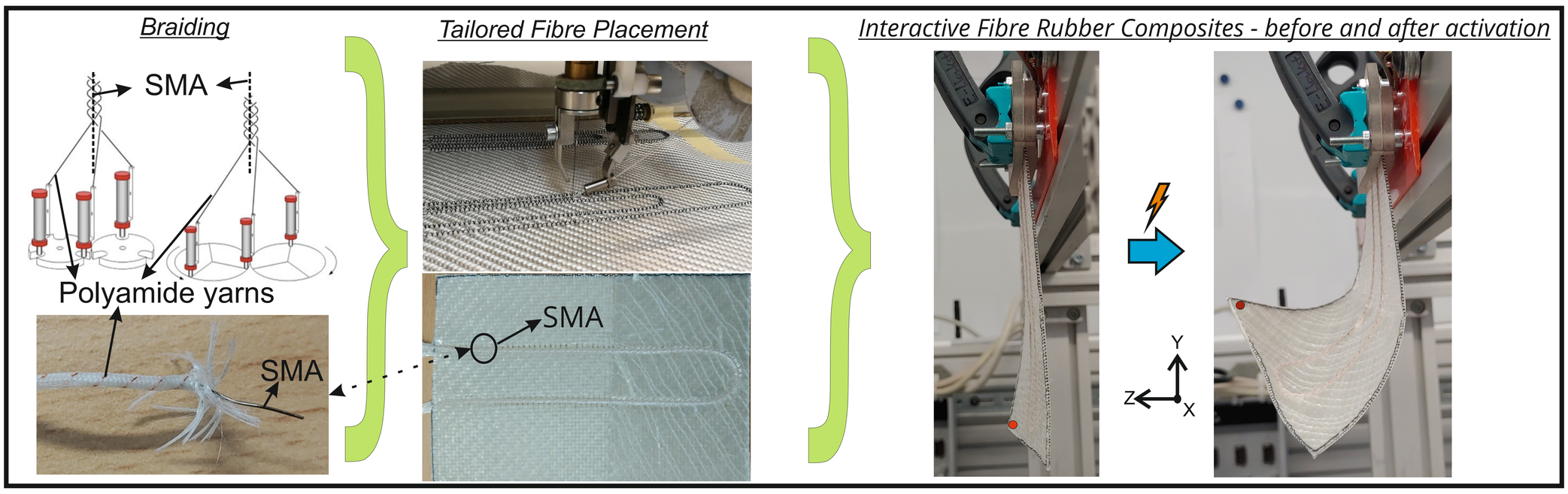
TECHNISCHE UNIVERSITÄT DRESDEN

ITM LEADING IN FIBRE & TEXTILE TECHNOLOGY
The Research Institute of University of Excellence

Faculty of Mechanical Science and Engineering Institute of Textile Machinery and High Performance Material Technology

MULTI-AXIAL FIBER APPROACH TO OBTAIN BEND-TWIST COUPLING IN INTERACTIVE FIBER RUBBER COMPOSITES (IFRC)

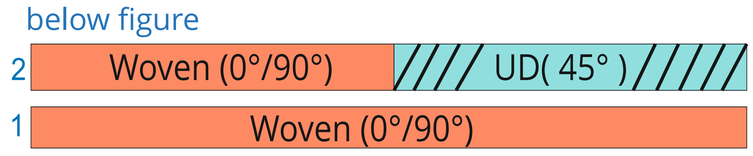


Objective

- Develop Shape Memory Alloy (SMA) integrated fibre rubber composites capable of bend-twist coupling using multi-axial fibres
- Model and simulate SMA integrated composites
- Validate the deformations using Multiple Digital Image Correlation (DIC)

Methods

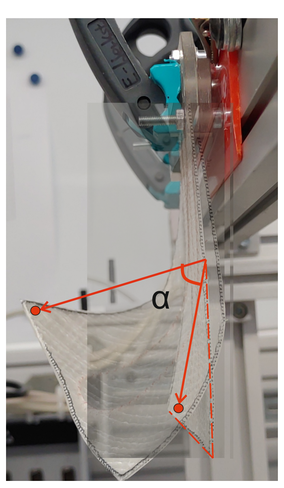
- Tailored Fiber Placement (TFP) is used to join two layers of textiles onto each other as shown in the below figure



