CDH/OPT and NX/NASTRAN a industry leading solution

Mladen Chargin

CDH AG

chargin@garlic.com

408-848-5716

Premium Partners:

CDH/OPT

- What is CDH/OPT?
  - An extension to NX/NASTRAN
  - Requires User Modifiable NX/NASTRAN (V3)
- Reasons to use:
  - Solve problems ***not possible*** with standard NASTRAN
  - ***Focused*** on NVH optimization for automotive industry
  - Generally faster and uses less disk space

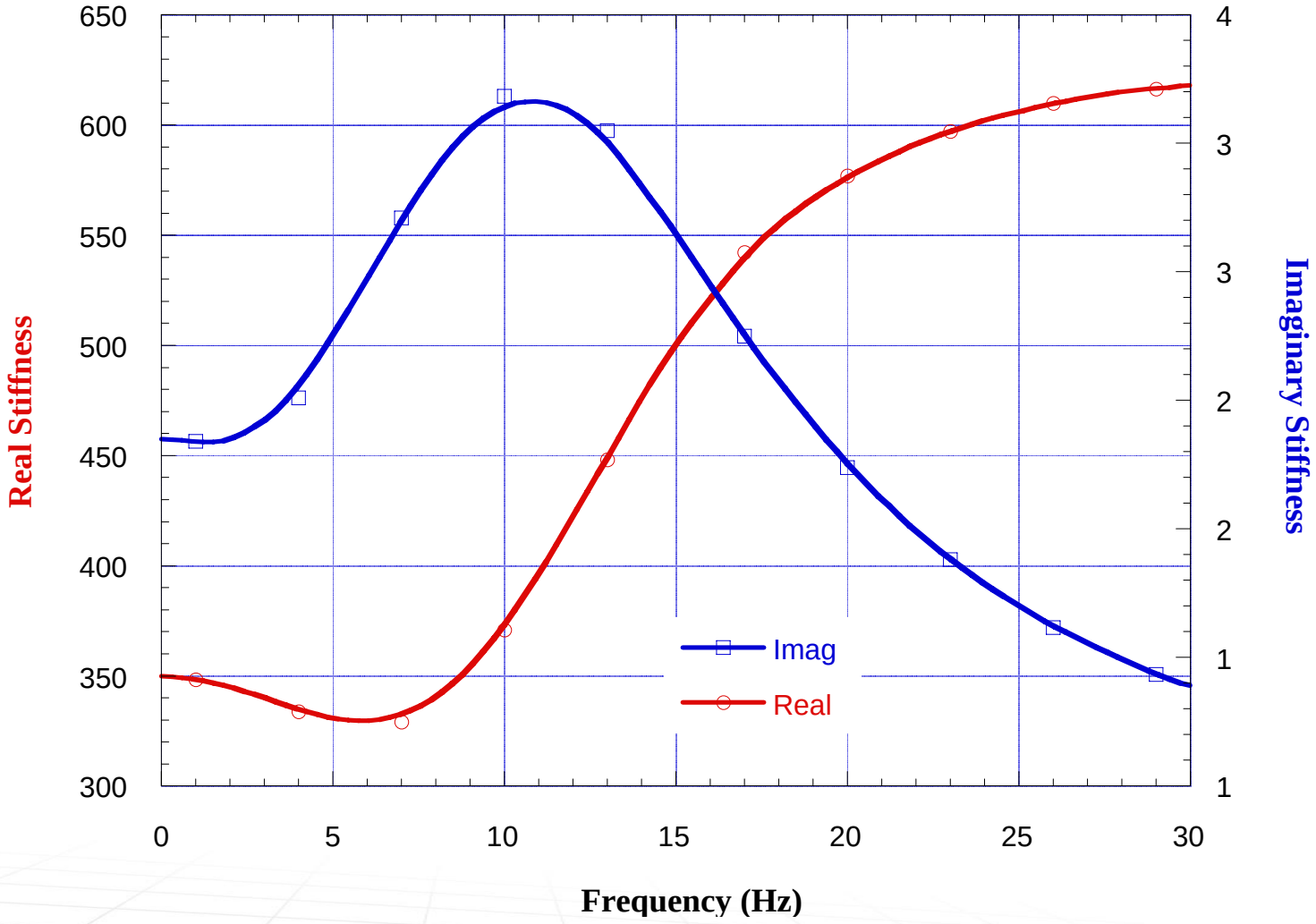
CDH/OPT - Capabilities

- Frequency Dependent Elements/Properties
  - Important for frequency range 100-300+ Hz
- Engine, Body, Exhaust Mount Optimization
- Radiated Noise Optimization by
  - Coupling of NASTRAN with BEM
  - Engine, Oil Pan, Valve Cover, etc.

