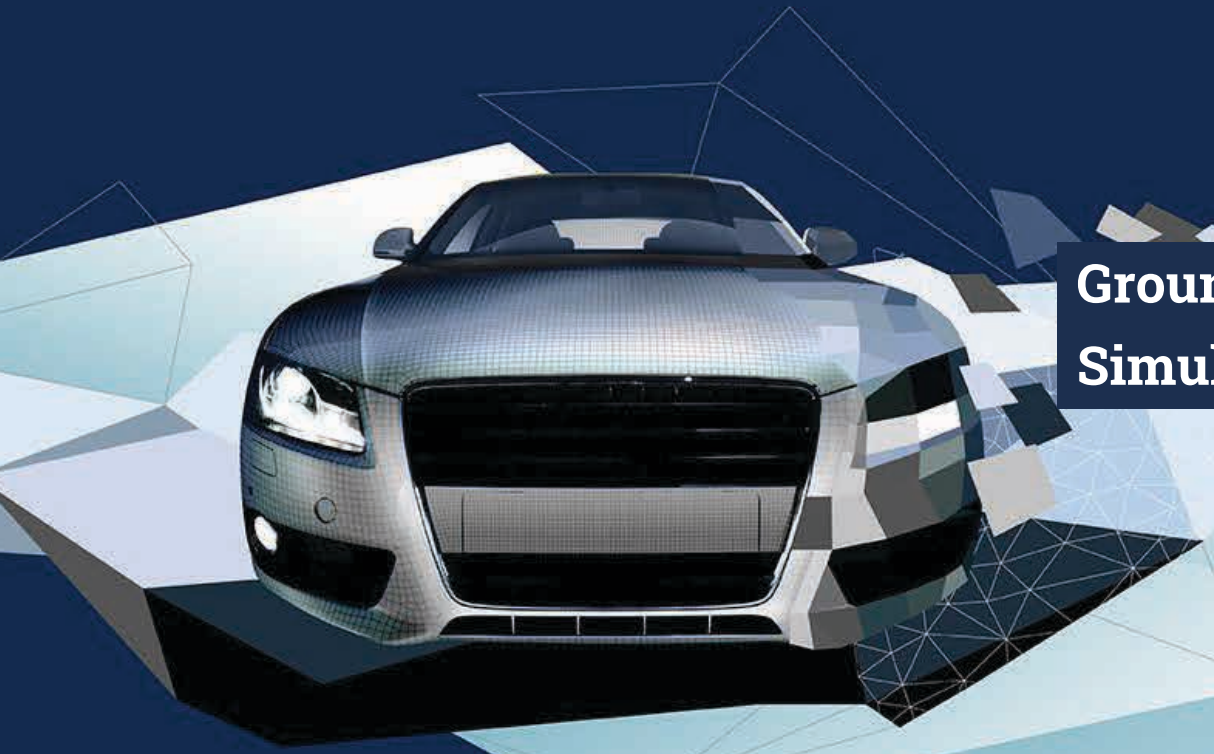
BETA

SIMULATION SOLUTIONS



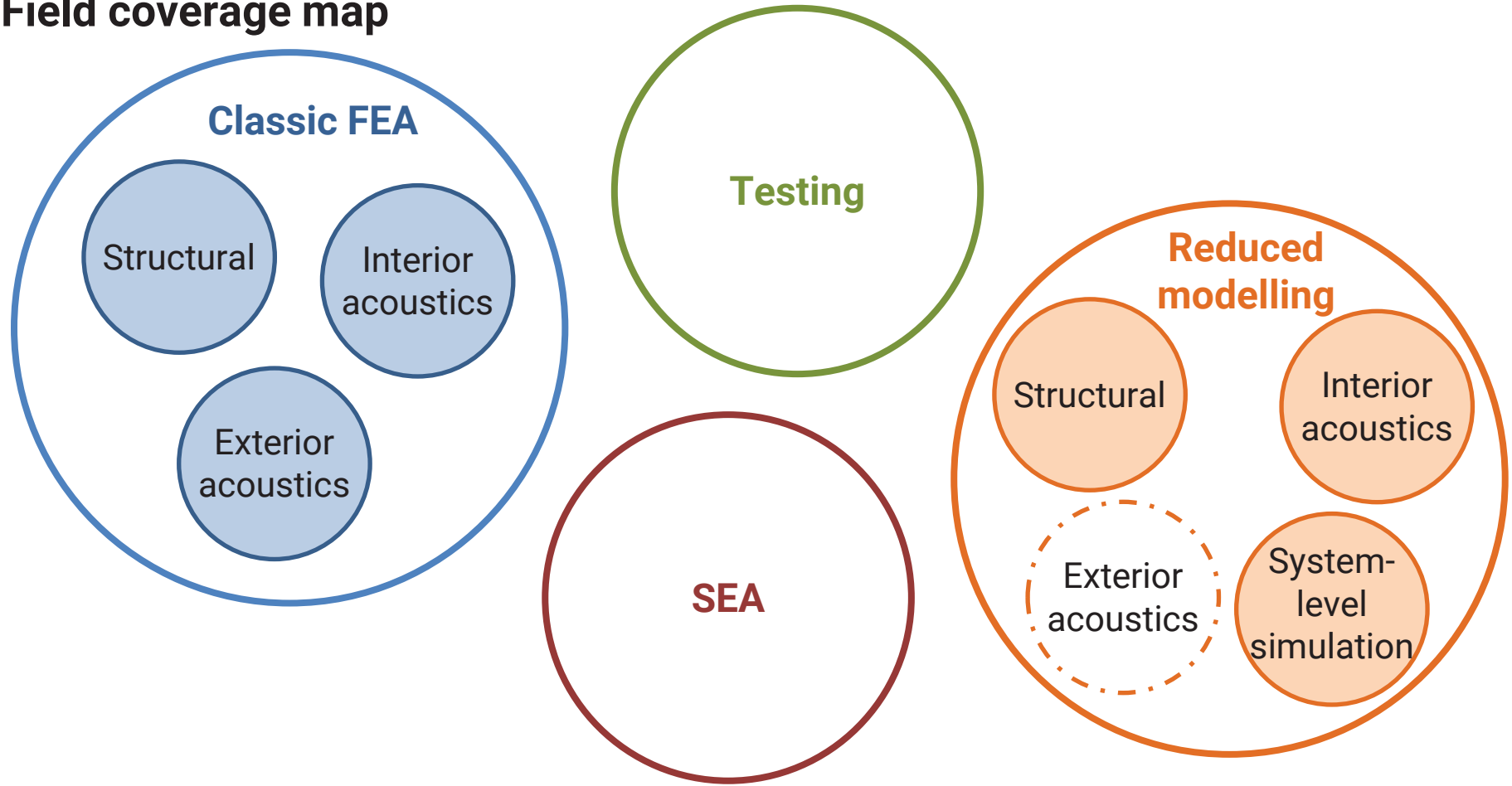
Groundbreaking Simulation Solutions

physics on screen

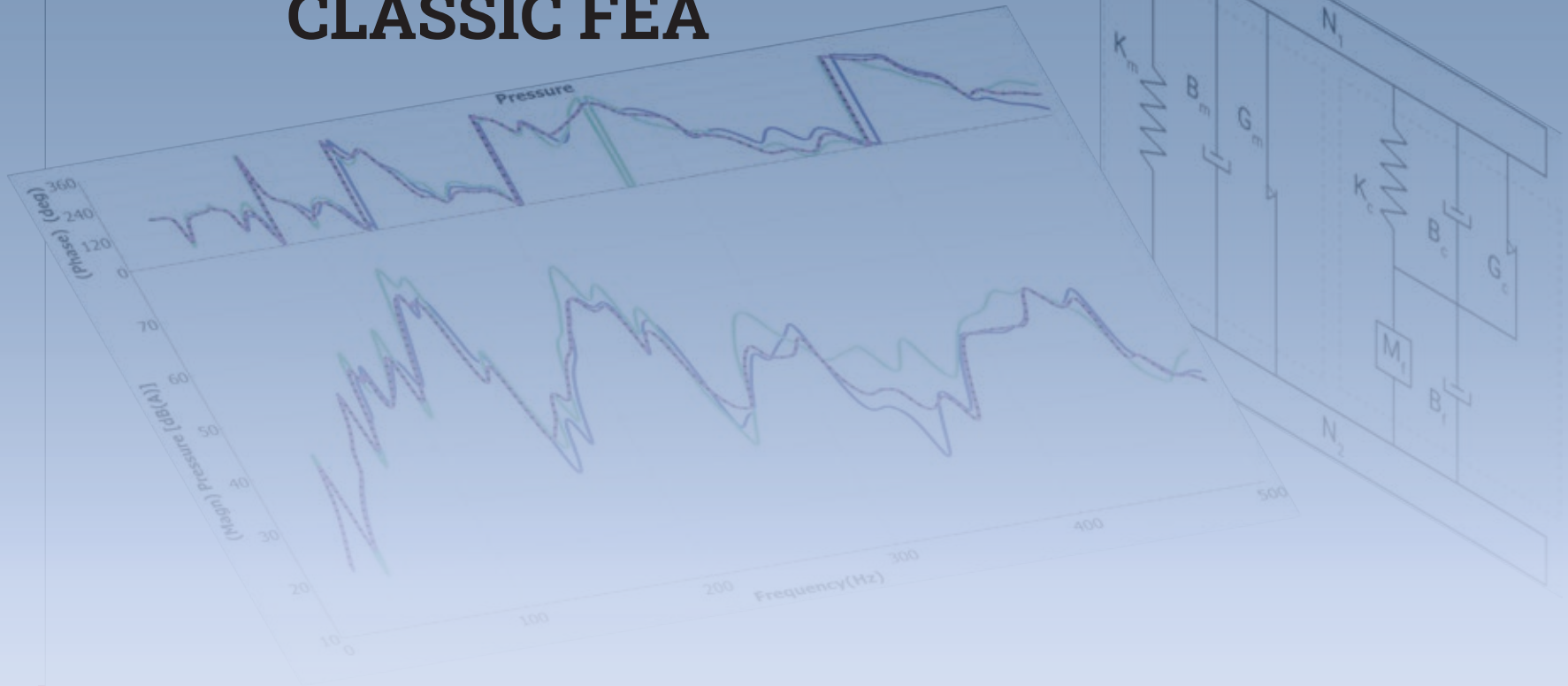
Latest and Future developments of BETA Suite in NVH

