
SHAPE MEMORY ACTUATORS FOR DEXTROUS SURGICAL INSTRUMENTS

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Shape memory alloy actuation

- NITINOL
- normalized force: 150 N/mm²*
- stroke: 3%*
- work density: 4,5 mJ/mm³ *

pros	cons
high work density	nonlinear dynamics
small diameters (25 to 150 µm)	small stroke
great potential for miniaturization	low bandwidth due to cooling

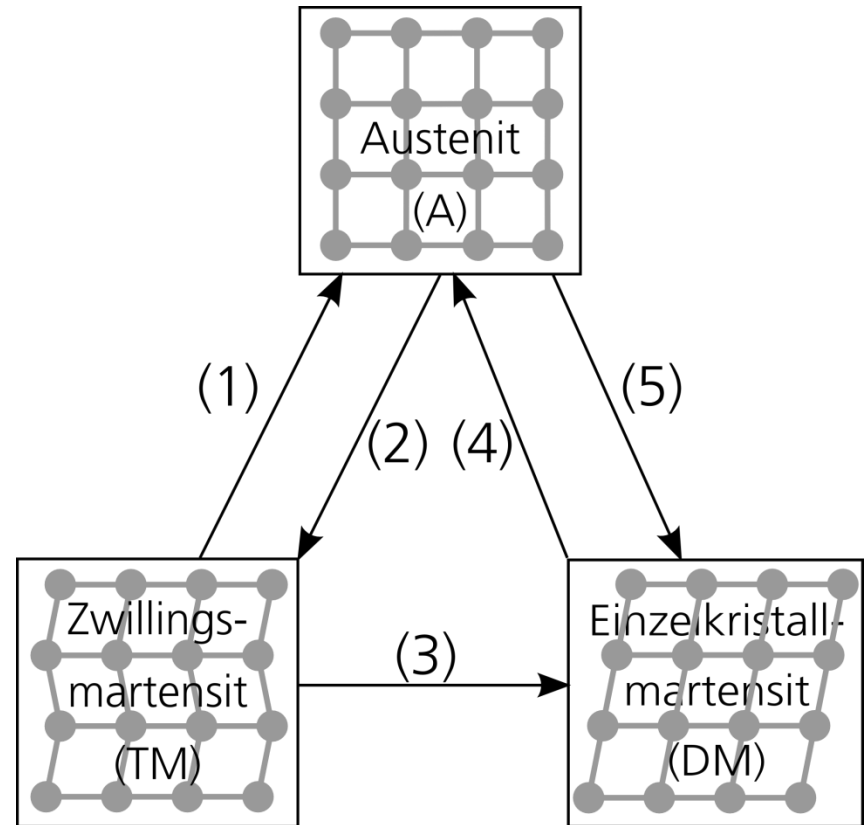
* source. van Peirs et al. 2001

Shape Memory Alloys (SMA)

