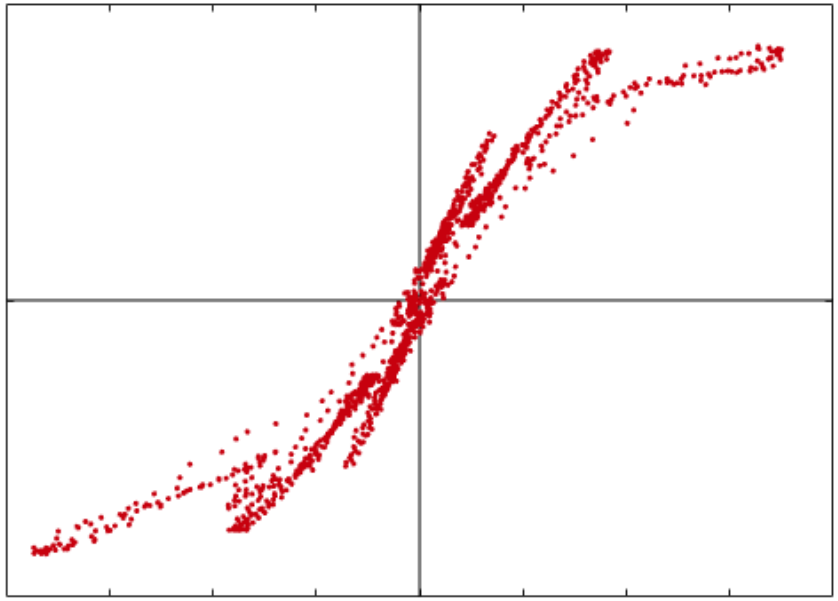
Nonlinear Vibrations of Aerospace Structures