Vasileios Pavlidis

Field coverage map

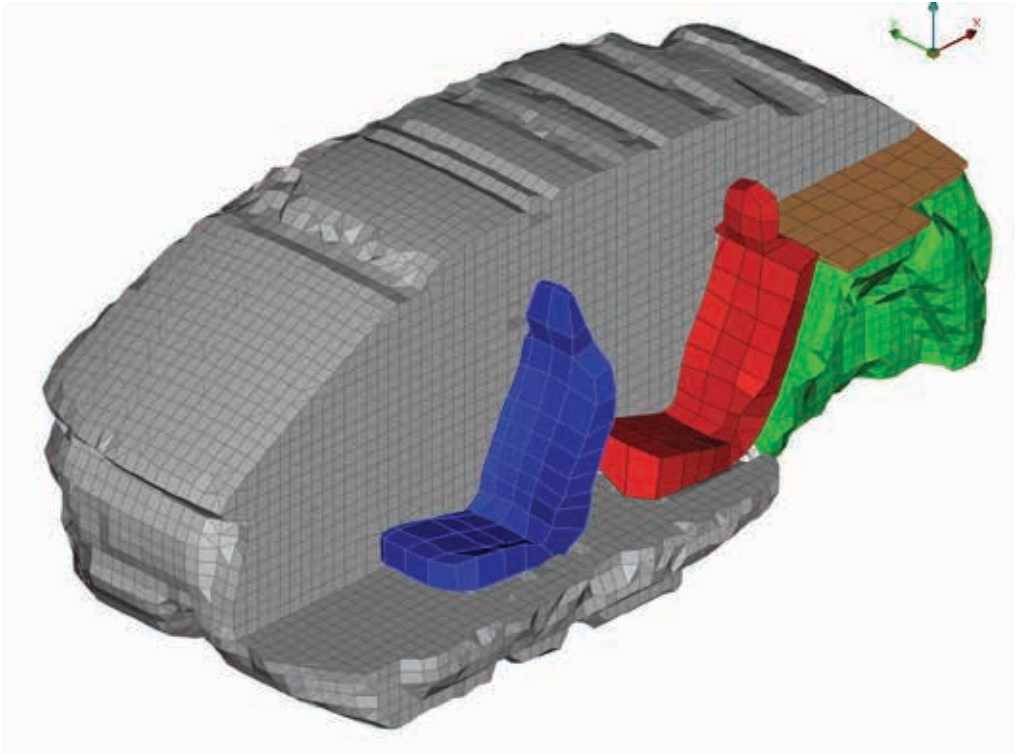


CLASSIC FEA



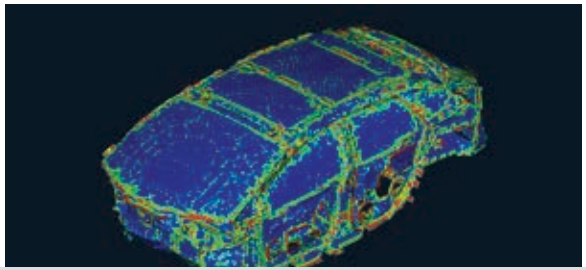
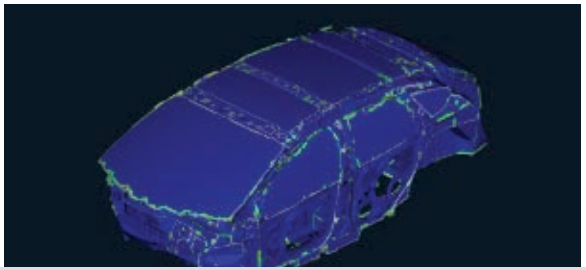
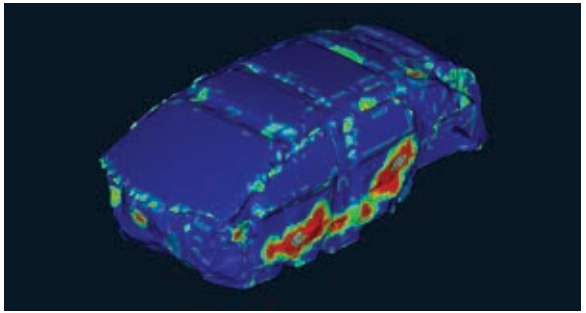
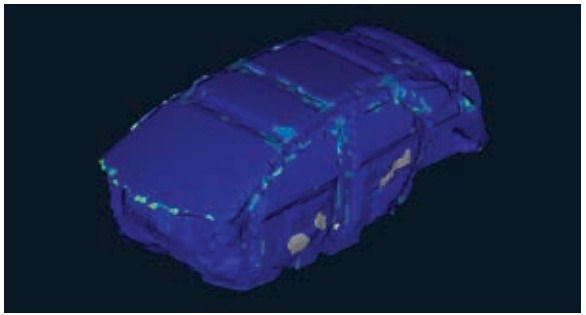
Classic FEA: Cavity creation

ANSA
PRE PROCESSOR



- Improved performance
- Improved quality in following feature lines

Classic FEA: Fluid-Structure coupling

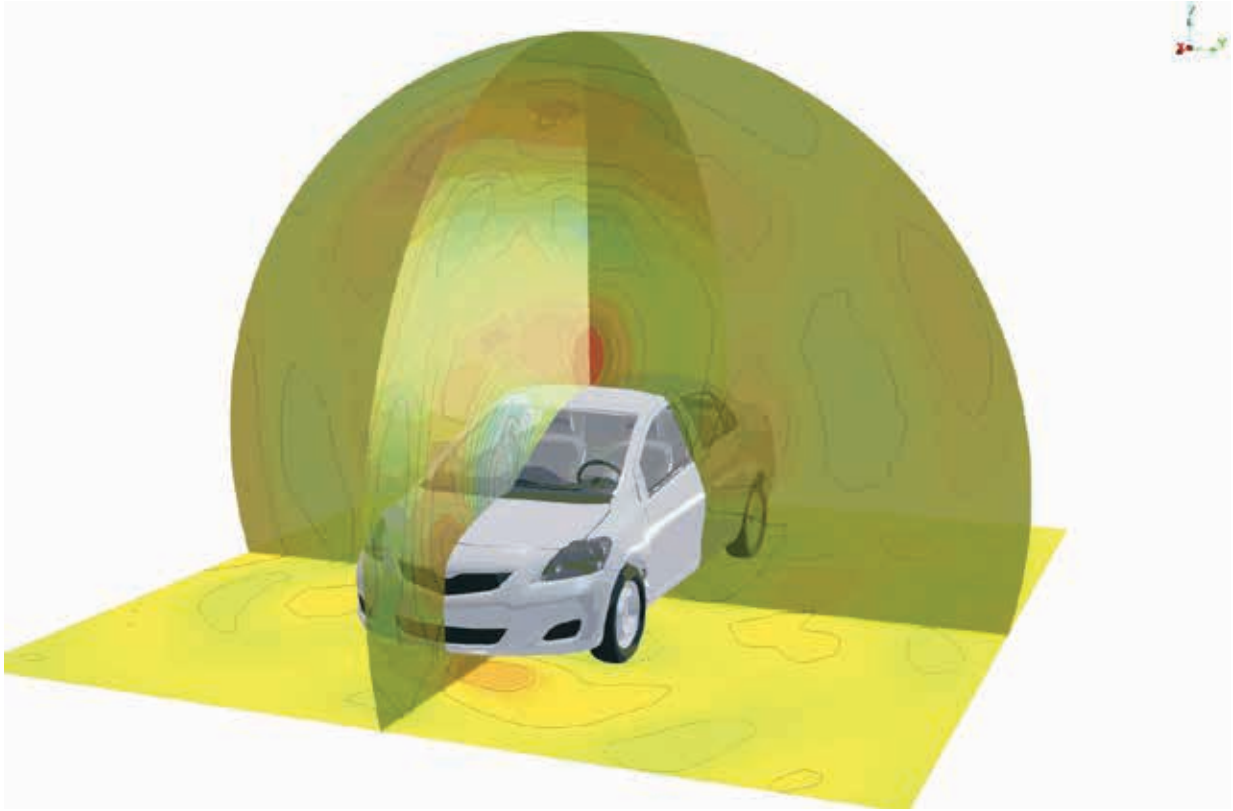
	Other Algorithm	Pressure Equilibrium
Point test		
Patch test		
	Error: 11.4%	**Error: 3.7%**

"Vibroacoustic Coupling: a new approach" – Kostas Skolarikis
Day 2, 15th of June at 17:30

ANSA PRE PROCESSOR
META POST PROCESSOR
EPILYSIS SOLVER

- New algorithm: Pressure equilibrium ...des higher ...racy
- New Inspect FS coupling tool to visually check or recalculate a coupling result
- Common FS coupling algorithms across BETA suite

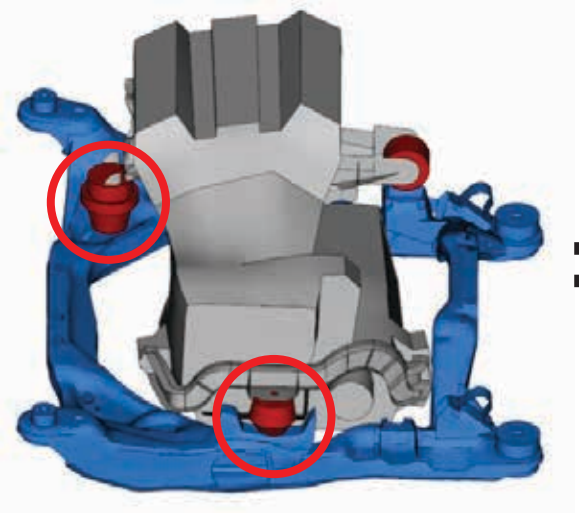
Classic FEA: Support of ACTRAN



ANSA PRE PROCESSOR META POST PROCESSOR

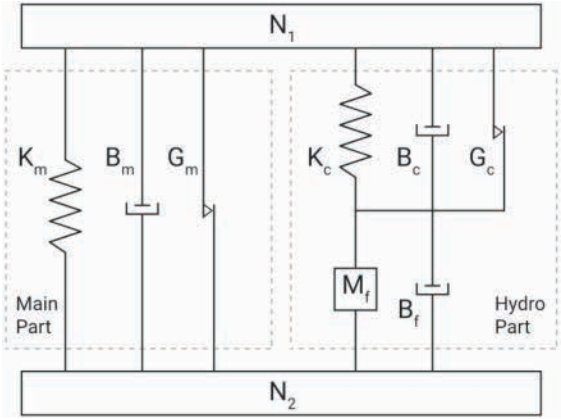
- ACTRAN deck is continuously enriched
- Exterior & Interior Vibroacoustics are supported

