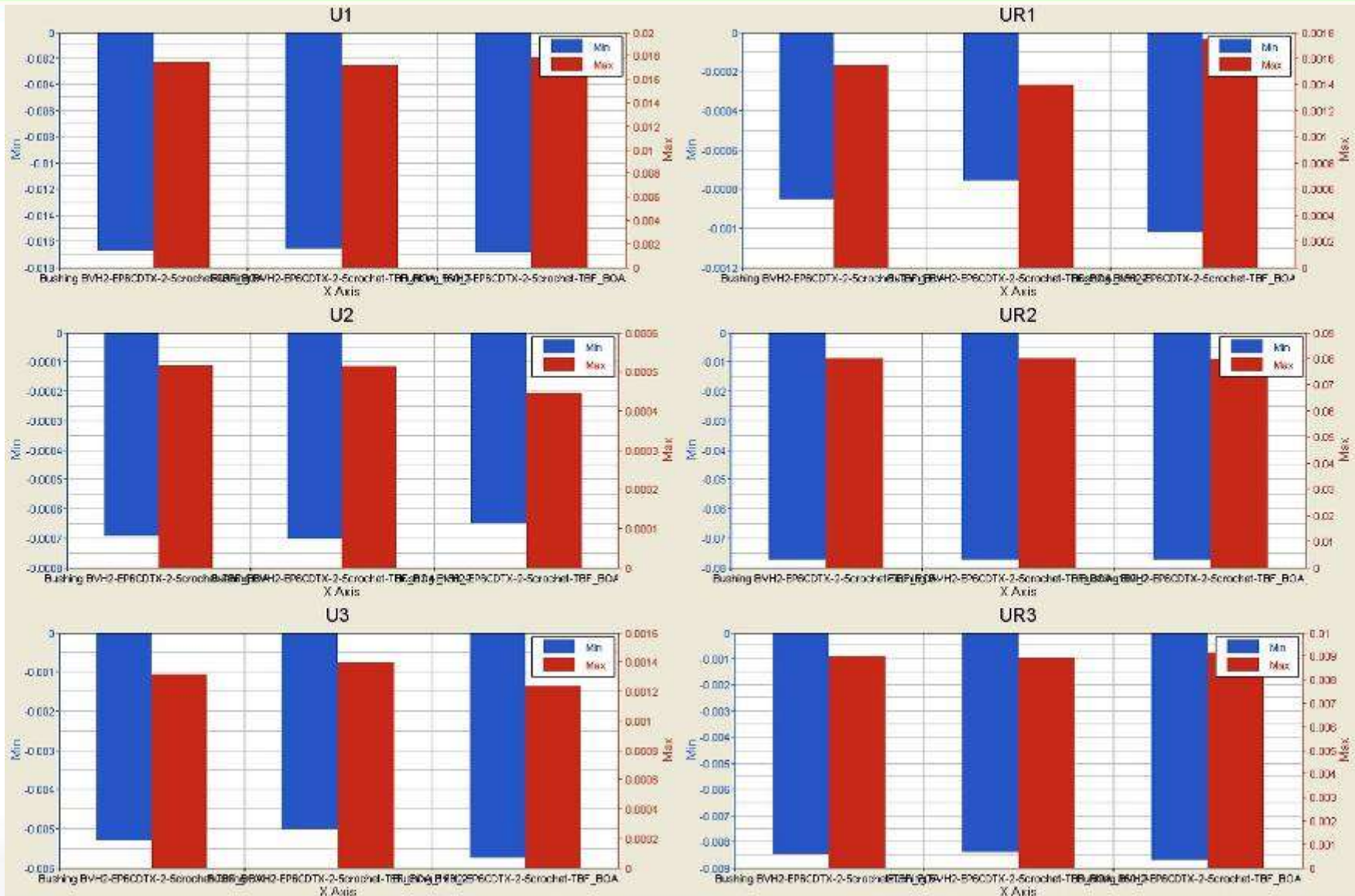
Length : 180 mm



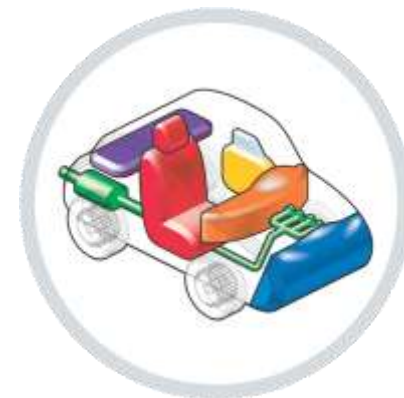
Comparison



Compare Min Max Values



**SUMMARY
&
PROSPECTS FOR
THE FUTURE**



Summary & Conclusions

- A CAE methodology has been developed for selection of flex couplings for Exhaust Systems in Very low frequency domain (0-20Hz).
- An case study was presented here and proved the relative displacements approach can speed up the definition and selection of Flex coupling in the earliest virtual development stage.
- The compromise of decreasing hanger forces and keeping lower stress values and bending moments is possible, after getting the different flex couplings lengths.
- The predicted results were correlated reasonably with observed results from Faurecia decoupling elements data base assuring the steadiness of results.
- The present method can be also apply under Force Response Frequency (FRF) excitation .

Thank you for your attention !



References

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Technical perfection, automotive passion

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