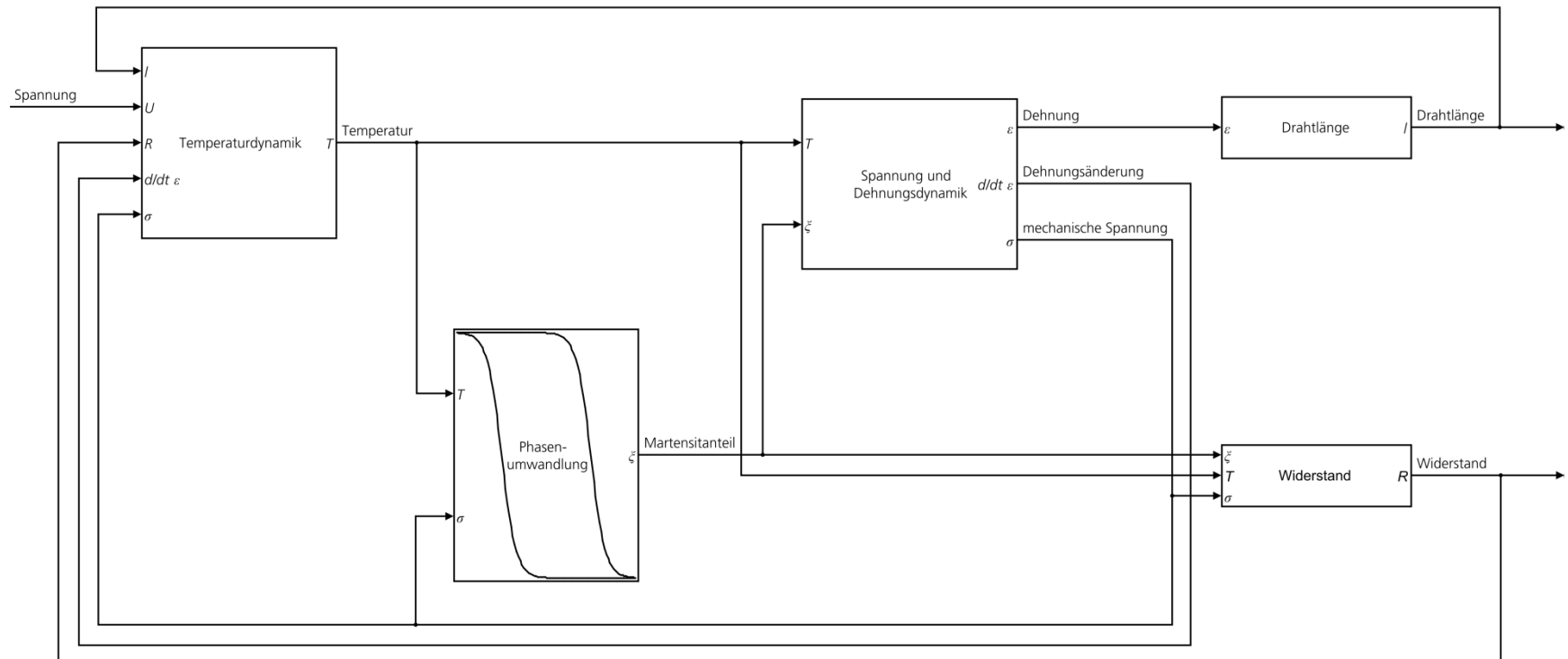
■ Phase changes depend on

- temperature
- stress

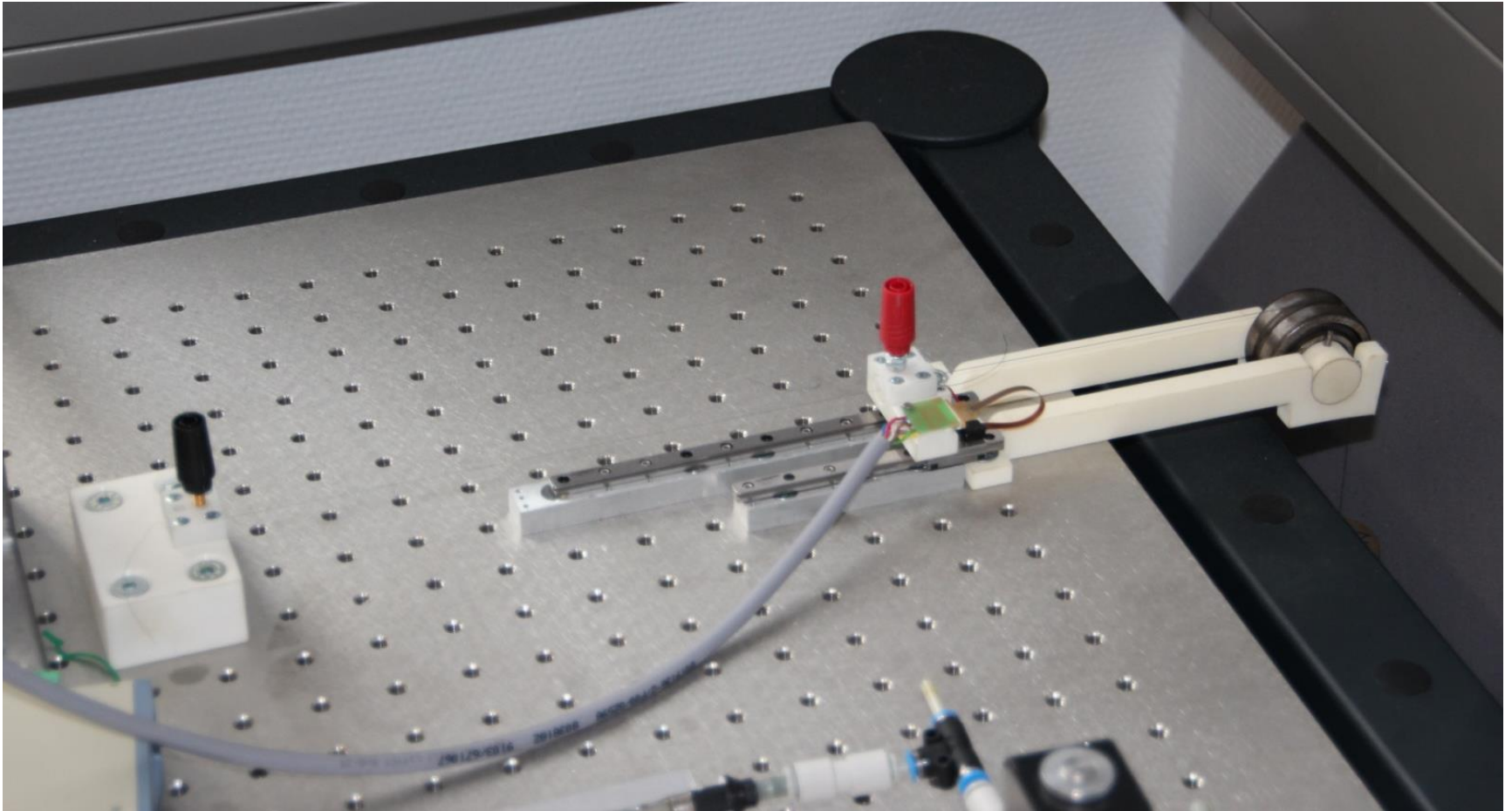
- (1) TM → A: heating
- (2) A → TM: cooling, low stress
- (3) TM → DM: stress increasing
- (4) DM → A: heating
- (5) A → DM: cooling, high stress