Freq. Dependent Properties

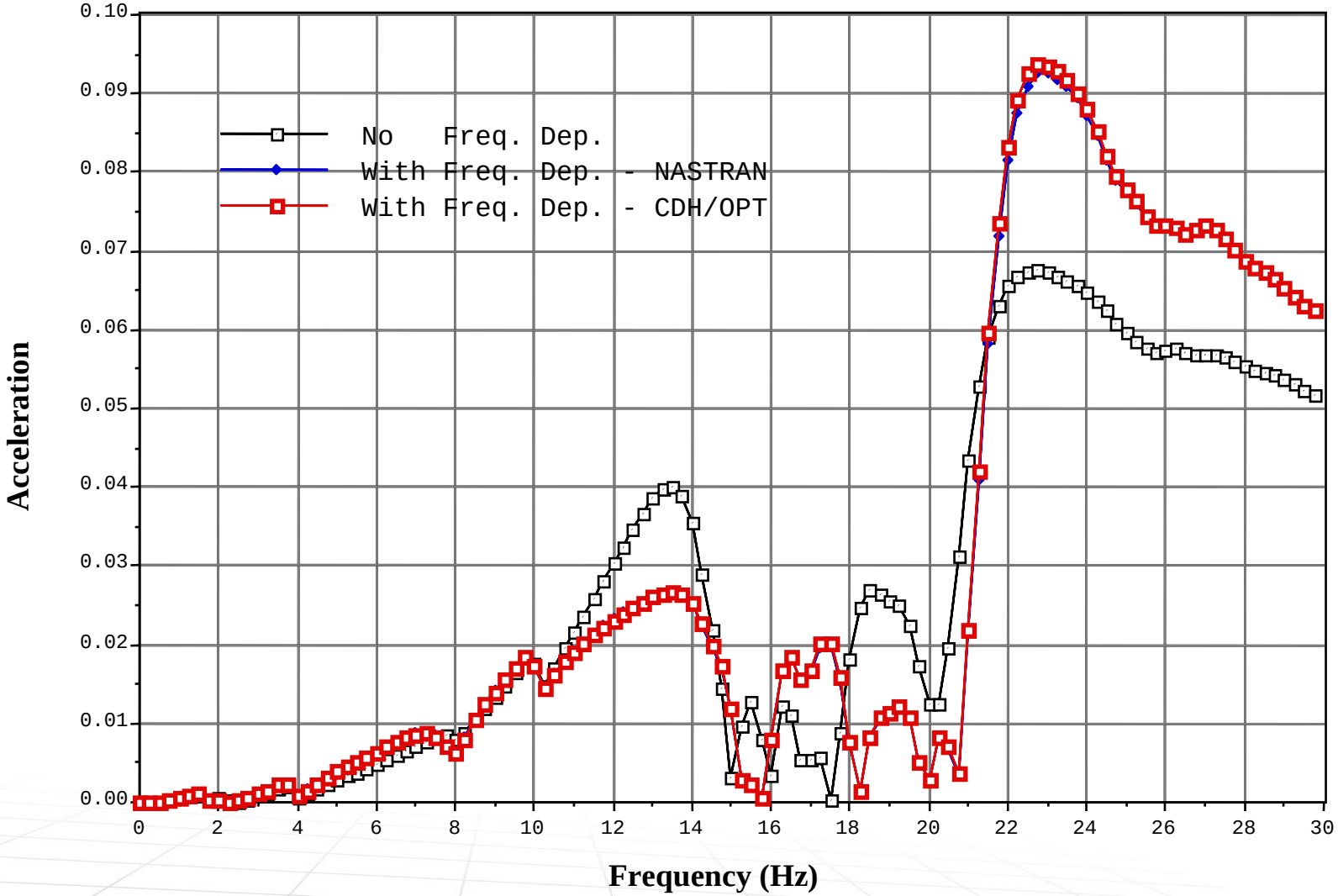
- Different from standard NASTRAN
- Any element w/Pxxxx can be frequency dependent
- Used for modeling hydromounts, rubber bushings
- Modeling mid-frequency response of damped structural panels (floor pan)
- Extremely efficient modal solution scheme
- Used as a foundation for other options

Typical Hydromount Prop.



