

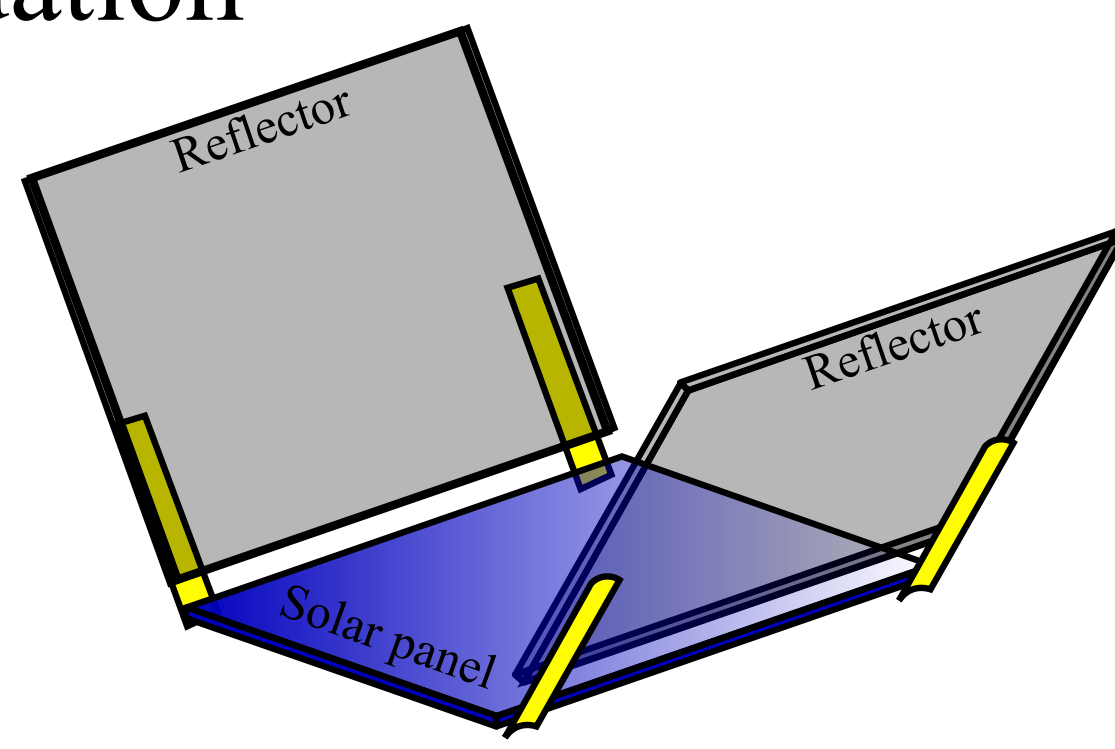
Nonlinear analysis of compliant mechanisms: application to tape springs