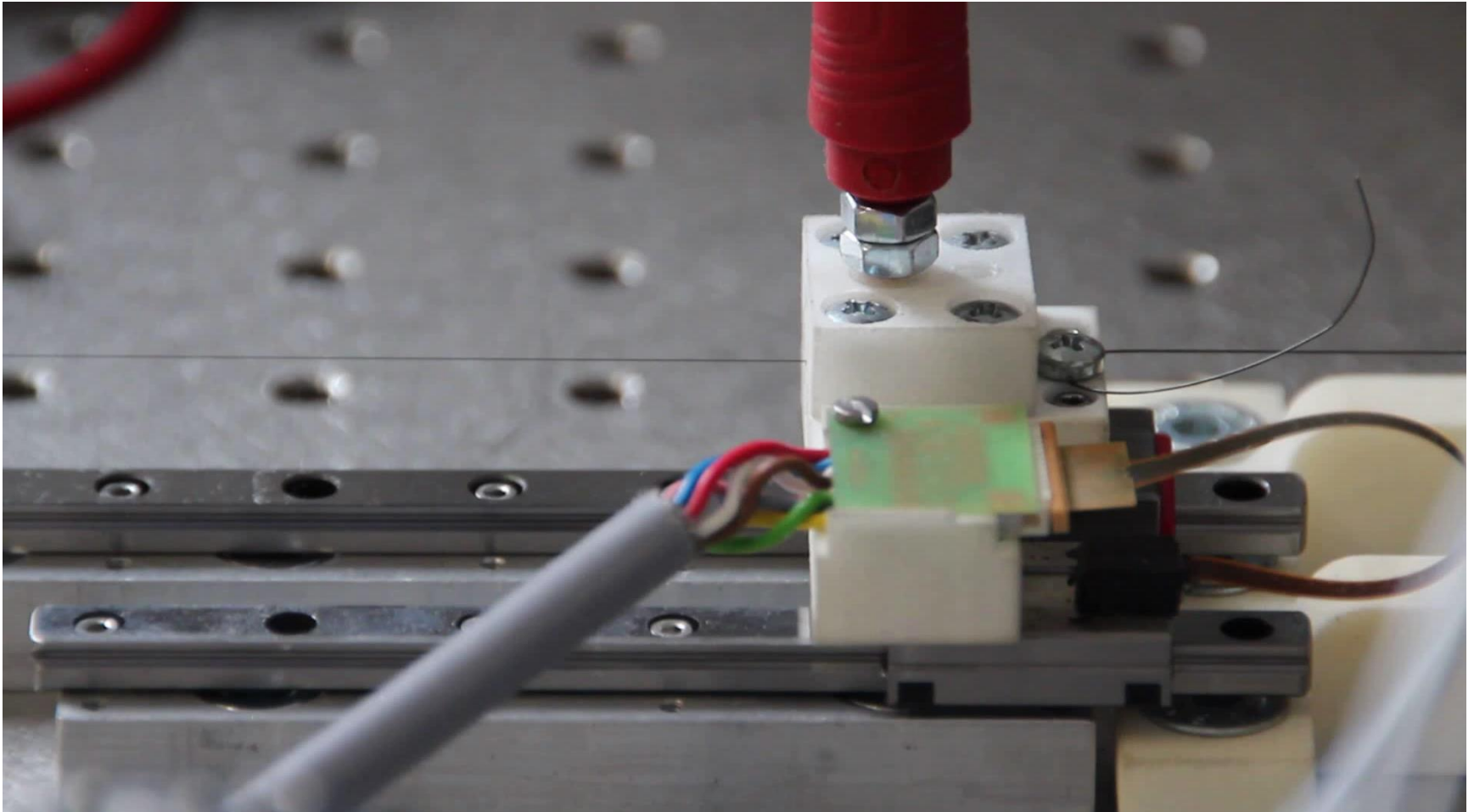
Dynamic Modeling



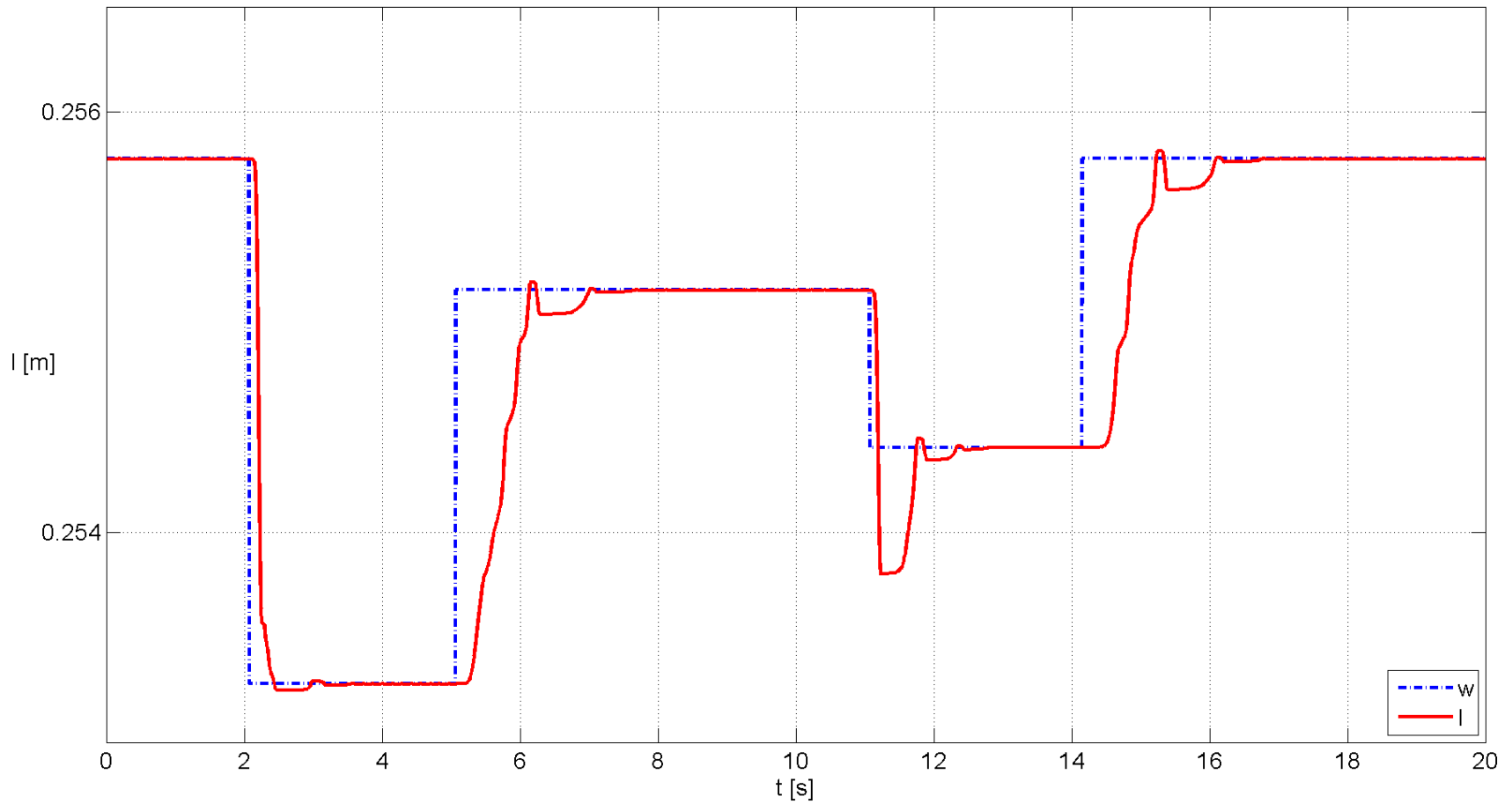
Experimental Setup



Experimental Setup



Results



Future Work

- Integration in a surgical instrument
- Improve overall performance
- Displacement estimation via electrical resistance

Thank you for your attention!

Questions?