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Plenary Lectures

SHAPE-MEMORY ALLOY: MODELING AND DESIGNING SMA-BASED DEVICES

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Summary: The present contribution wishes to address several aspects related to shape-memory alloy (SMA) materials and structures, with a final emphasis on the use of such tools for the simulations of actuators and stent cardiovascular devices. In particular, we plan to:

- review some recent 3D constitutive model developments (with models taking into account with different level of accuracy several physical phenomena, e.g., martensite reorientation, different kinetics between forward/reverse phase transformations, smooth thermo-mechanical response, low-stress phase transformations, transformation-dependent elastic properties) and their numerical treatment (for the more complex models through the use of Fischer-Burmeister complementarity conditions) to predict experimental results on spring-like actuators [1]

- explore the use of simpler constitutive models to capture the response of spring-like actuators as well as of geometrically complex biomedical devices like self-expandable cardiovascular stents, with particular attention to a correct modeling of buckling phenomena [2]

- investigate the extension of Dang Van high cycle fatigue criterion to SMAs and its application to uniaxial experimental data taken from the literature with the final goal of approaching the development of a general multi-axial SMA failure criterion [3]

References

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