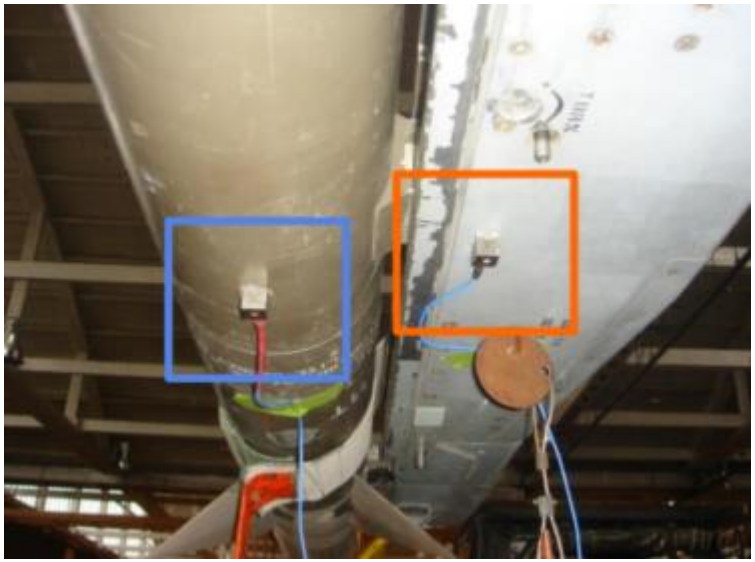
Tutorial 08

Characterising Nonlinearity using ASM



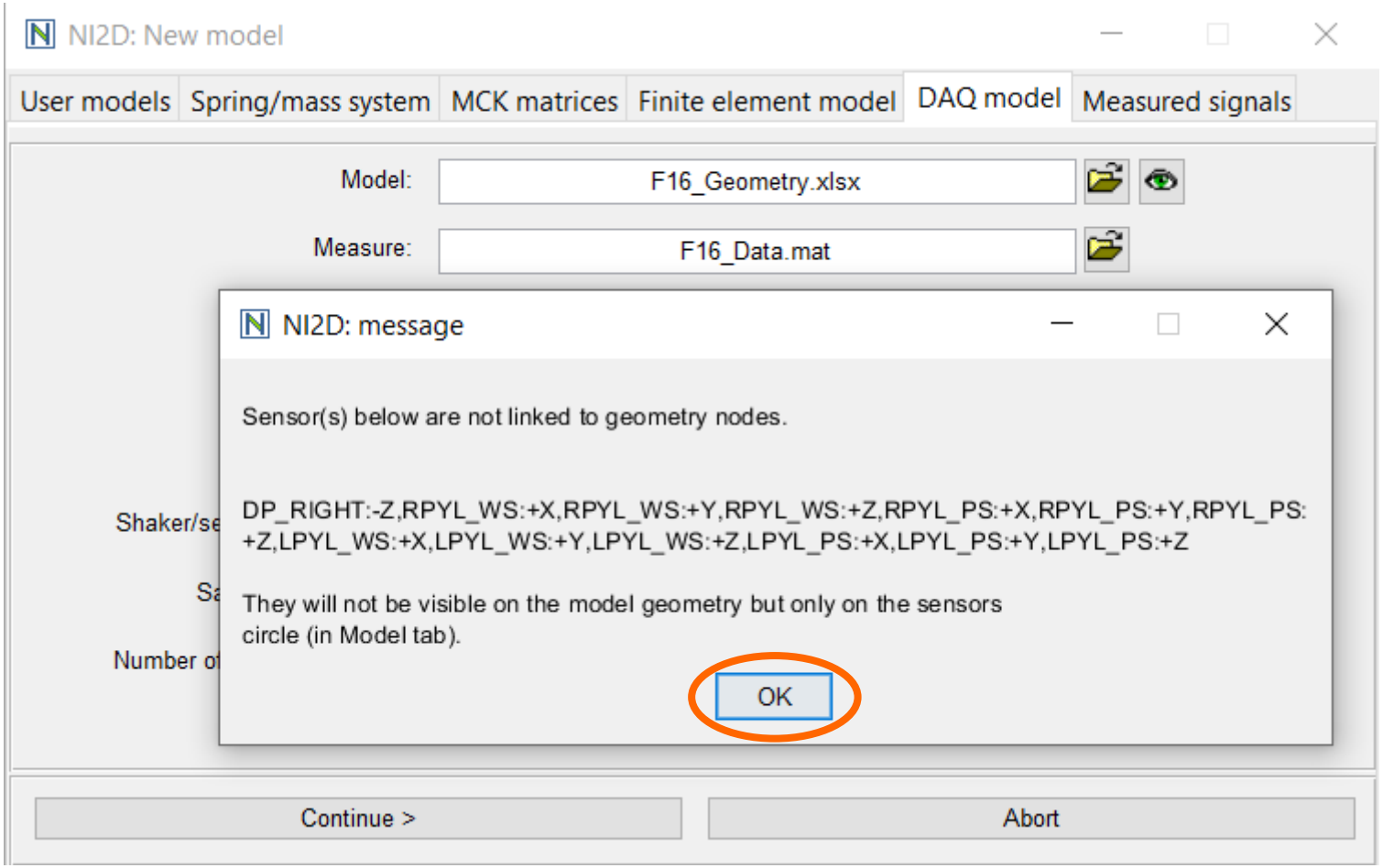
Application to a Real-life Structure: F-16 Fighter

F-16 aircraft,
Saffraanberg,
Belgium.

