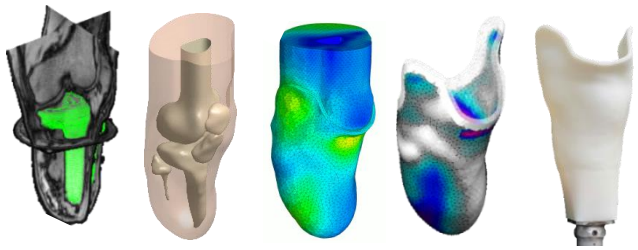

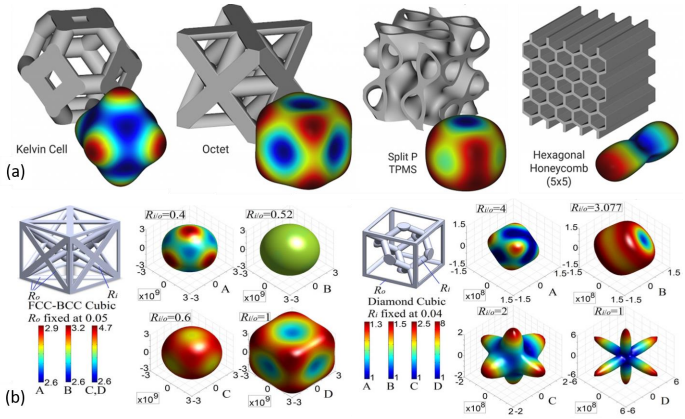


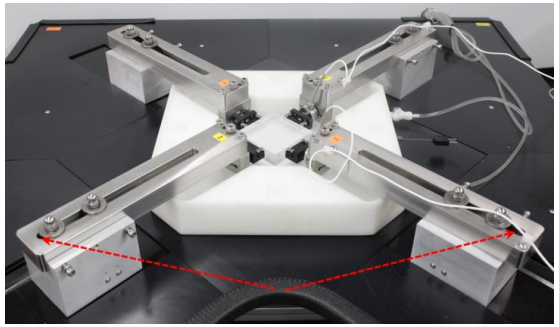

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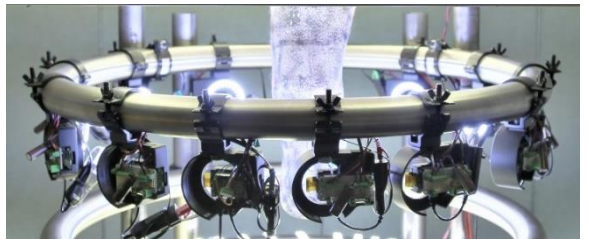
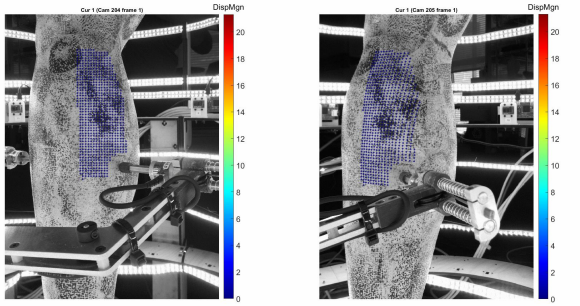
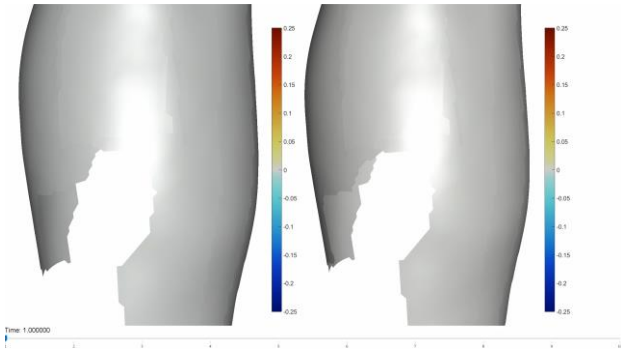
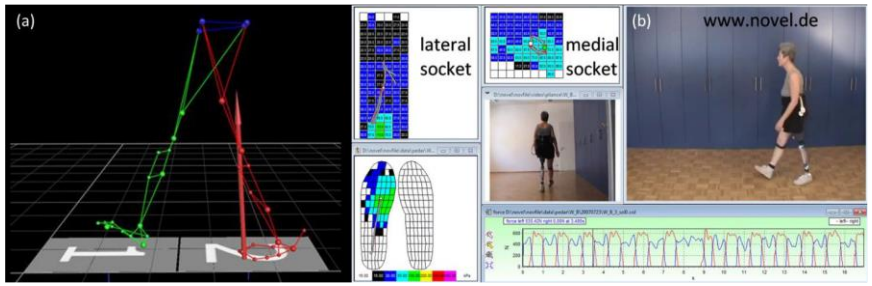