Classic FEA: Hydromount connector



Hydro Mounts between PT and Subframe

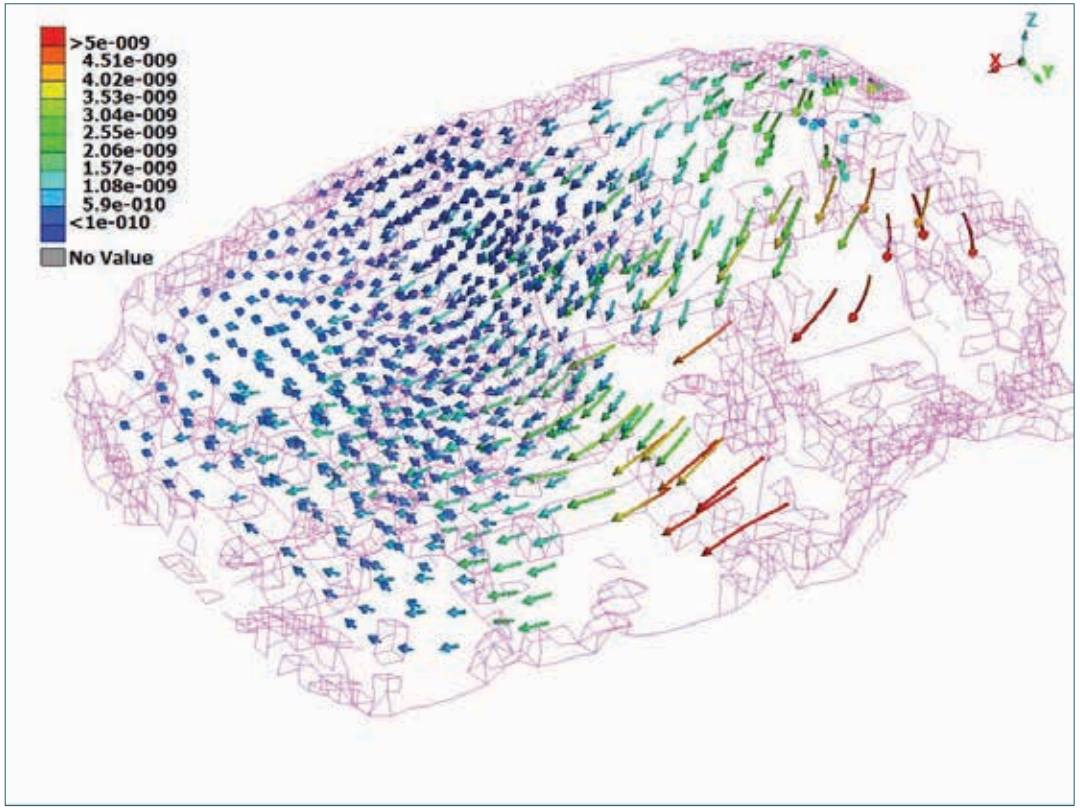
=



Hydro Mount mechanical realization in ANSA/META (Hydro part is 1D)

- BETA implementation consists of **Main Part** (K_m, B_m, G_m) and **Hydro Part** (K_c, B_c, G_c and fluid M_f, B_f)
- Connector type in ANSA and in META FRF Assembly

Classic FEA: EPILYSIS

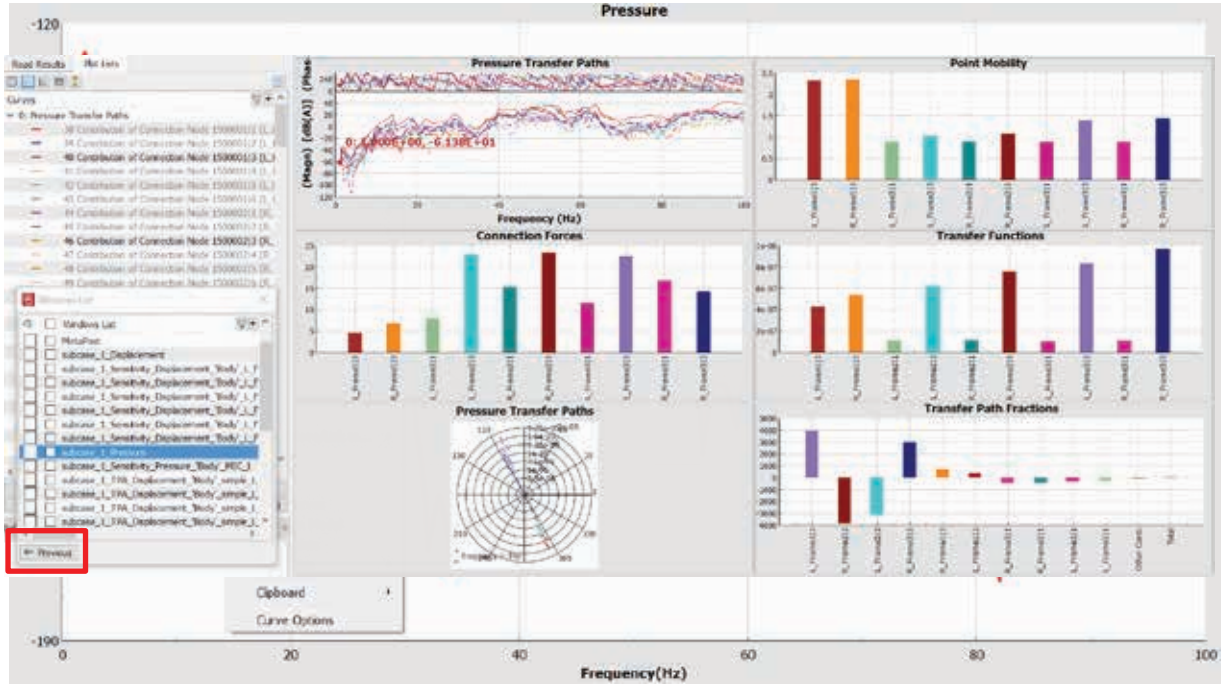


EPILYSIS SOLVER

- Improved robustness of AMLS
- Output of full damping matrix from a SOL103
- Calculation of Mechanical & Sound intensity

Classic FEA: User Productivity

META
POST PROCESSOR



- Easier navigation through diagnostic results

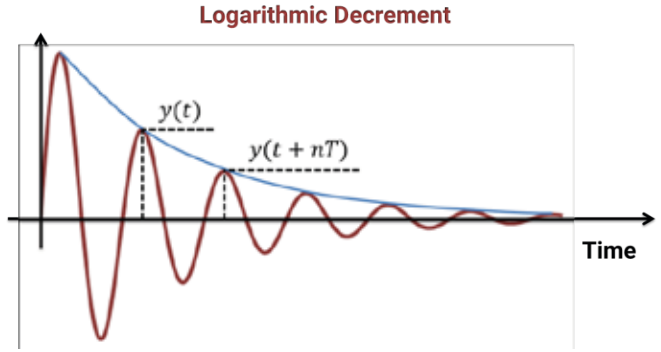
Classic FEA: Grid/Panel/Modal Participation Analysis

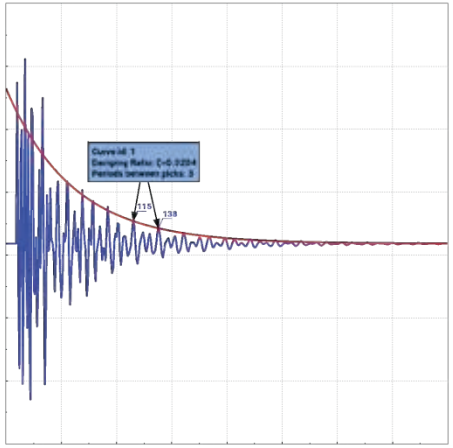
META
POST PROCESSOR

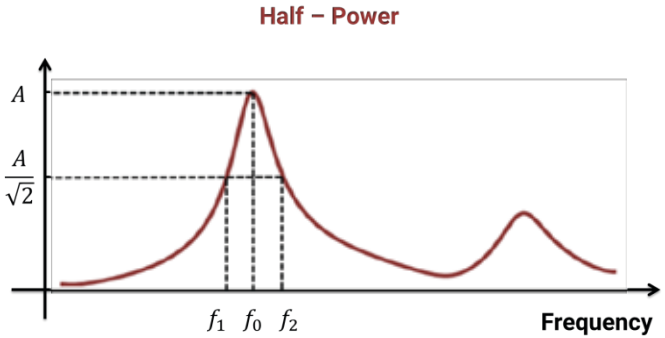
- What-If studies to identify
  - Candidate areas
  - Candidate panels
  - Critical modes

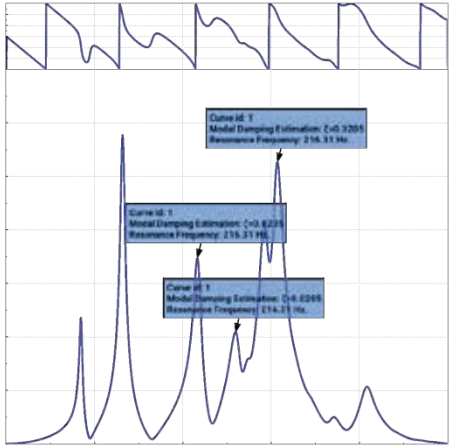
  for CAE-driven NVH performance improvements
- Advanced modal/panel/grid point participation analysis