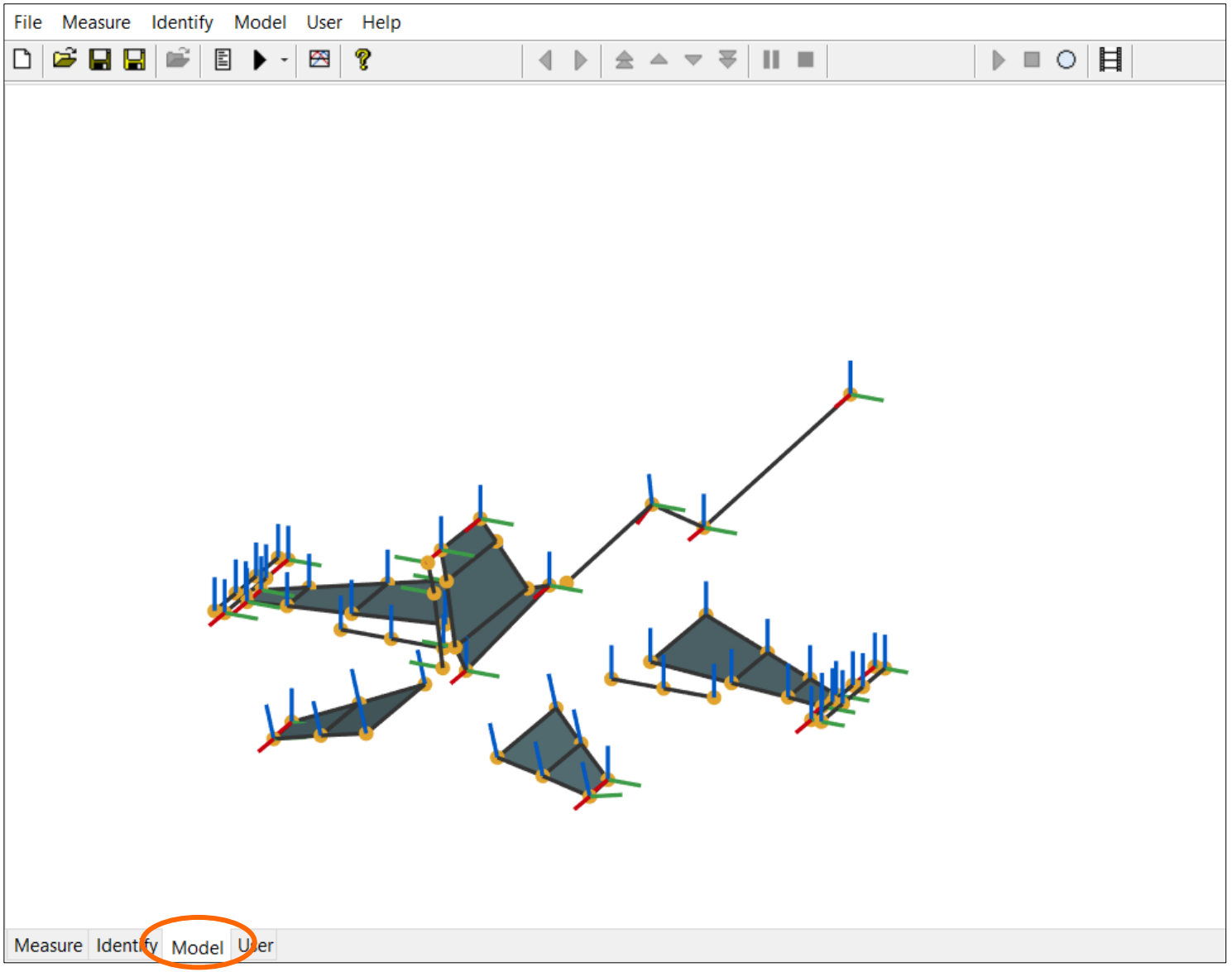


Nonlinear connection
instrumented
on both sides.

Import LMS Measurement Geometry and Recorded Data

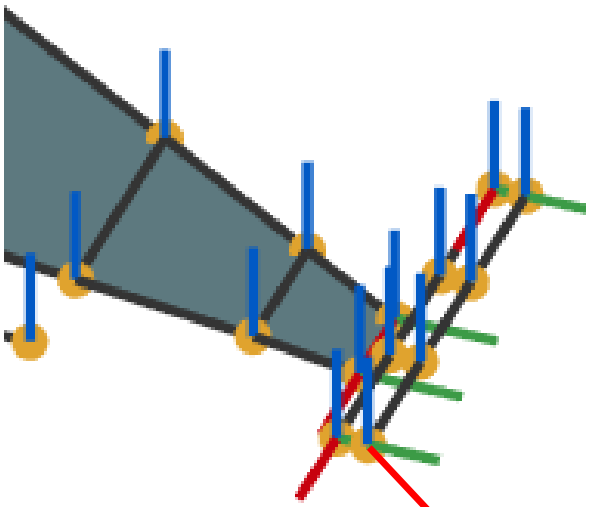


The F-16 Measurement Geometry Is Visualised



Nonlinearity in the Back Connection of the Right Wing

Remember: ASM characterises the nonlinearity between two nodes.