Full System Model

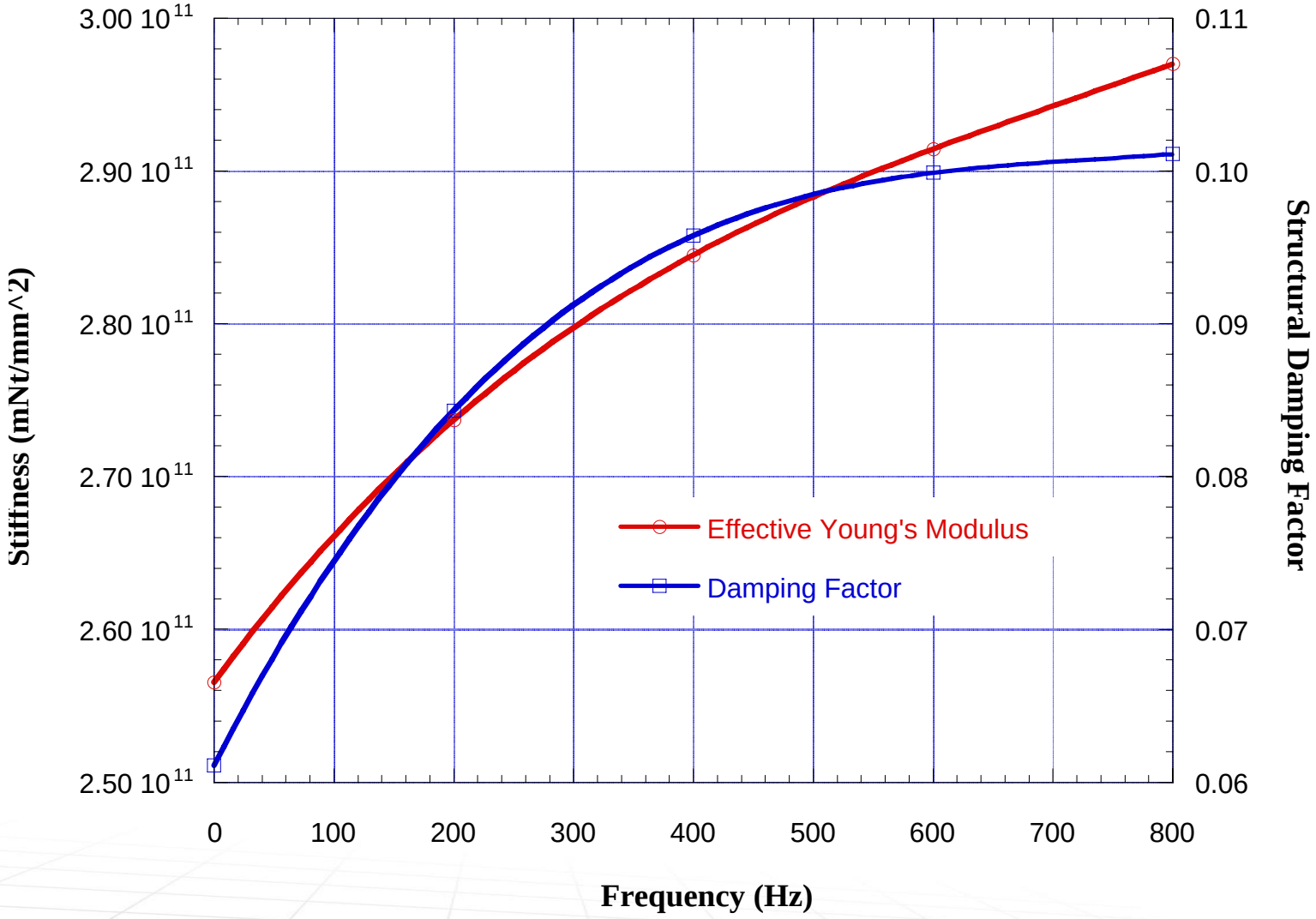
Frequency Dependent Hydromounts



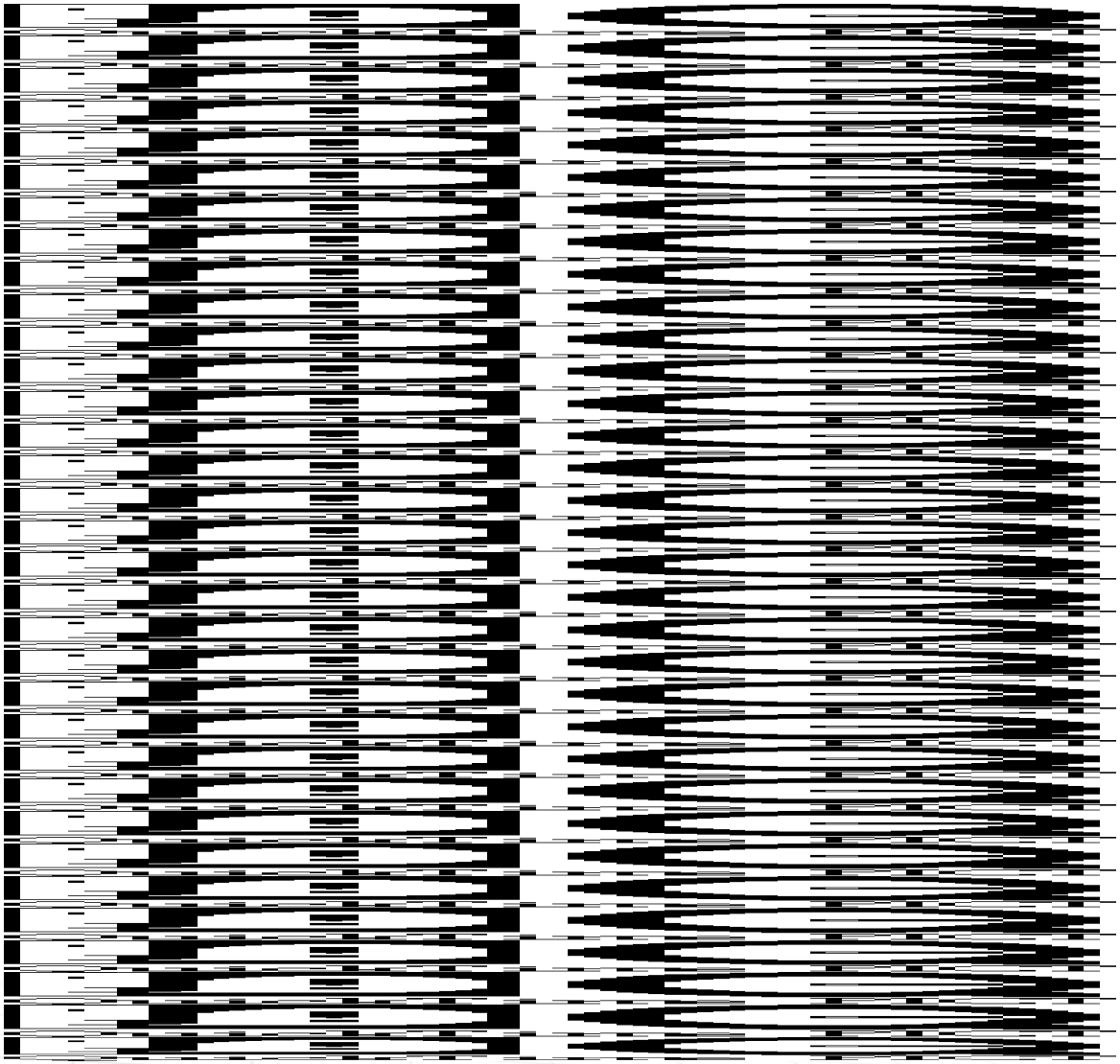
CPU Comparison

- DOFs 6.7M DOFs
- Modes below 200 Hz. - 1767
- Excitation frequency 0 - 30 Hz in 0.25 Hz inc.
- CPU time (SGI/Altix) sec
  - No Freq. Dep. 7097
  - NX/NASTRAN 16736
  - CDH/OPT 7146