Classic FEA: Damping Estimation





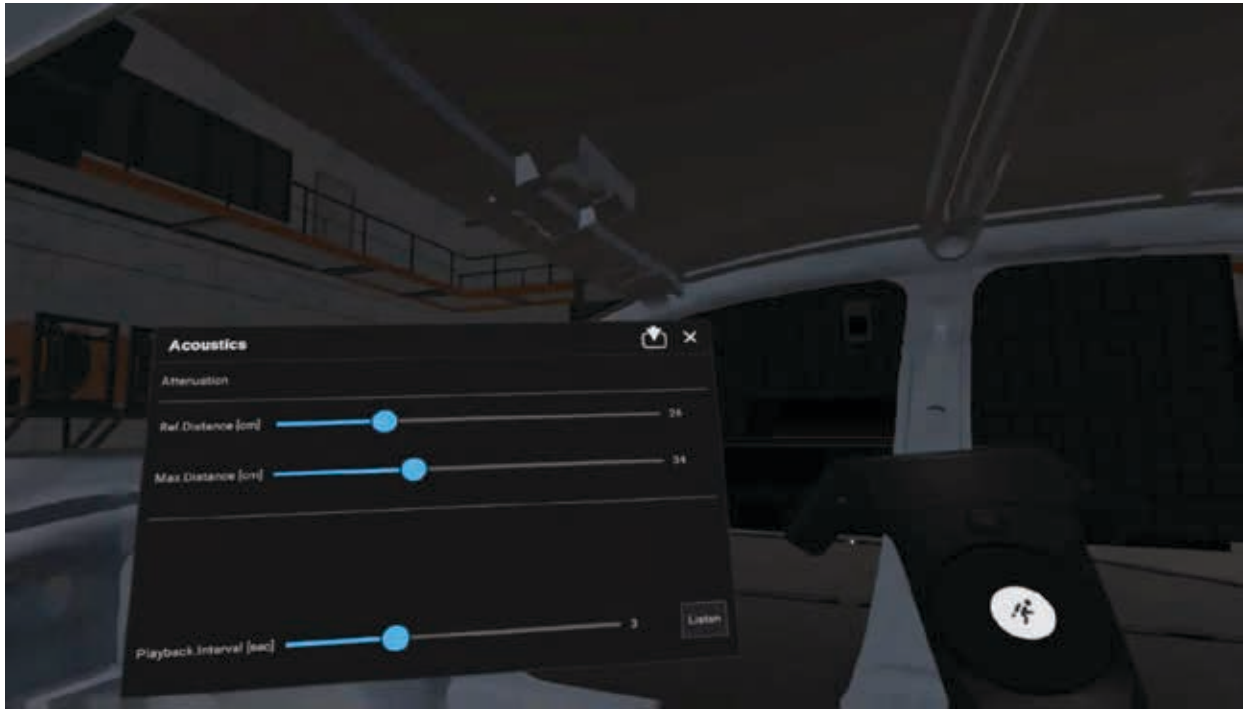




- From Time domain
- From Frequency domain

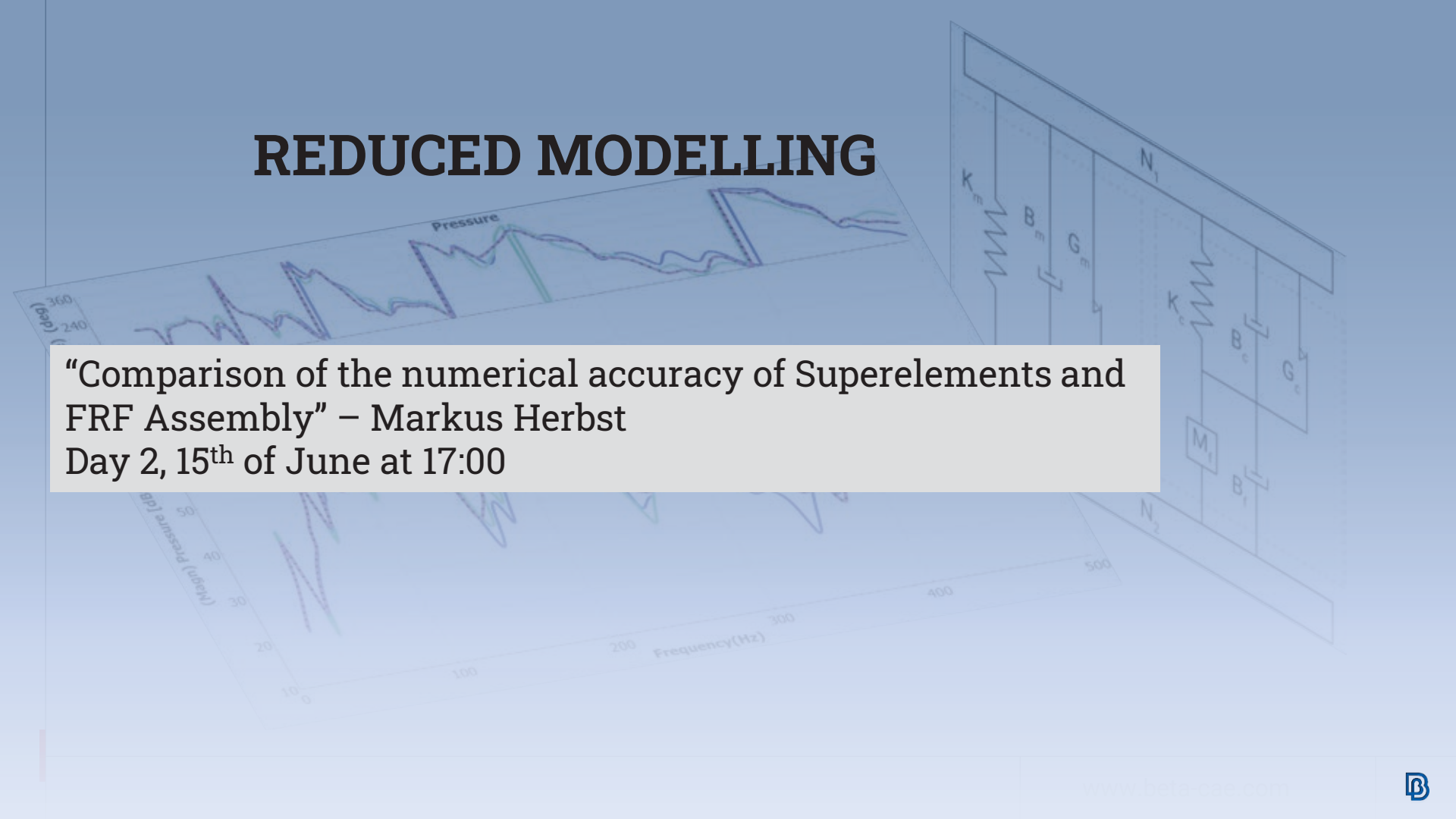
Classic FEA: VR - NVH

META
POST PROCESSOR



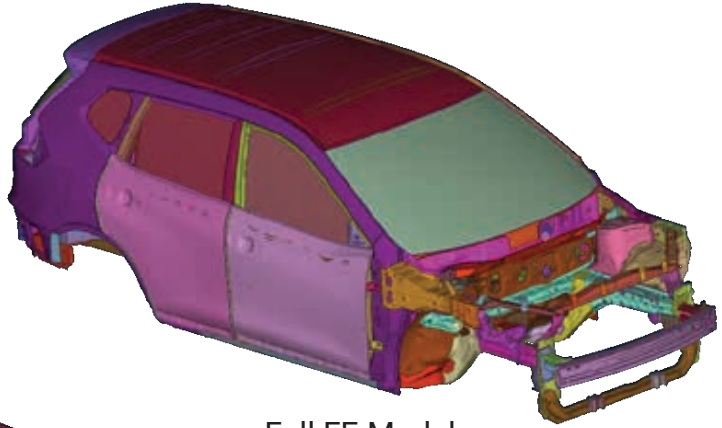
- Acoustic analysis support
- Listen to the sound pressure
- Mark the acoustic source

REDUCED MODELLING

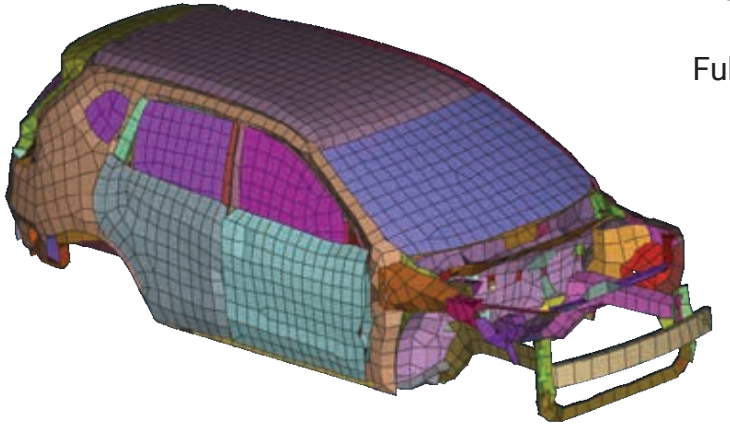


"Comparison of the numerical accuracy of Superelements and FRF Assembly" – Markus Herbst
Day 2, 15th of June at 17:00