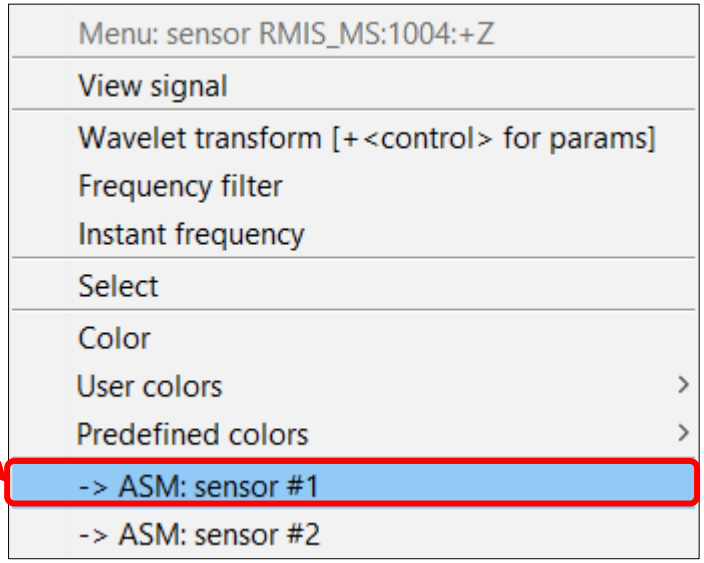


$$g_i(q_i - q_j, \dot{q}_i - \dot{q}_j) \cong -\ddot{q}_i$$

i refers to sensor #1 and

j to sensor #2

‘Right click’ on the sensor



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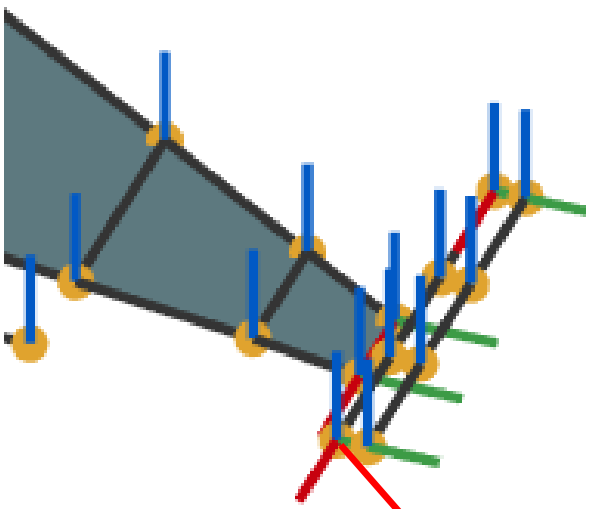