Tape springs

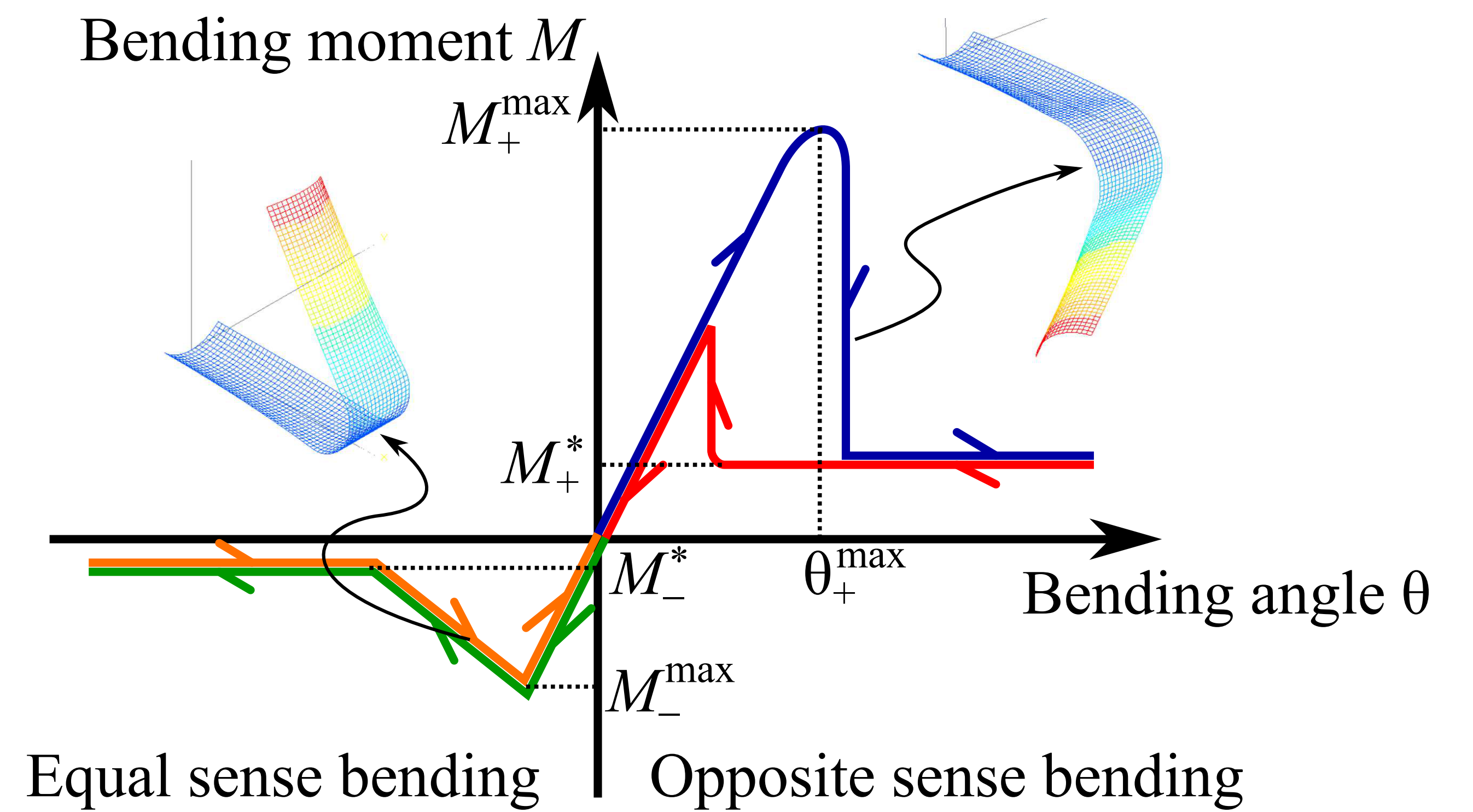
Definition: Thin strip curved along its width commonly used in deployable structures

Assets: - Passivity and self-actuation

- Elastic deformations
- Self-locking
- Simplicity
- Lighness
- Various combinations
- Compact folded configuration