Reduced Modelling: Creation of representations



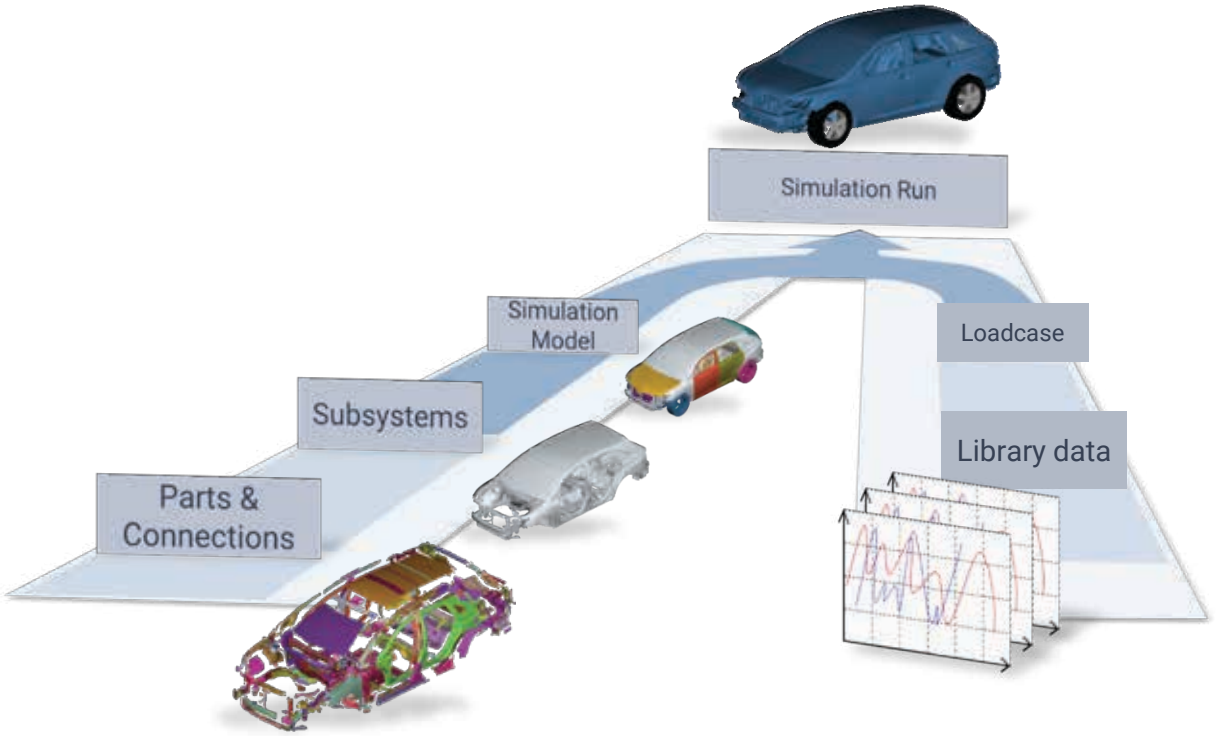
Full FE Model



Display Model

- Enhanced Display Model creation

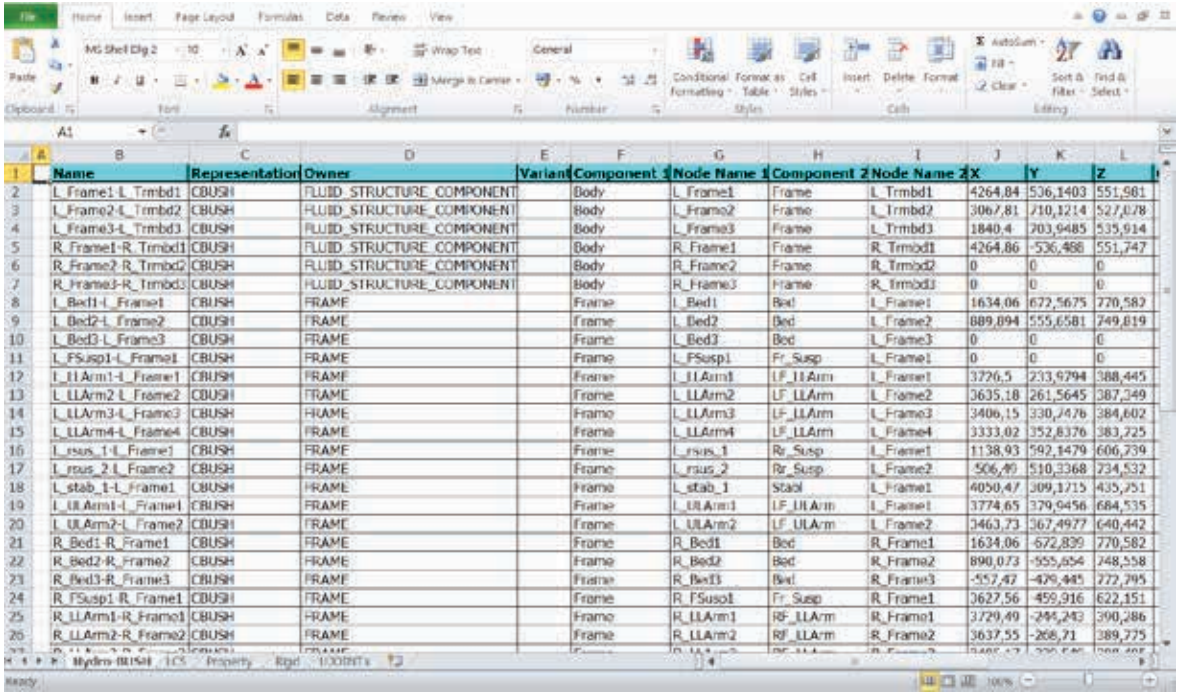
Reduced Modelling: Creation of representations



ANSA PRE PROCESSOR

- Creation of reduced representations incorporated in the Modular Environment
- Versioning of reduced models

Reduced Modelling: NVH Console



	Name	Representation	Owner	Variant	Component 1	Node Name 1	Component 2	Node Name 2	X	Y	Z
2	L_Frame1-L_Trmbd1	CBUSH	FLUID_STRUCTURE_COMPONENT		Body	L_Frame1	Frame	L_Trmbd1	4264,84	536,1403	551,981
3	L_Frame2-L_Trmbd2	CBUSH	FLUID_STRUCTURE_COMPONENT		Body	L_Frame2	Frame	L_Trmbd2	3067,81	710,1214	527,078
4	L_Frame3-L_Trmbd3	CBUSH	FLUID_STRUCTURE_COMPONENT		Body	L_Frame3	Frame	L_Trmbd3	1840,4	703,9485	535,914
5	R_Frame1-R_Trmbd1	CBUSH	FLUID_STRUCTURE_COMPONENT		Body	R_Frame1	Frame	R_Trmbd1	4264,86	-536,488	551,747
6	R_Frame2-R_Trmbd2	CBUSH	FLUID_STRUCTURE_COMPONENT		Body	R_Frame2	Frame	R_Trmbd2	0	0	0
7	R_Frame3-R_Trmbd3	CBUSH	FLUID_STRUCTURE_COMPONENT		Body	R_Frame3	Frame	R_Trmbd3	0	0	0
8	L_Bed1-L_Frame1	CBUSH	FRAME		Frame	L_Bed1	Bed	L_Frame1	1634,06	672,5675	770,582
9	L_Bed2-L_Frame2	CBUSH	FRAME		Frame	L_Bed2	Bed	L_Frame2	889,894	555,6581	749,819
10	L_Bed3-L_Frame3	CBUSH	FRAME		Frame	L_Bed3	Bed	L_Frame3	0	0	0
11	L_FSusp1-L_Frame1	CBUSH	FRAME		Frame	L_FSusp1	Fr_Susp	L_Frame1	0	0	0
12	L_LLArm1-L_Frame1	CBUSH	FRAME		Frame	L_LLArm1	LF_LLArm	L_Frame1	3726,5	233,6794	388,445
13	L_LLArm2-L_Frame2	CBUSH	FRAME		Frame	L_LLArm2	LF_LLArm	L_Frame2	3635,18	261,5645	387,349
14	L_LLArm3-L_Frame3	CBUSH	FRAME		Frame	L_LLArm3	LF_LLArm	L_Frame3	3406,15	330,2476	384,602
15	L_LLArm4-L_Frame4	CBUSH	FRAME		Frame	L_LLArm4	LF_LLArm	L_Frame4	3333,02	352,8376	383,725
16	L_rsus_1-L_Frame1	CBUSH	FRAME		Frame	L_rsus_1	Rr_Susp	L_Frame1	1138,93	592,1479	606,739
17	L_rsus_2-L_Frame2	CBUSH	FRAME		Frame	L_rsus_2	Rr_Susp	L_Frame2	506,49	510,3368	734,532
18	L_stab_1-L_Frame1	CBUSH	FRAME		Frame	L_stab_1	Stabl	L_Frame1	4050,47	309,1715	435,751
19	L_ULArm1-L_Frame1	CBUSH	FRAME		Frame	L_ULArm1	LF_ULArm	L_Frame1	3774,65	379,9456	684,535
20	L_ULArm2-L_Frame2	CBUSH	FRAME		Frame	L_ULArm2	LF_ULArm	L_Frame2	3463,73	367,4977	640,442
21	R_Bed1-R_Frame1	CBUSH	FRAME		Frame	R_Bed1	Bed	R_Frame1	1634,06	-672,839	770,582
22	R_Bed2-R_Frame2	CBUSH	FRAME		Frame	R_Bed2	Bed	R_Frame2	890,073	-555,654	748,558
23	R_Bed3-R_Frame3	CBUSH	FRAME		Frame	R_Bed3	Bed	R_Frame3	-557,47	-479,445	772,795
24	R_FSusp1-R_Frame1	CBUSH	FRAME		Frame	R_FSusp1	Fr_Susp	R_Frame1	3627,56	459,916	622,151
25	R_LLArm1-R_Frame1	CBUSH	FRAME		Frame	R_LLArm1	RF_LLArm	R_Frame1	3729,49	-244,243	390,286
26	R_LLArm2-R_Frame2	CBUSH	FRAME		Frame	R_LLArm2	RF_LLArm	R_Frame2	3637,55	-268,71	389,775

ANSA
PRE PROCESSOR

- Increased productivity through:
  - Connectors List redesign
  - Import / Export of connectors in XLSX

Reduced Modelling: NVH Console

Dynamic - Equivalent Stiffness

Dynamic Stifness Start Frequency	100.0 Hz
Dynamic Stifness End Frequency	400.0 Hz
Calculate System Modes	Yes
Up to	3.0 Hz
Equivalent stifness at	2.0 Hz