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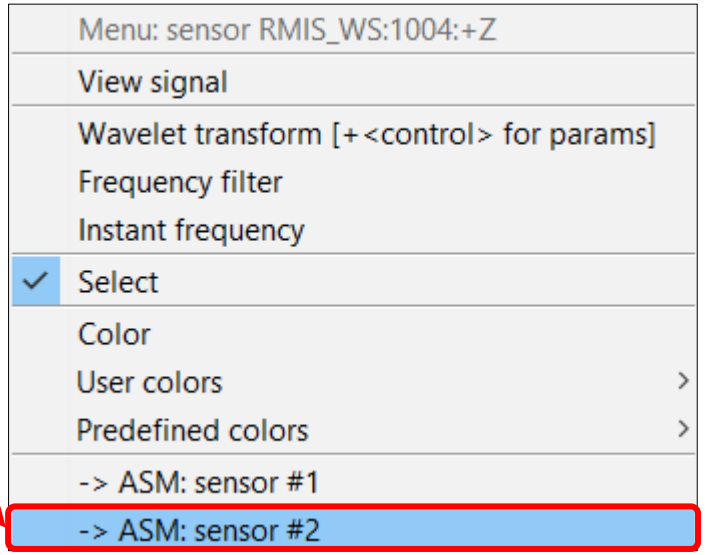