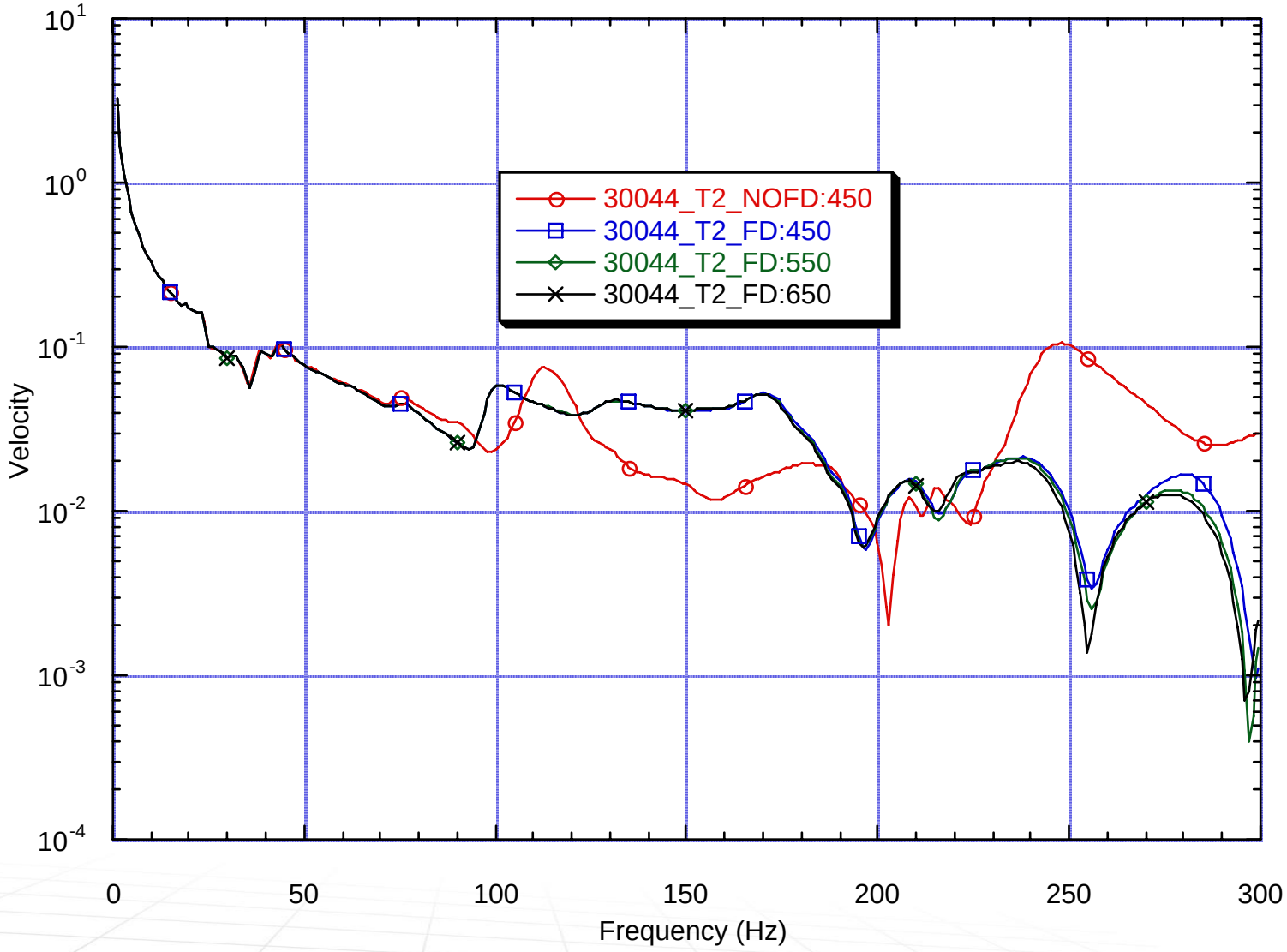
Typical Floor Pan Properties



Acoustic Damping Test



Comparison NoFD vs FD



Mount Optimization

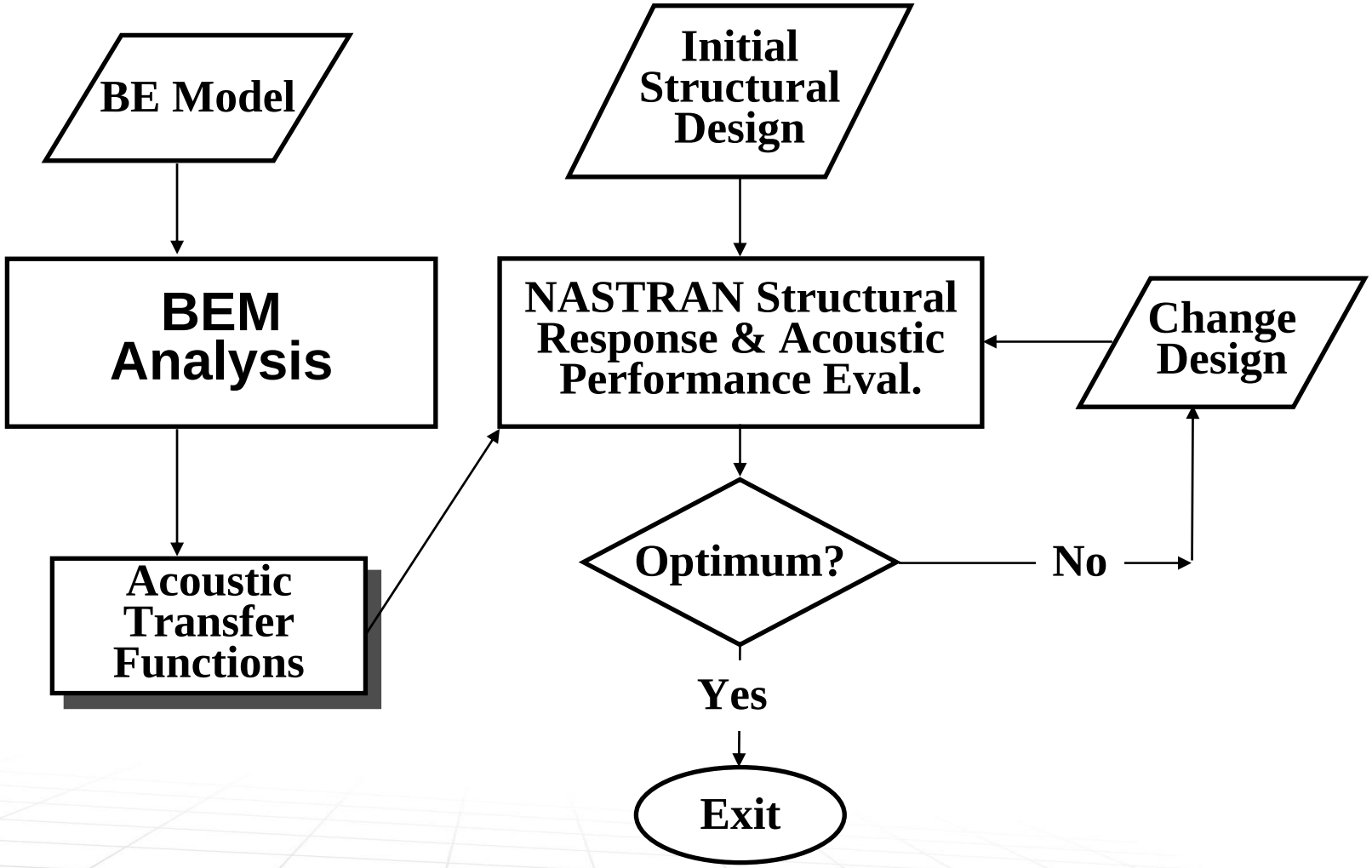
- Two step reduction procedure
  - FRF representation for most of the structure
  - Dynamic reduction to a minimal physical DOFs
  - Reduce a 10^6 order problem to ~ 20-50 DOFs
  - Resulting matrices are frequency dependent
- Needs CDH/OPT freq. dependent capability
- ~10 iter. in SOL 200 require few minutes
- Potential for global optimum by using many starting designs