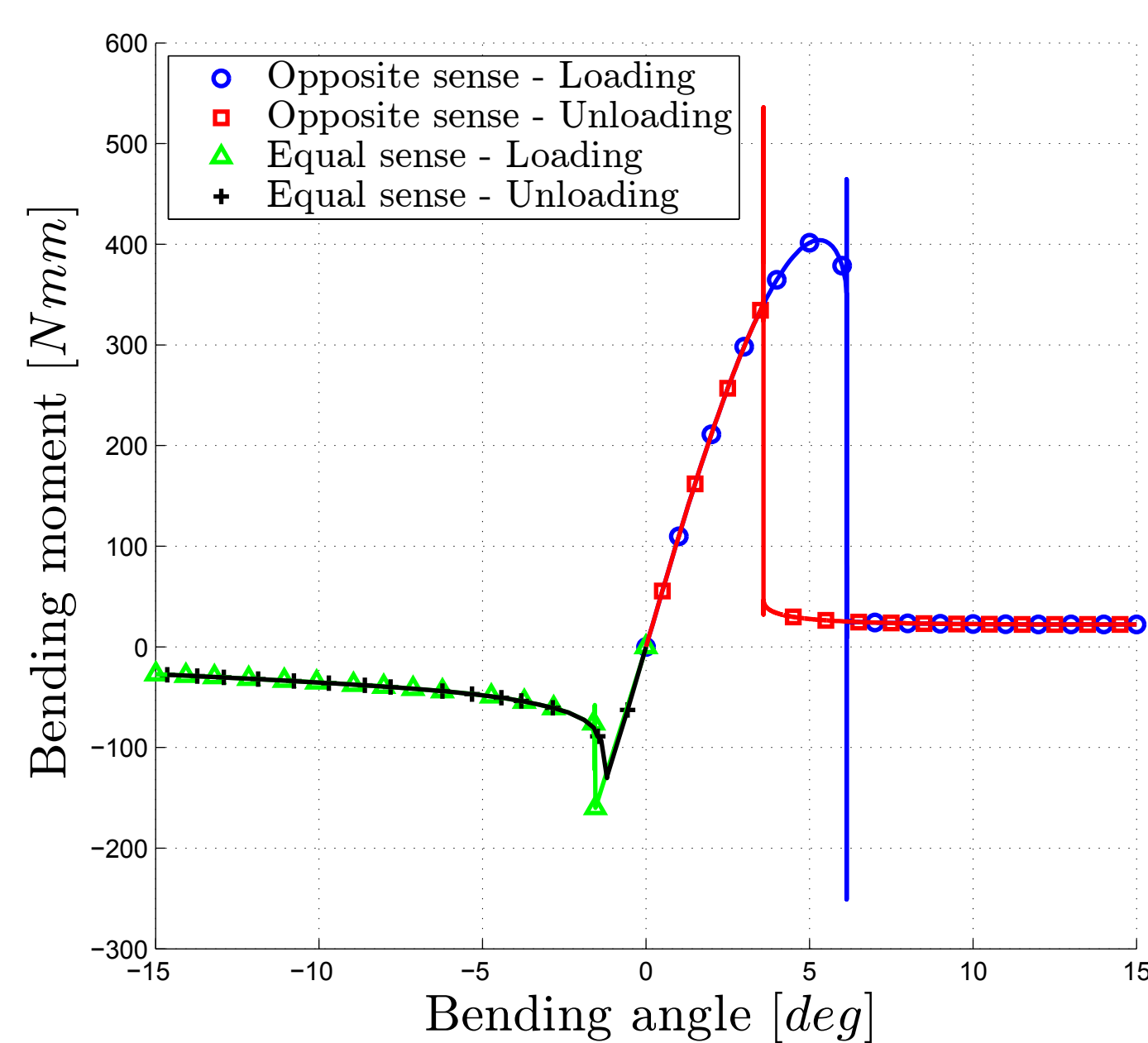
Theoretical mechanical behaviour:



Nonlinear finite element models

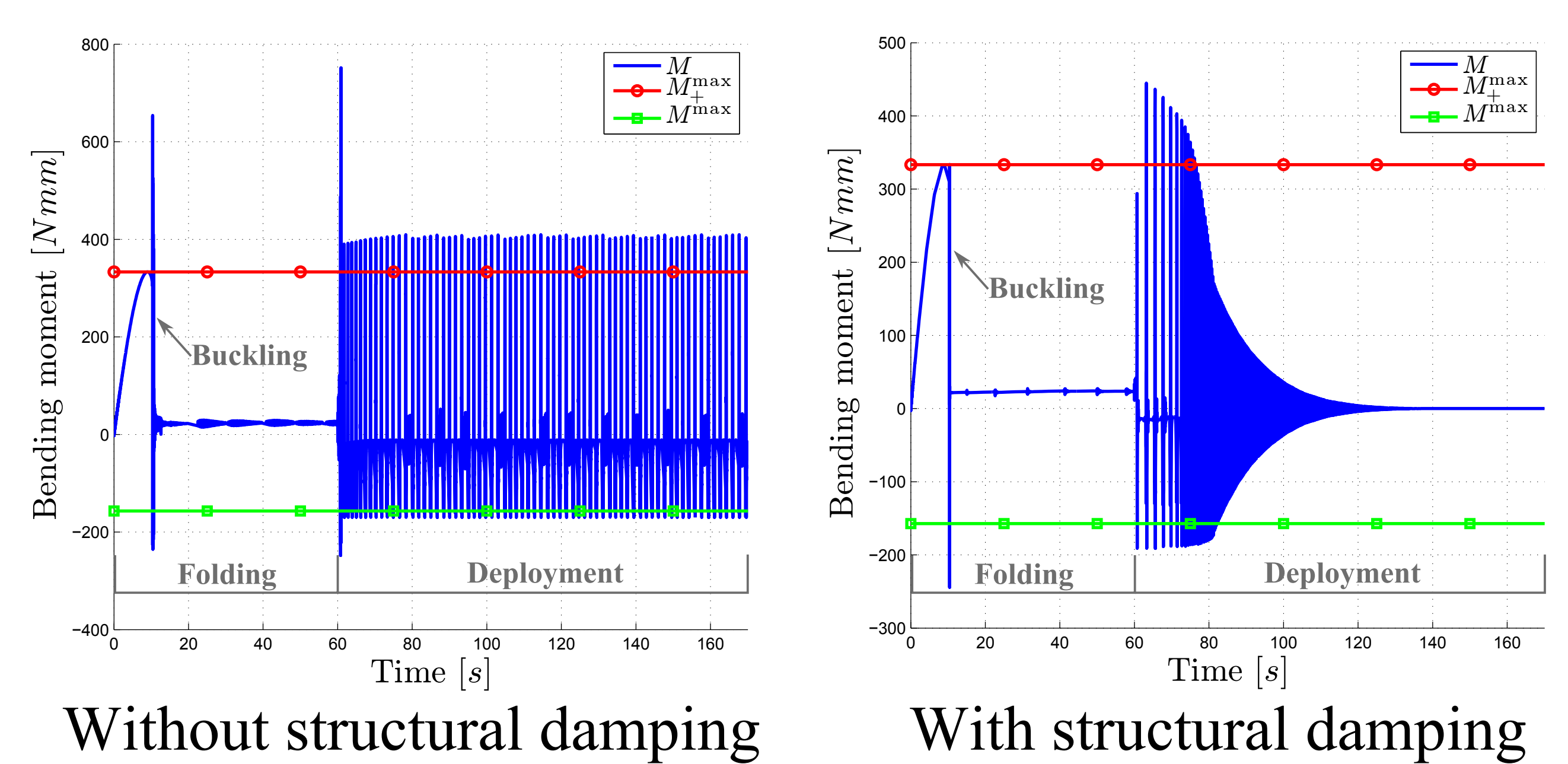
Quasi-static analyses:

- Shells
- Newmark or generalised- α method
- Adaptive time stepping procedure
- High numerical damping
- Control on the bending angle