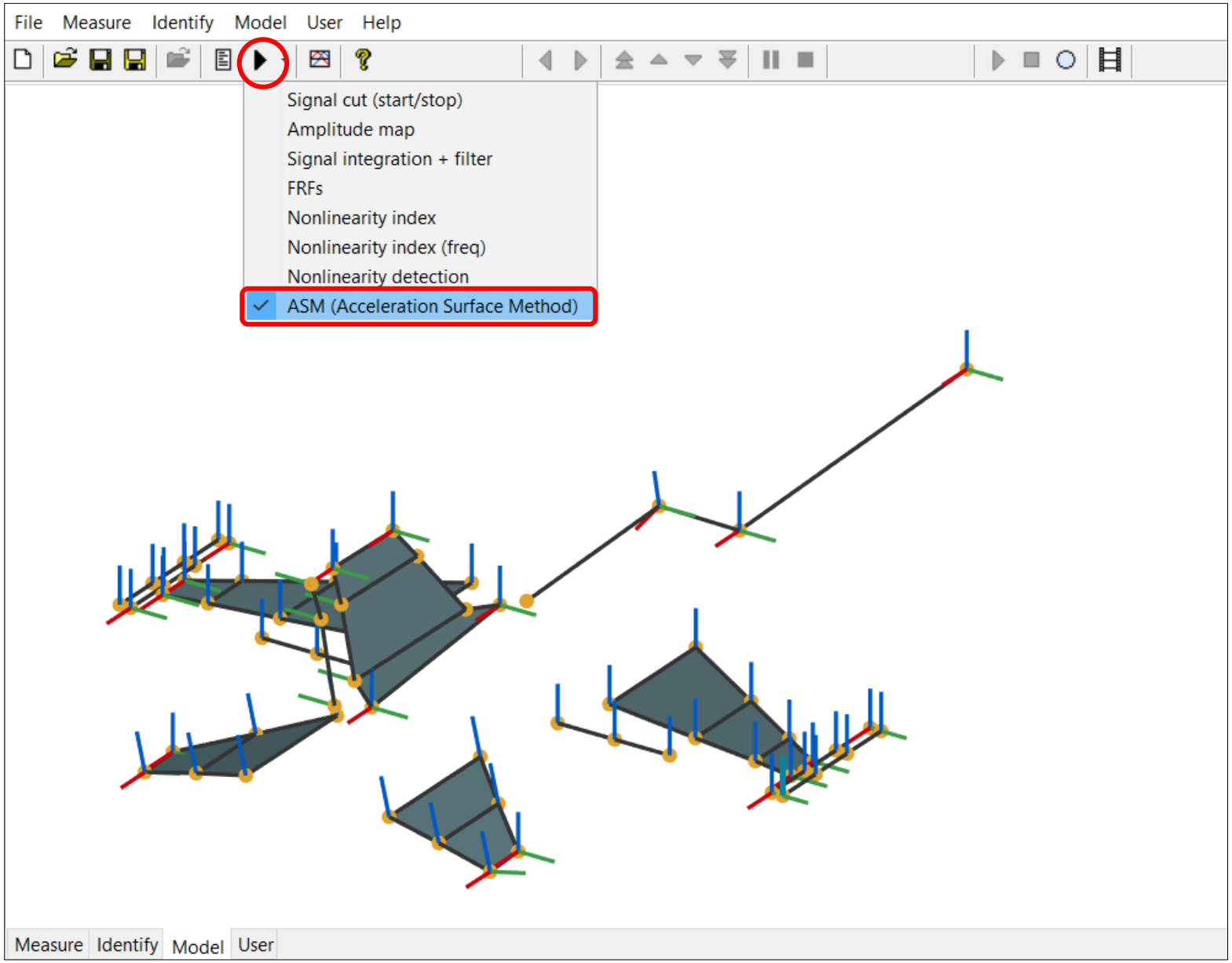
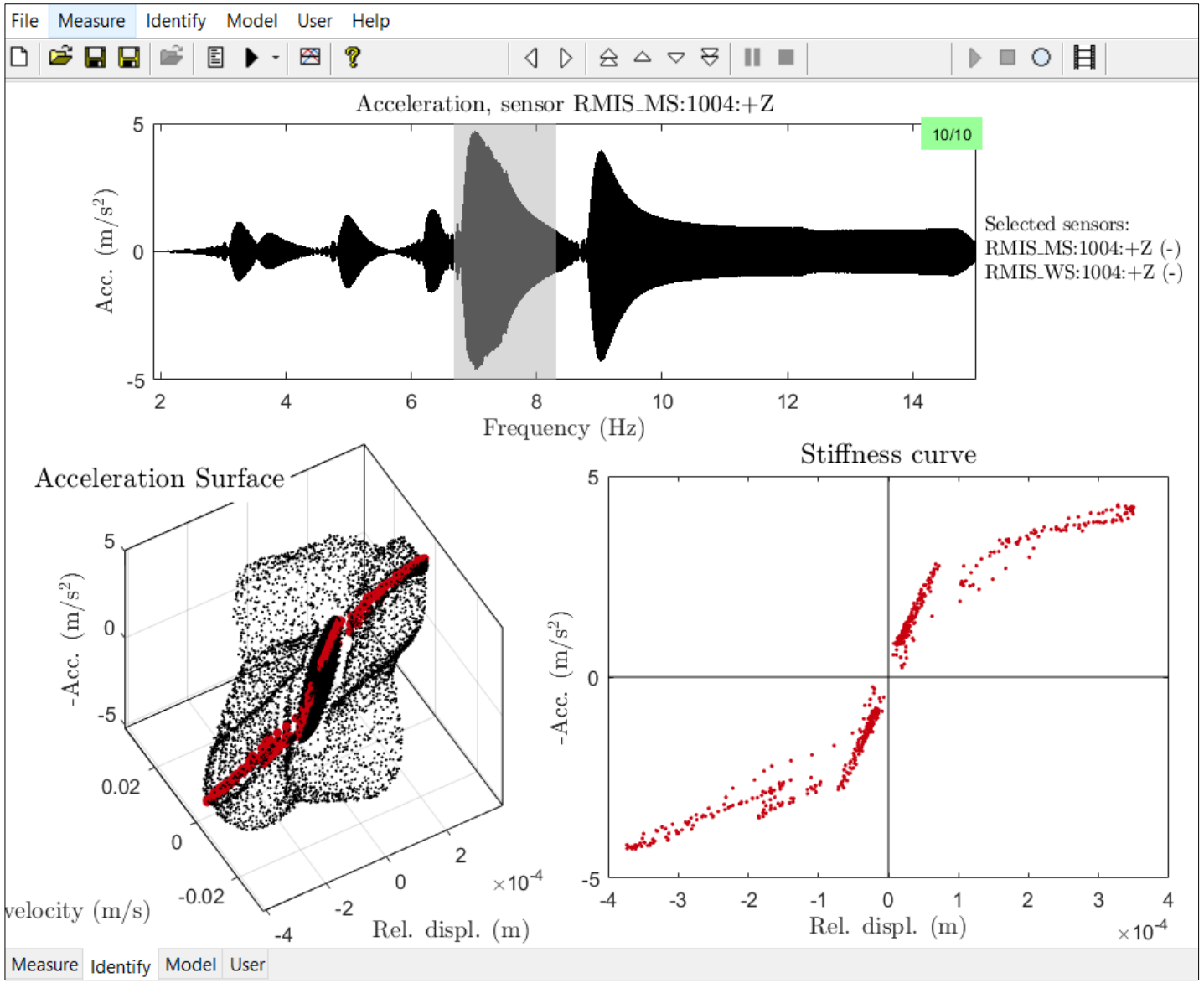