Radiated Noise Optimization

- Requires frequency dependent capability in CDH/OPT
- Unique capability where <u>BEM is used as a preprocessor</u> to NASTRAN
- BEM not in the optimization loop
  - for thickness changes
  - addition or removal of stiffeners
  - assume no (or small) shape changes
- Output limited for points in the far-field
  - Radiated power obtained from DRESP2
  - Simulate the qualification tests in anechoic chamber

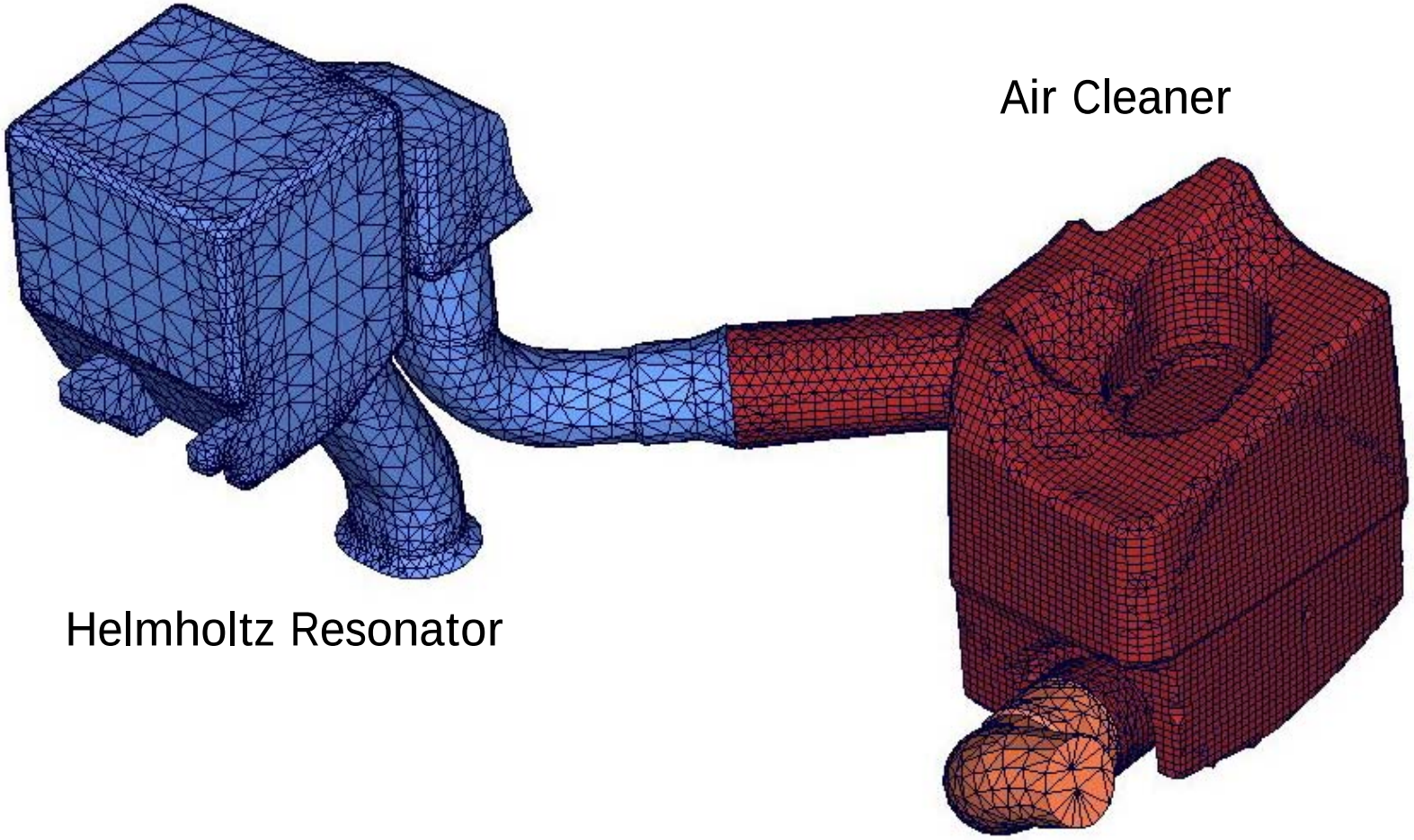
NASTRAN-BEM Coupling

- New Methodology



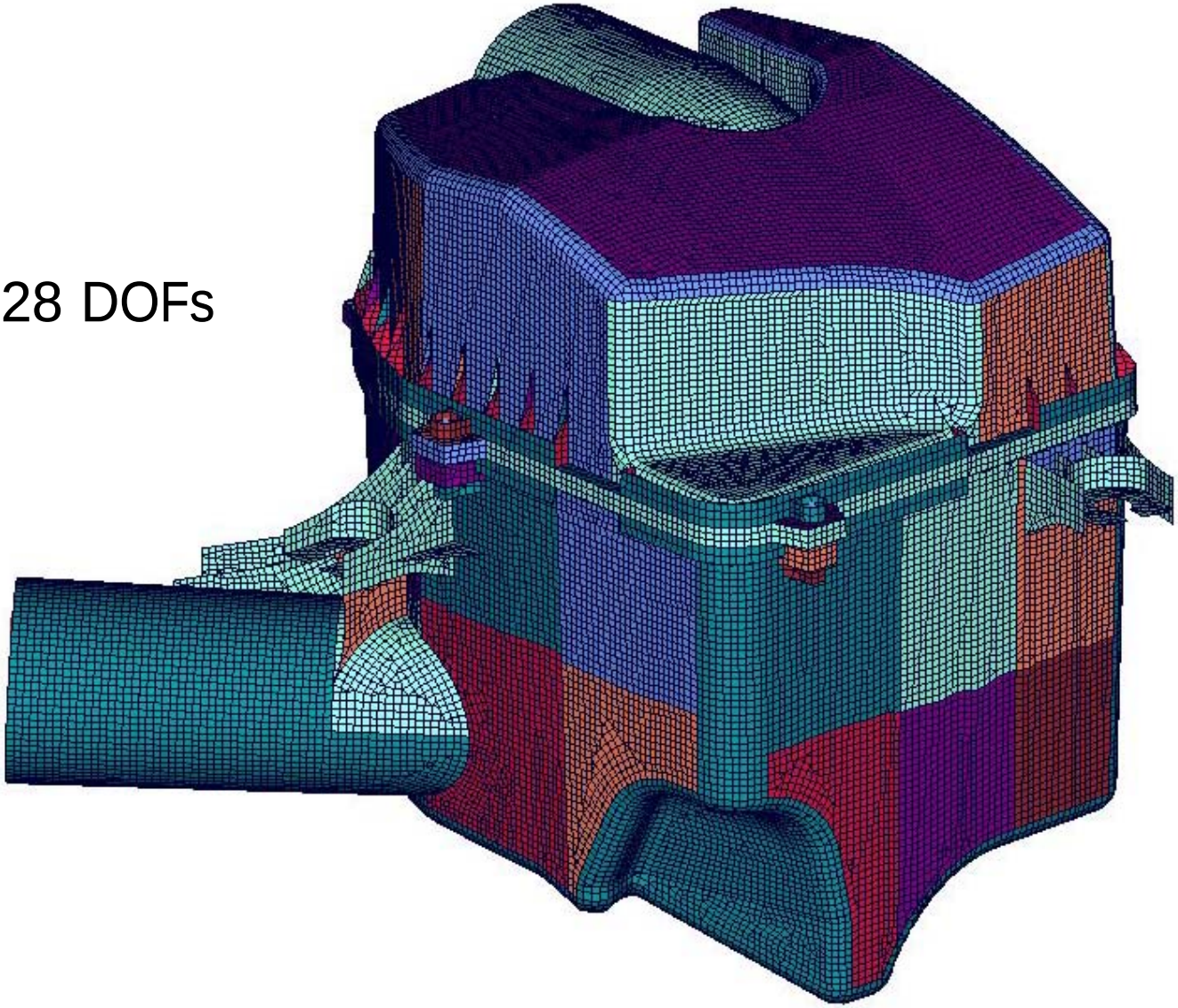
Air Cleaner Application

Air FEM Model for the Interior (42524 DOFs)