Dynamic - Equivalent Stiffness Values

Component	Node Name	DOF	Freq. Range	Average Value of Dynamic Stifness	Equivalent stifness Value
Frame	PwrTrn_r	+Z Translation	100-400	4627.222934319405	656.8369573737815
Frame	EXH_04	+Z Translation	100-400	15981.587320683519	693.9351824612257
Frame	EXH_03	+Z Translation	100-400	543.8561055909961	338.53980069317843
Frame	EXH_02	+Z Translation	100-400	142.72653004861874	148.28728317571333
Frame	EXH_01	+Z Translation	100-400	1749.741247533914	489.28740402275?2
Frame	PwrTrn_r	+Z Rotation	100-400	1518143079.1091814	920749339.2502921
Frame	EXH_04	+Z Rotation	100-400	685027842.3543634	526720700.0753234
Frame	EXH_03	+Z Rotation	100-400	216567294.17482448	155044999.13101172
Frame	EXH_02	+Z Rotation	100-400	192859120.17846534	144753634.94929835
Frame	EXH_01	+Z Rotation	100-400	71106098.74001783	68411378.89215992
Frame	PwrTrn_r	+Y Translation	100-400	9855.807120068115	875.7107242814405
Frame	RHSG_RF	+Y Translation	100-400	61476.71997912875	882.7983498472504
Frame	EXH_04	+Y Translation	100-400	3344.4944092878336	838.7627620695246
Frame	EXH_03	+Y Translation	100-400	874.8352341764225	700.2458322161564
Frame	EXH_02	+Y Translation	100-400	311.2135487896294	207.97738221543804
Frame	EXH_01	+Y Translation	100-400	16548.62737400144	750.6206204067709
Frame	PwrTrn_r	+Y Rotation	100-400	28317274.84084443	4238379.60931445
Frame	RHSG_RF	+Y Rotation	100-400	3002165.553472758	2990512.351878115
Frame	RHSG_LR	+Y Rotation	100-400	1915475.0604361522	1944002.233045368
Frame	EXH_04	+Y Rotation	100-400	924235530.0209875	228046879.4867256
Frame	EXH_03	+Y Rotation	100-400	5756370.909469948	9220647.258776372

- Dynamic Equivalent Stiffness loadcase
  - Streamlined loadcase creation
  - Spreadsheet and .unv format output

Reduced Modelling: NVH Console

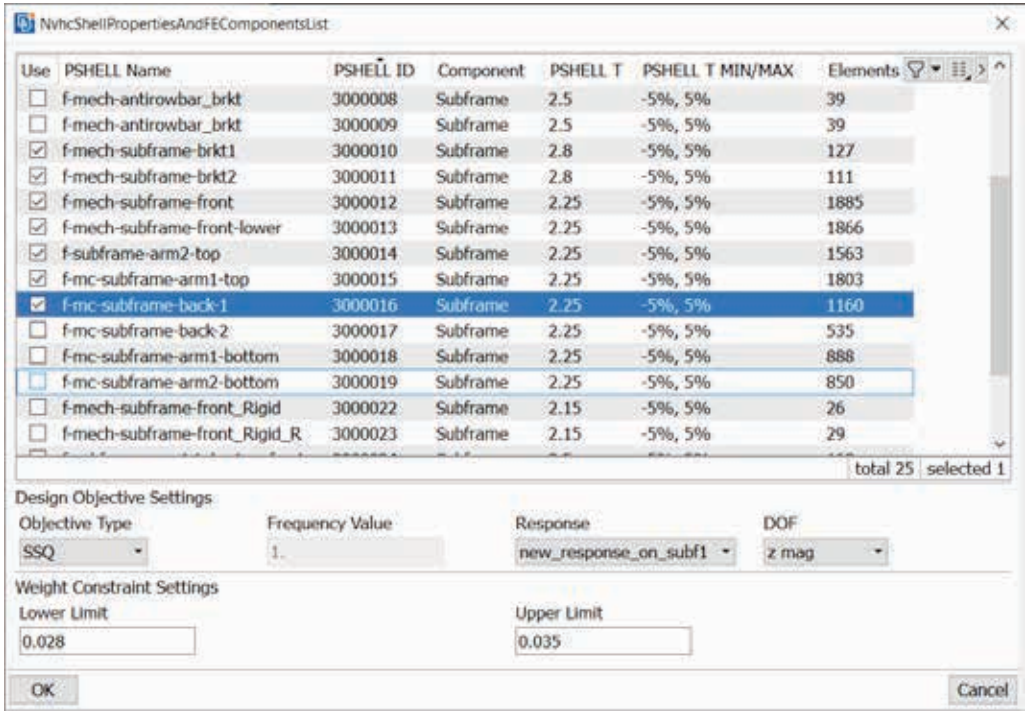
"New optimization capabilities in NVH-Console" – Grigorios Kalampoukas
Day 2, 15th of June at 14:00

ANSA PRE PROCESSOR

Optimization/DOE

- Seamless set-up of optimization variables, responses and
ves in ANSA
zation Tool
NVH Console
- Monte Carlo algorithm for DOE

Reduced Modelling: NVH Console



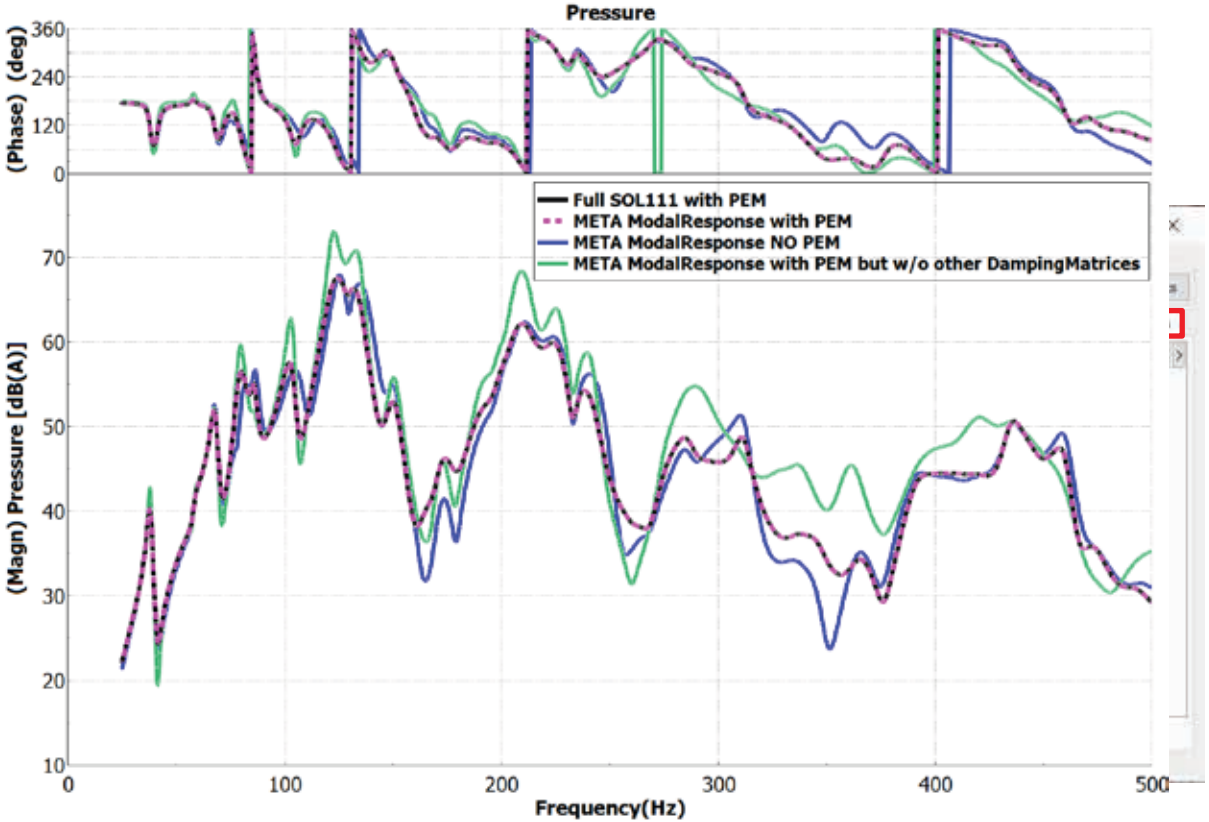
- Nastran SOL200 GUI within NVH-Console
- Panels and thickness parameters as design variables
- Various response settings, e.g. objective type SSQ, AVG, etc.

Reduced Modelling: Modal Response tool

META
POST PROCESSOR

- Acoustic Sources in Modal Response and FRF Assembly
- Modal displacements as input for Frequency and Transient Response analysis
- Pam-Crash erfh5 & Optistruct h3d for modal basis input
- Complete API for Modal Response and FRF Assembly

Reduced Modelling: Modal Response tool



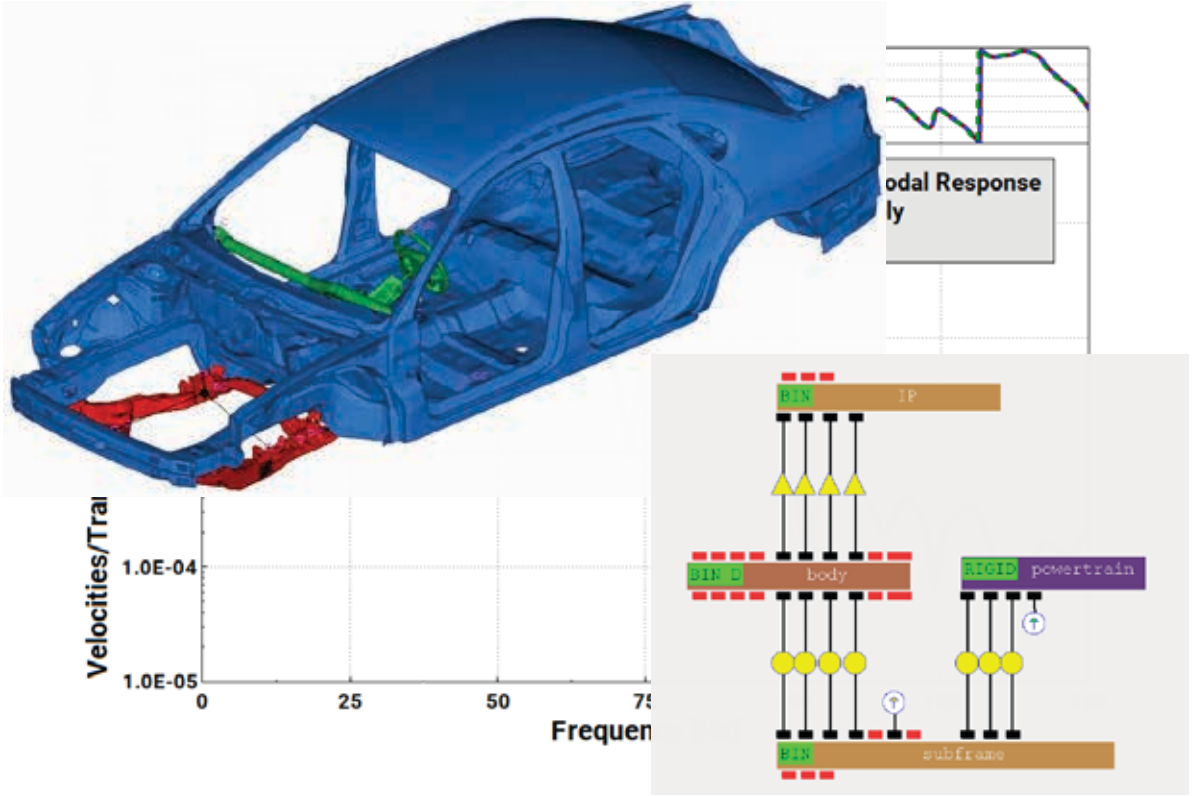
Demo Example

Modal Matrices in Modal Response

META
POST PROCESSOR

- Support & management of modal matrices
- Supported types:
  - Viscous damping
  - Structural damping
  - PEM (poroelastic)
- META FSI can be combined with PEM for what-if studies
- Perfect correlation with FE solution results