Select ASM in the Solver List

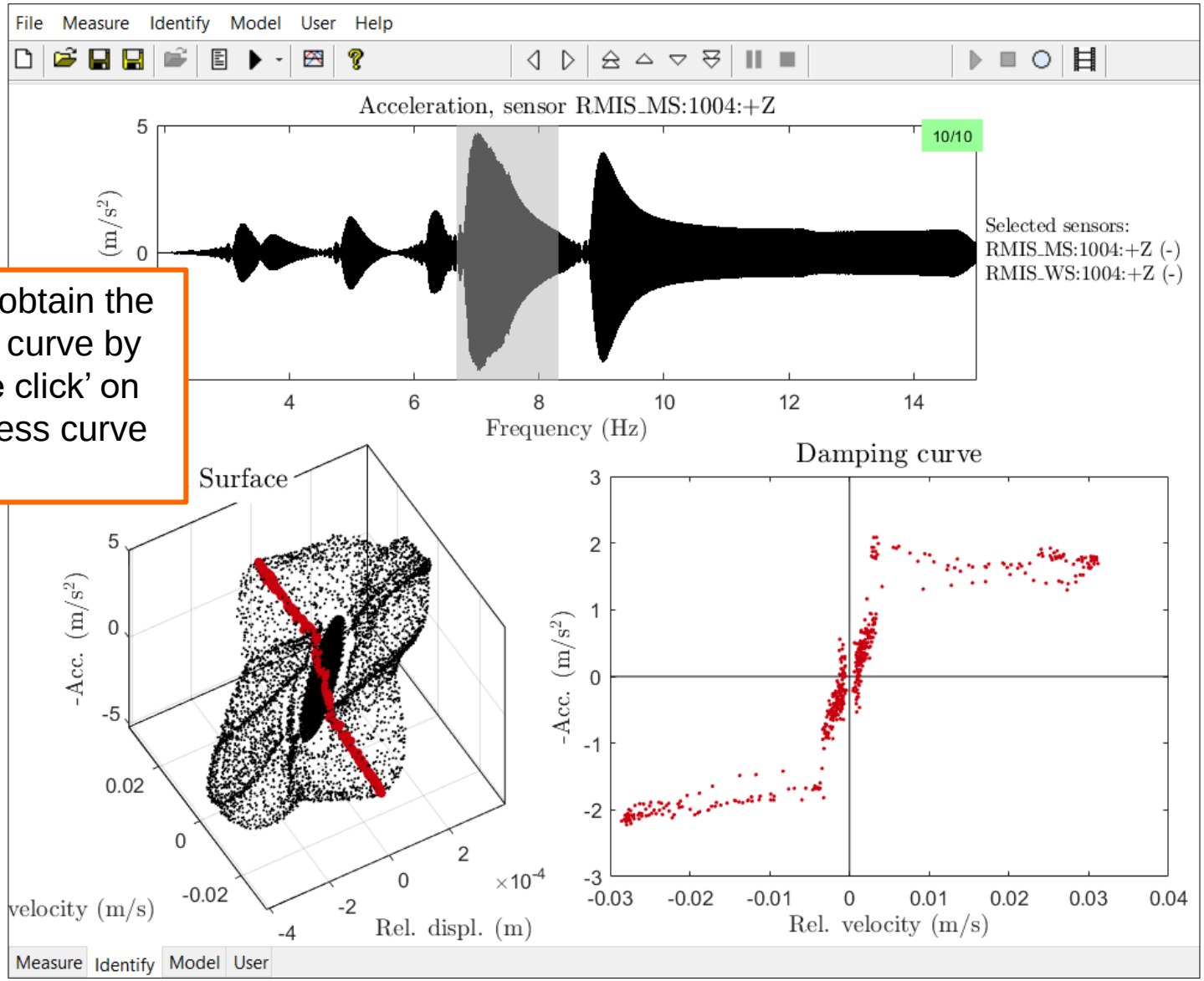


Qualitative Stiffness Nonlinearity around One Mode

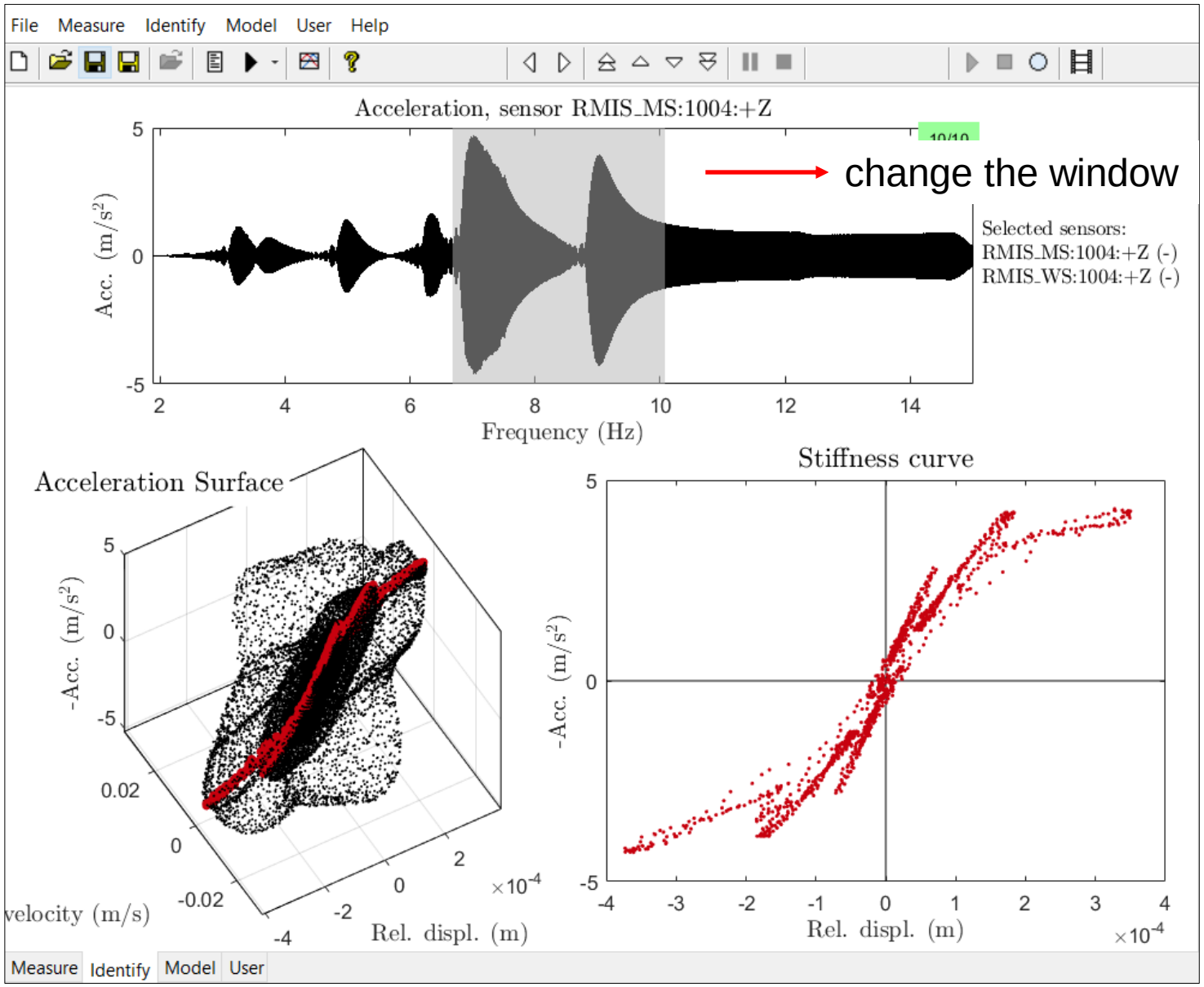


Qualitative Damping Nonlinearity around One Mode

You can obtain the damping curve by a ‘double click’ on the stiffness curve heading.



ASM Applied over Two Modes Leads to Unclear Results



Concluding Remarks and Learning Outcomes

Nonlinearities in complex structures can be visualised!

The NI2D software provides a user-friendly platform to apply ASM:

- Selection of the modes of interest ;
- Zero-velocity slices ;
- Stiffness and damping curves.