Air Cleaner-Structure FEM

406128 DOFs

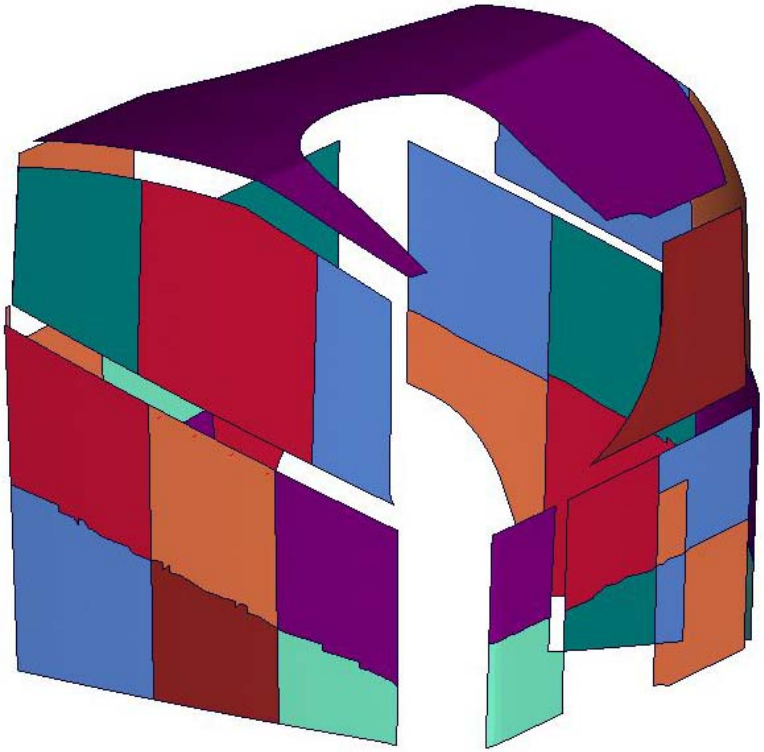


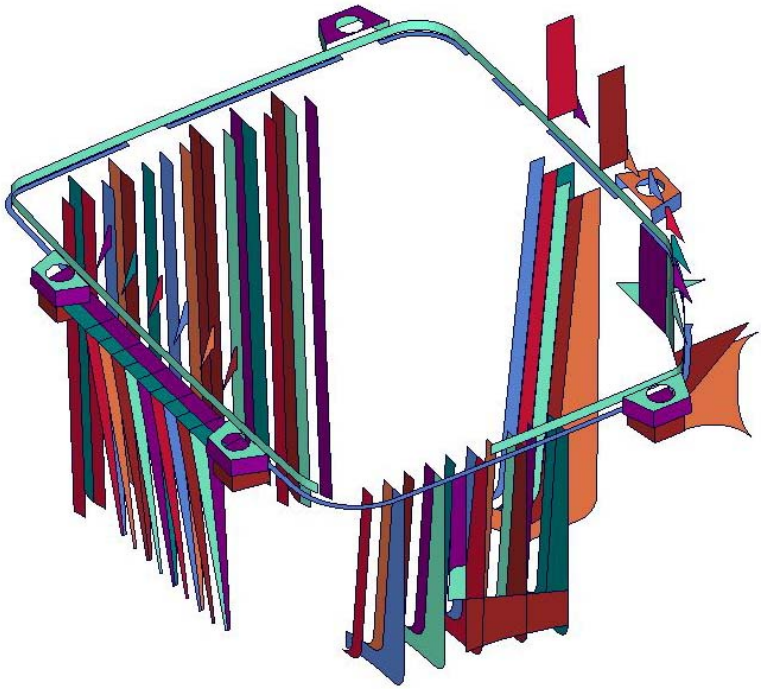
Structural Design Variables

Housing walls DV