Reduced Modelling: Fast SOL103

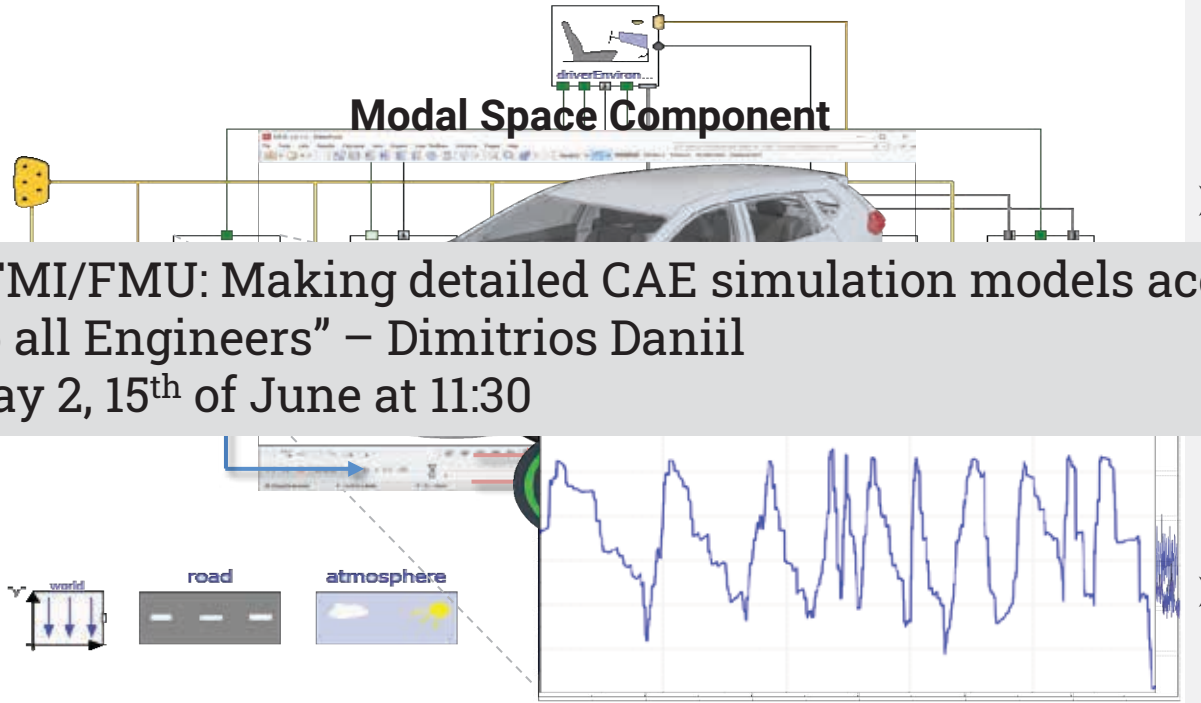


ANSA PRE PROCESSOR

EPILYSIS SOLVER

- Easy and robust set-up of Fast SOL103 from within NVHConsole
- Support of modal damping matrices BHH and KHH (input and output)

Reduced Modelling: System-Level simulation



"FMI/FMU: Making detailed CAE simulation models accessible to all Engineers" – Dimitrios Daniil
Day 2, 15th of June at 11:30

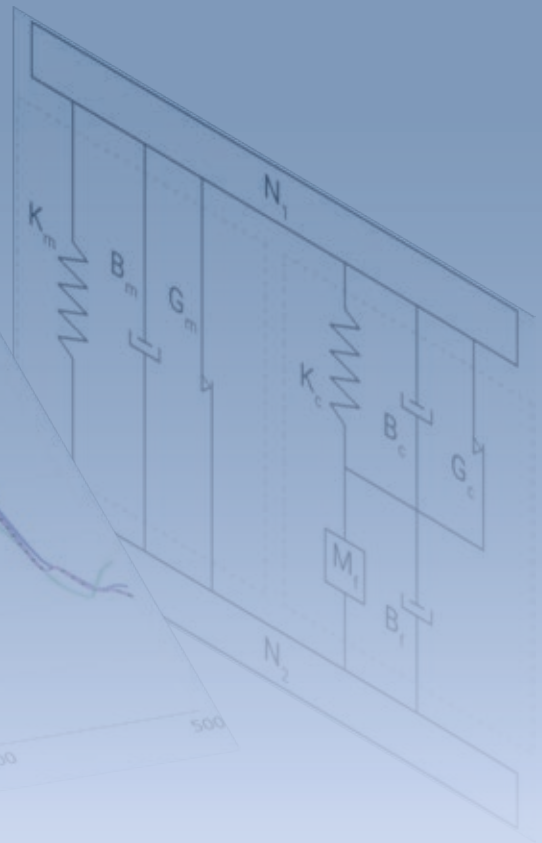
META POST PROCESSOR

EPILYSIS SOLVER

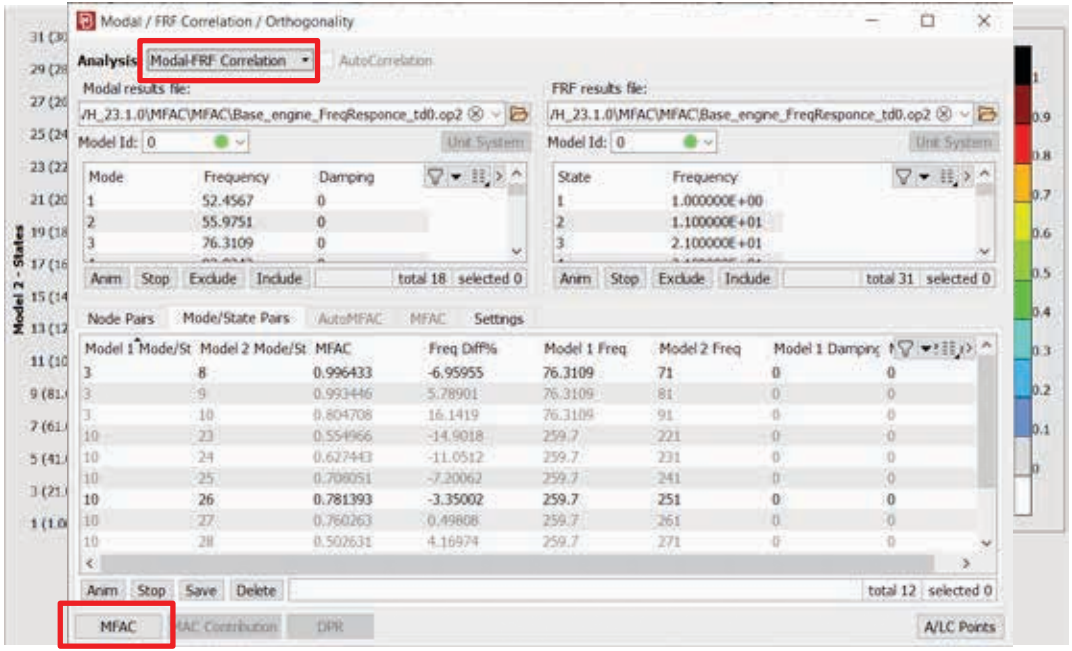
KOMVOS SDM CONSOLE

- Modal Transient Response export as Functional Mock-Up Unit
- State Space equations export as Functional Mock-Up Unit from Epilysis
- ML Predictors export as Functional Mock-Up Units from KOMVOS

TESTING



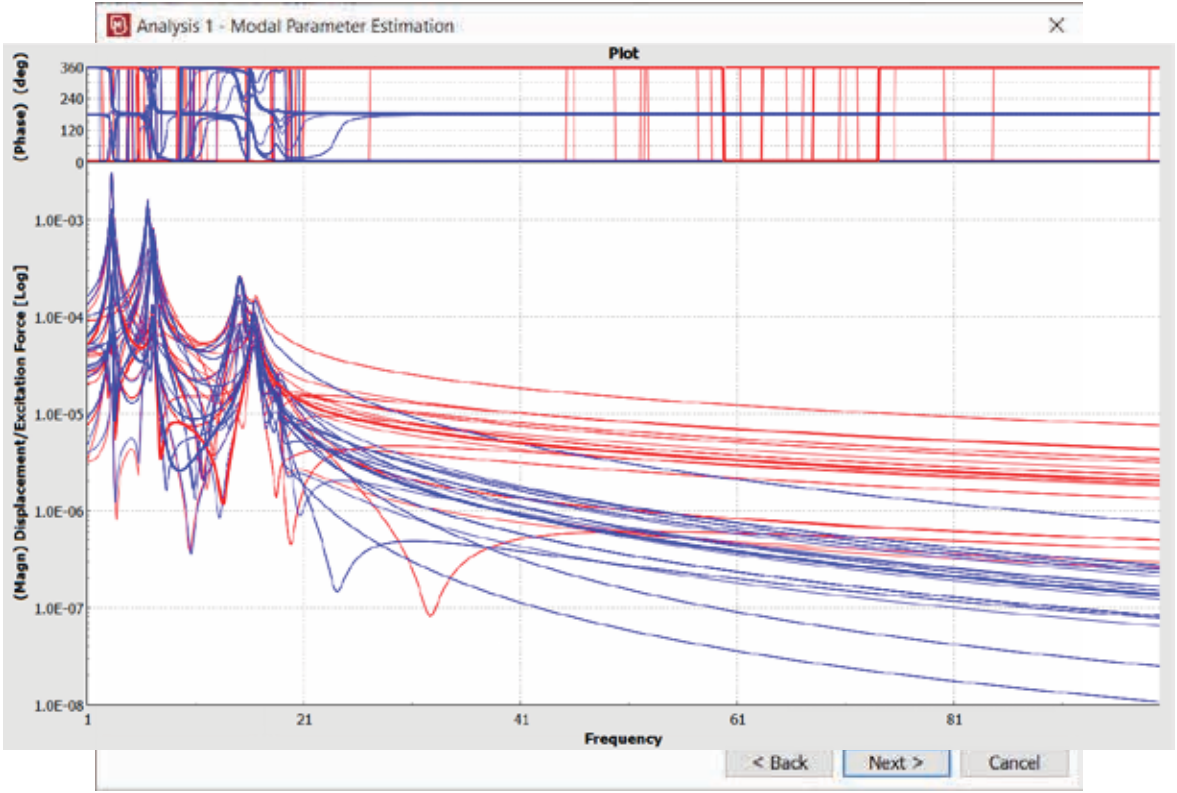
Testing: Modal/FRF Correlation tool



- Calculation of Orthogonality
- Calculation of MFAC: Correlation of Modal and FRF data