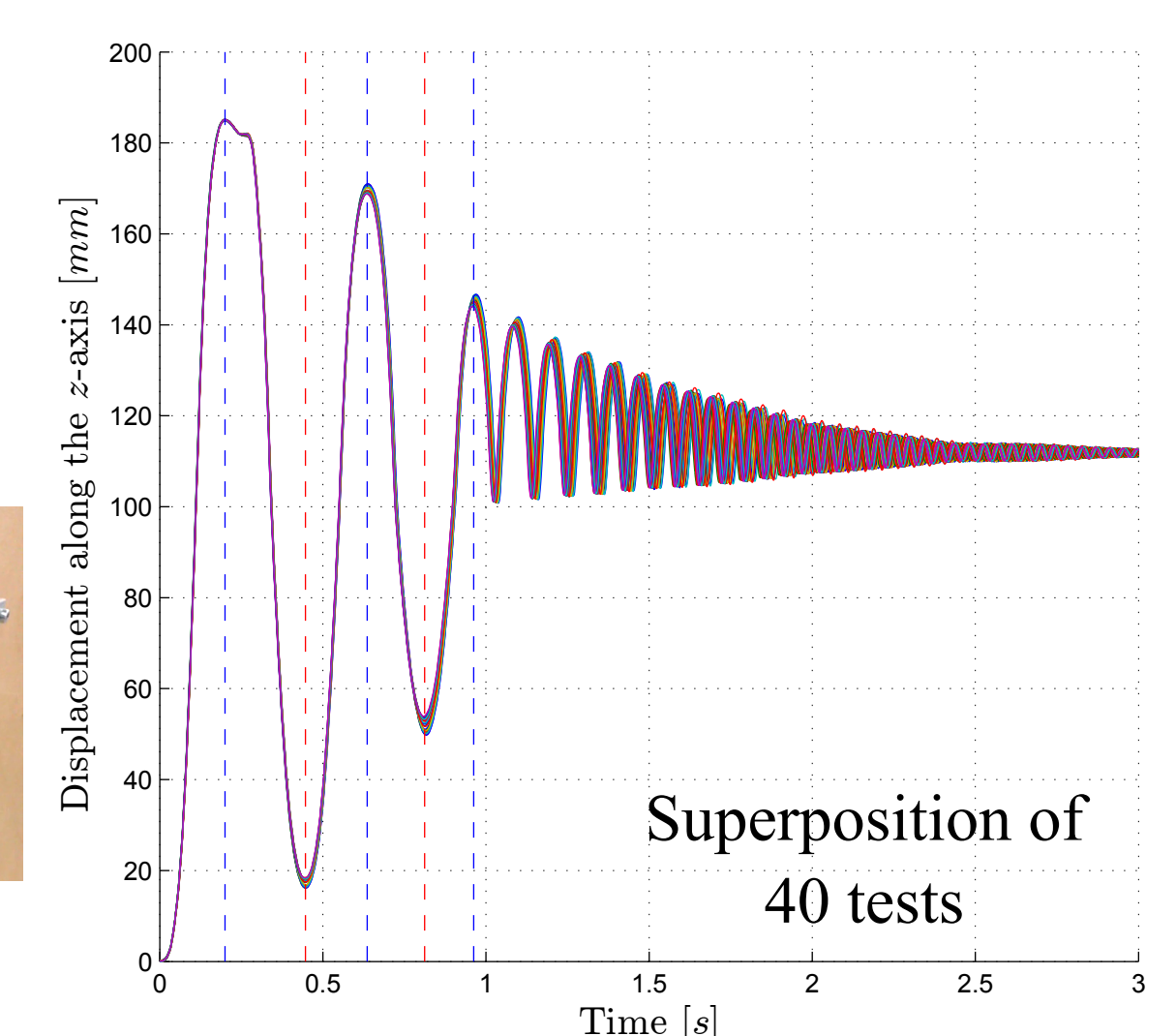