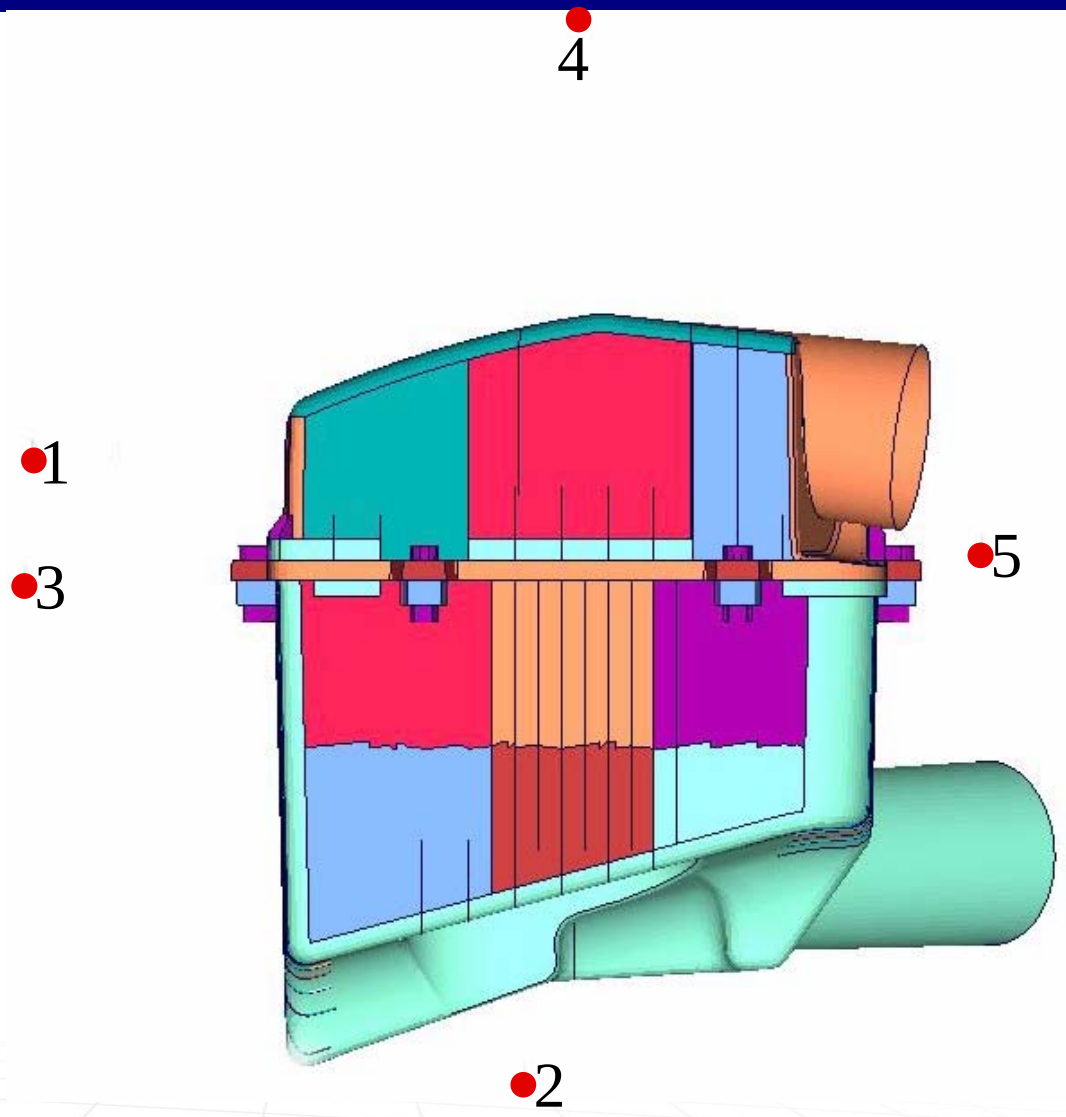
Rib/stiffener DV

Total 125 DV

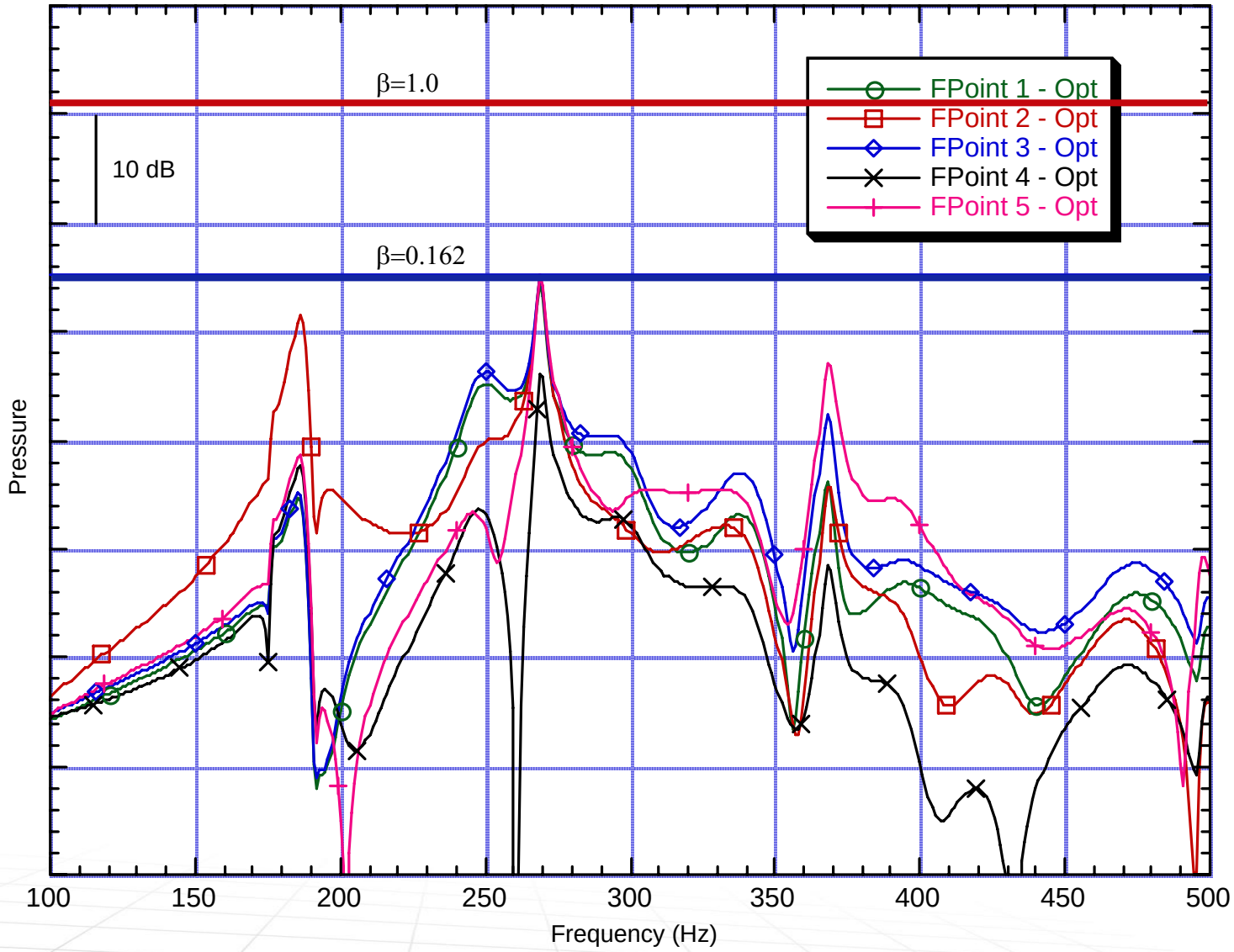




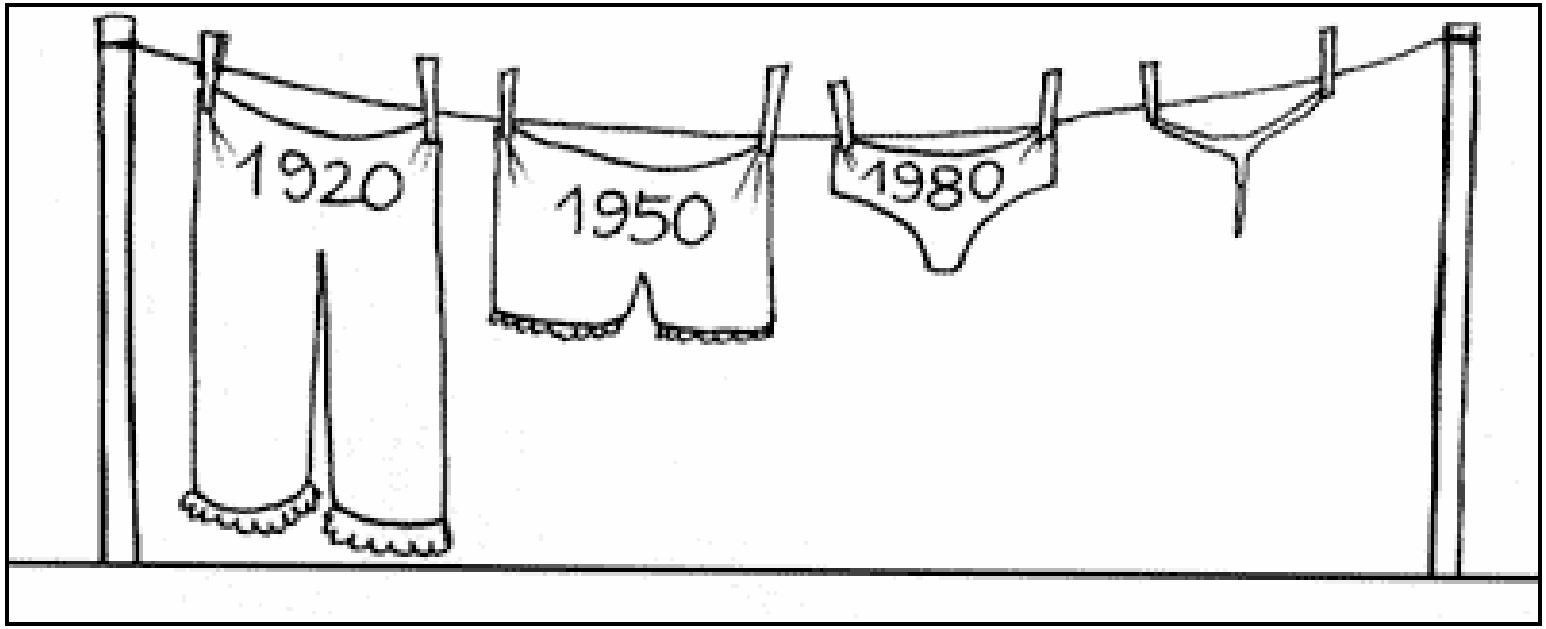
Location of Field Points



Optimized Response



Conclusion

CDH contribution to faster and improved NVH analysis and optimization has been, and will continue to be, very significant

Global Warming Explained