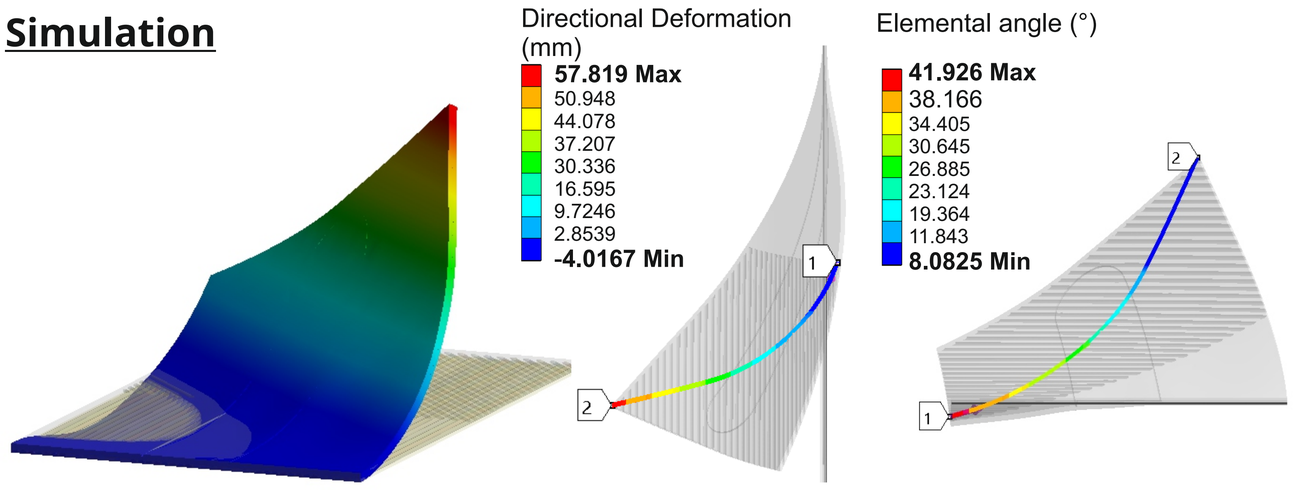
- Braided SMA (Nitinol) is integrated onto the textile using TFP process
- Textiles with SMA are then infiltrated with PDMS using Vacuum Assisted Resin Infusion (VARI) process
- SMA is activated via Joule heating

Results

- Woodworth-Kaliske SMA material model is used in Ansys Workbench to obtain the Shape Memory Effect in the SMAs
- Deformations are highlighted at a corner point using Multi DIC in the experiments
- The developed specimens are the basis for more complex geometries like multi-sectoinal joint strucutres

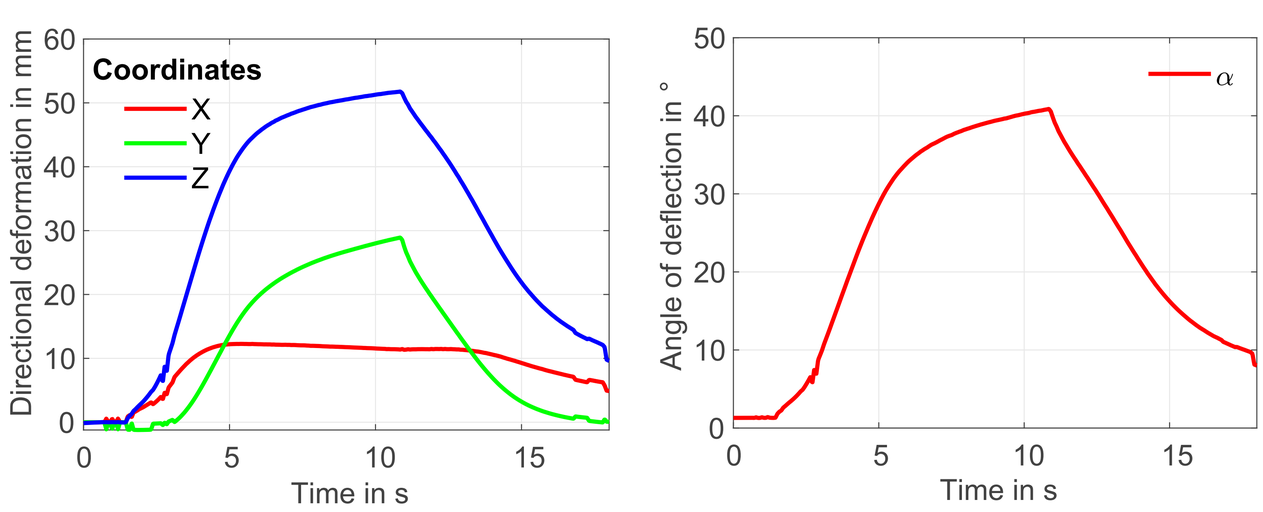


Simulation



Graphs depicting directional deformations and twist angle during activation of SMA in the simulation

Experiment



Graphs depicting directional deformations and twist angle during activation and deactivation of SMA with respect to a corner reference point (•)

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