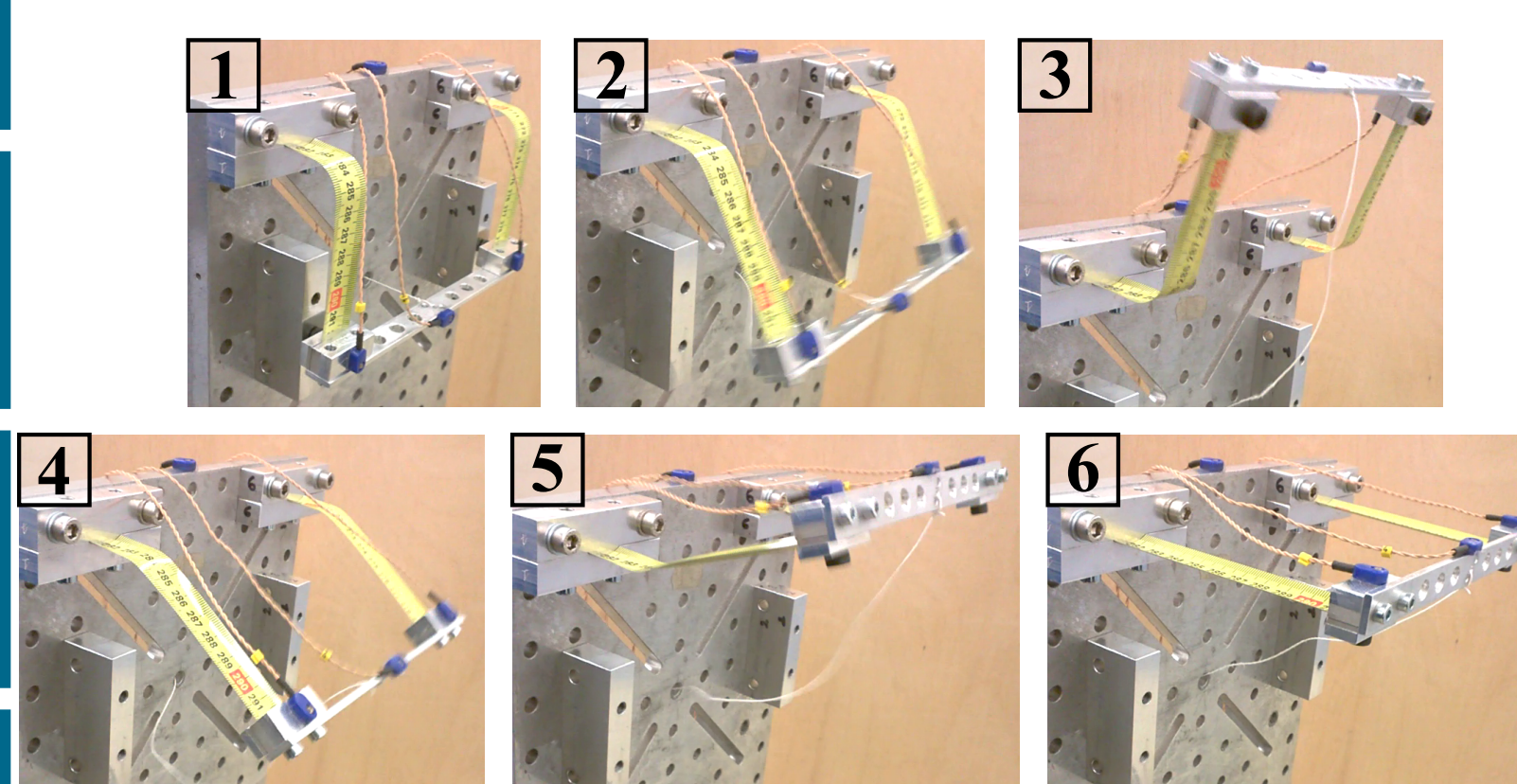
Dynamic analyses:

- Shells
- Generalised- α method
- Adaptive time stepping procedure
- Low numerical damping
- Importance of the structural damping

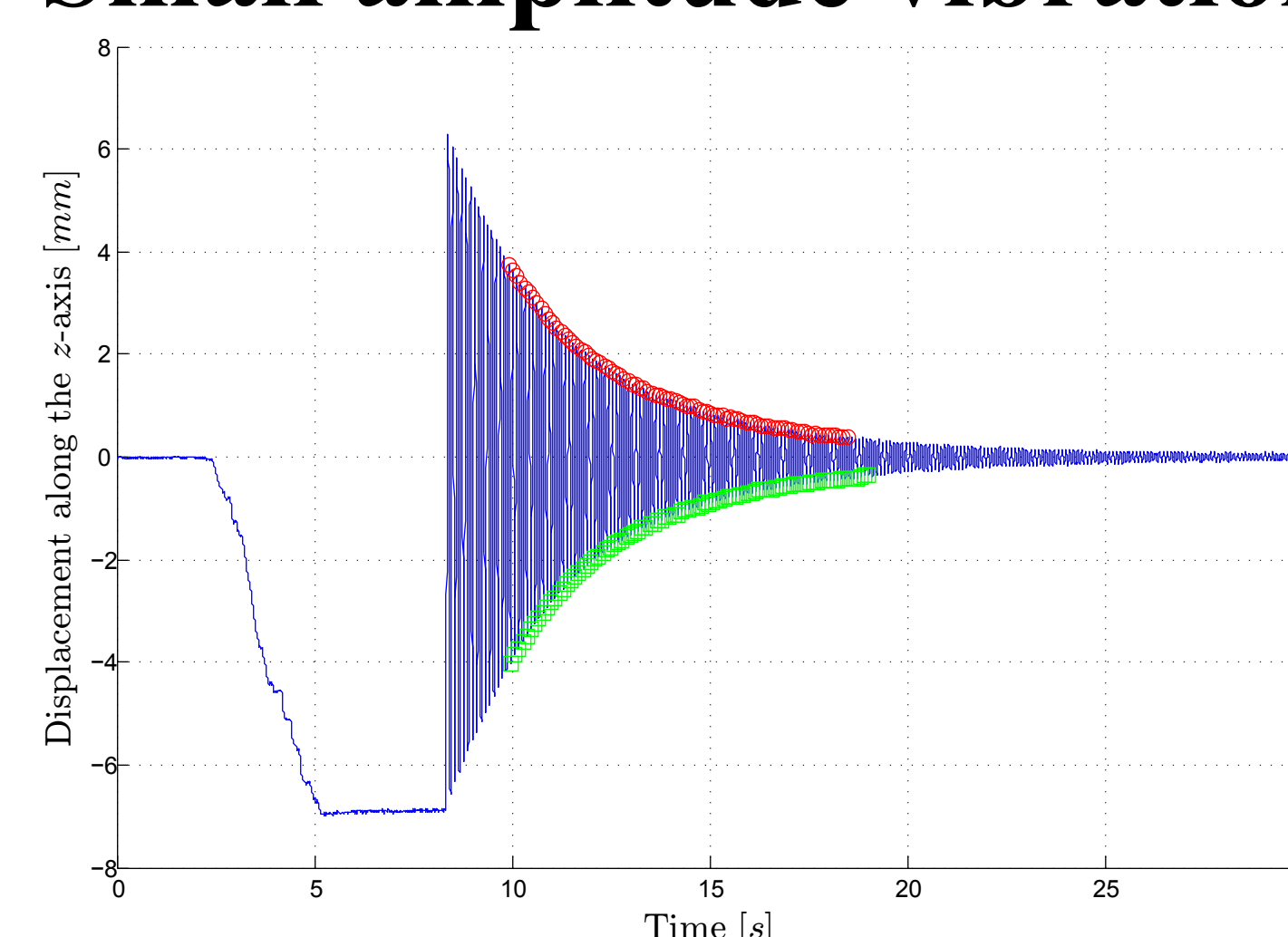


Experimental validation and damping estimation

Deployment tests:



Small amplitude vibration tests:



Motion dominated by the first bending mode:

⇒ estimation of the structural damping based on the exponential decay of the response