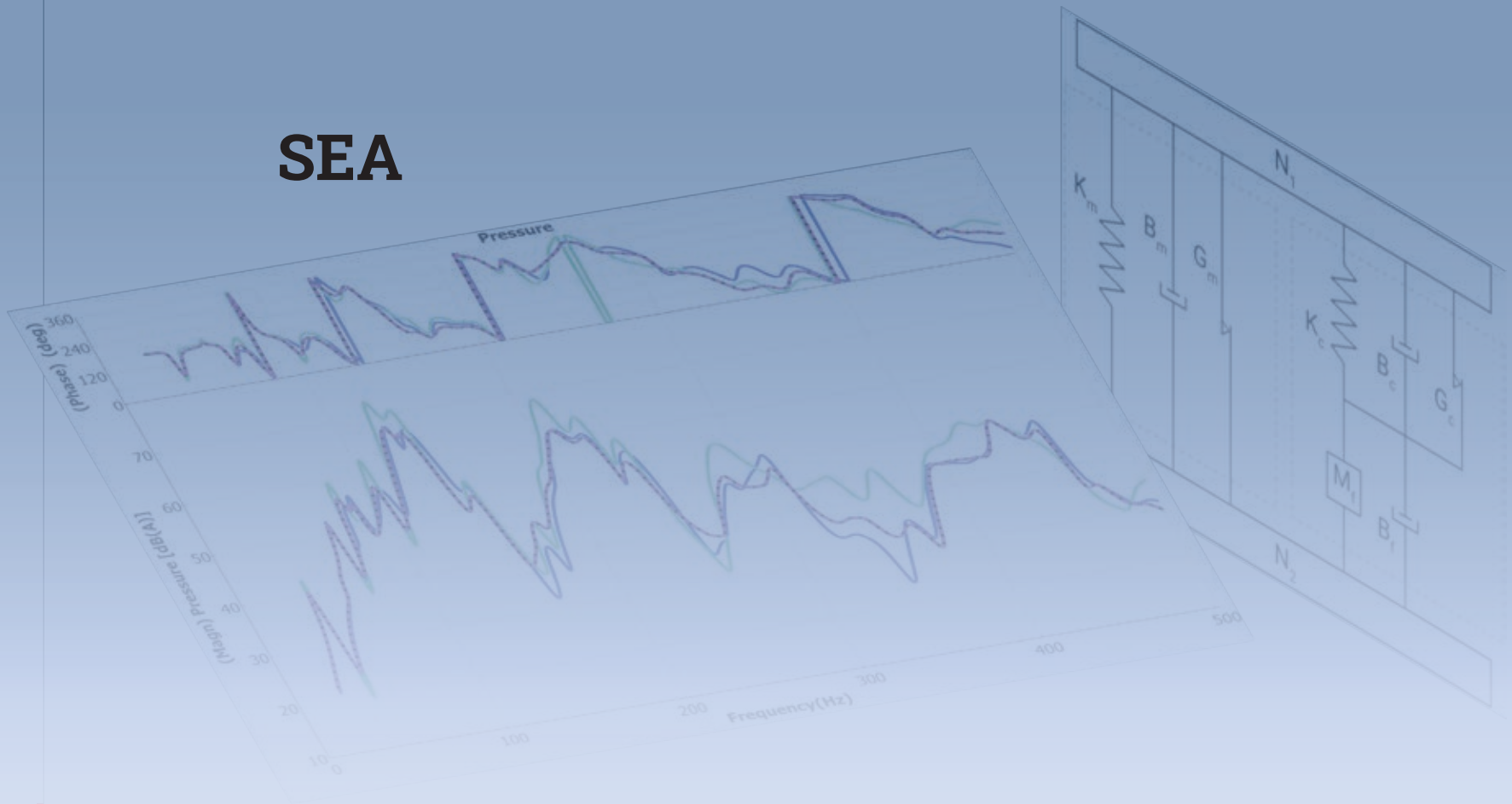
Testing: Modal Parameter Estimation tool

META
POST PROCESSOR

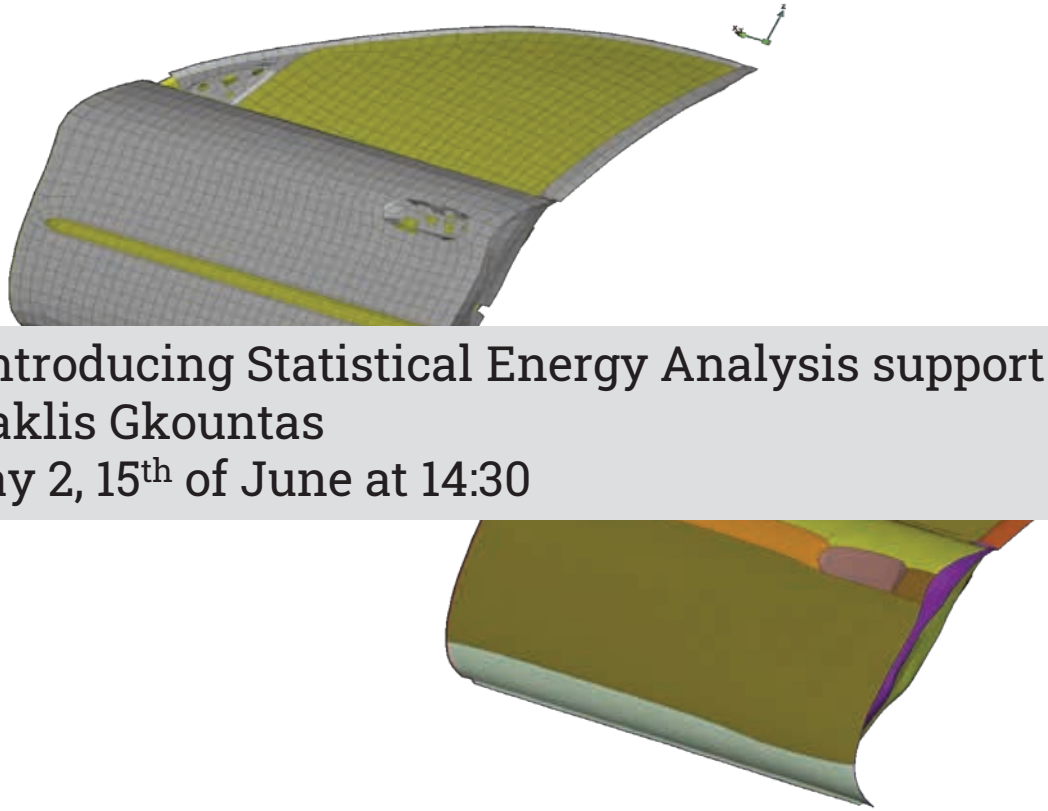


- Calculation of transfer functions based on the calculated poles
- Better selection of poles
- Verification for estimated modes

SEA



SEA: Set up of SEA model

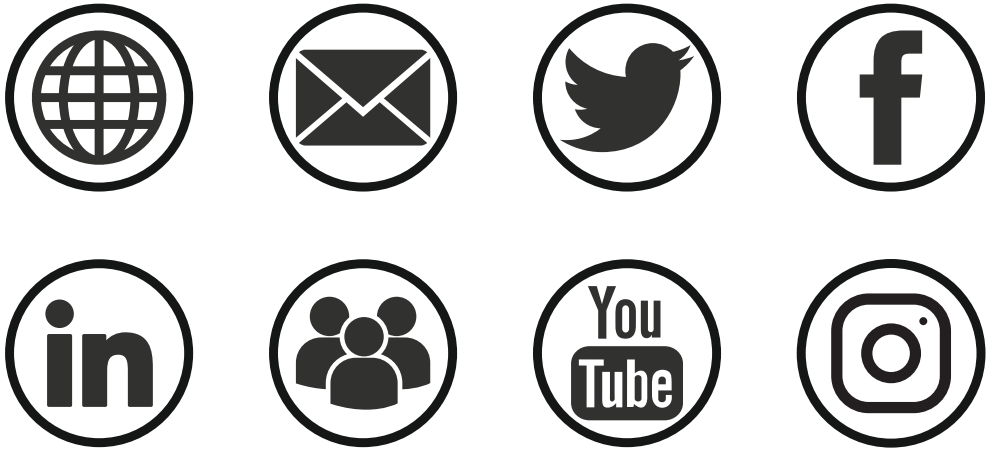


"Introducing Statistical Energy Analysis support in ANSA" – Iraklis Gkountas
Day 2, 15th of June at 14:30

ANSA
PRE PROCESSOR

- Support of Analytical SEA
- Process from FEA model to SEA model through ard ANSA onality
- & Edit SEA Subsystems, junctions, properties, materials
- I/O of SEA xml

BETA
SIMULATION SOLUTIONS



Thank you &
Stay connected