# FEA-driven design of prosthetic sockets

The stump is cast

Cast filled to create plaster mold

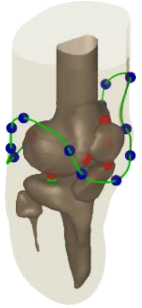
Manually defined cut-lines

The mold is manually modified


Carbon laminate wrapped to create the socket

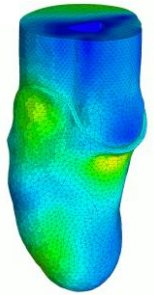
Imaging and segmentation

Patient geometry

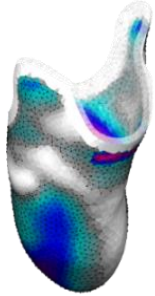


Cut-line generation

Initial solid model



Multi-step FEA



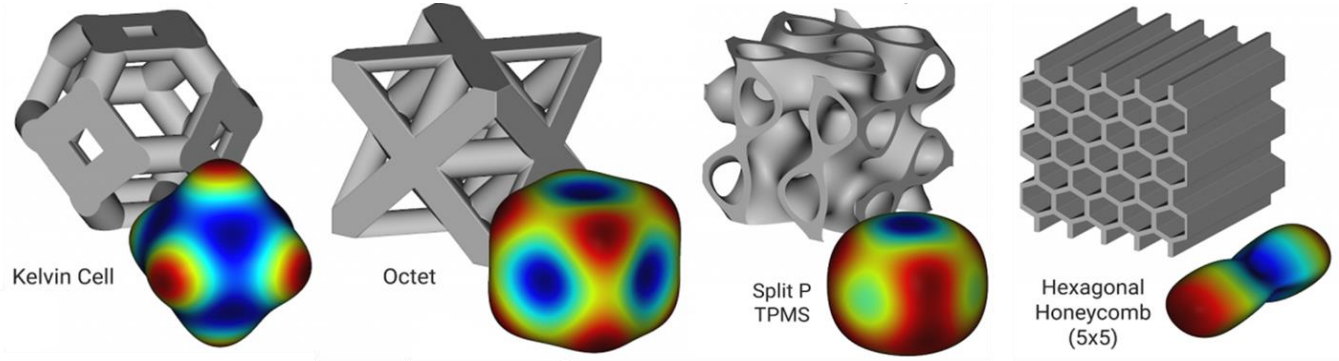
Design modifications

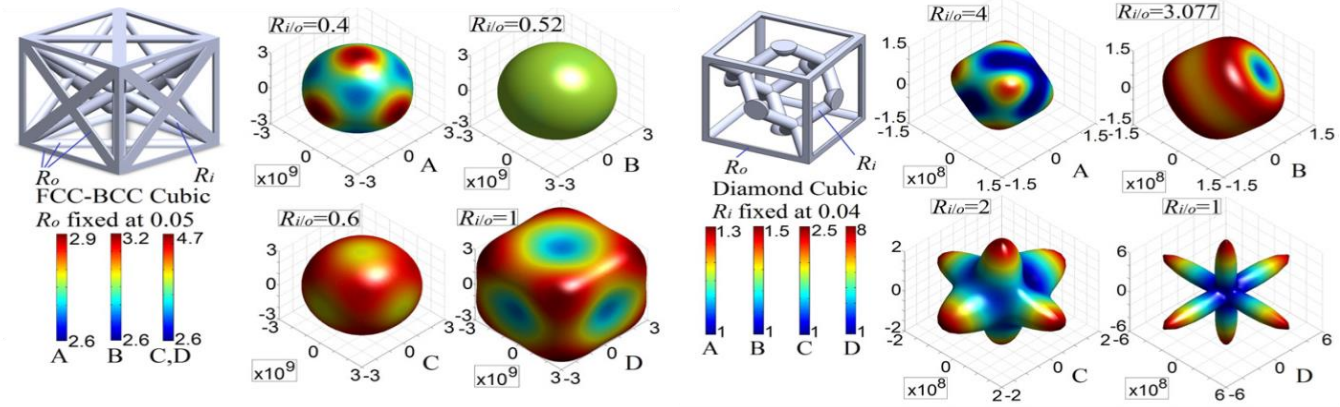
3D printing

Virtual iterations

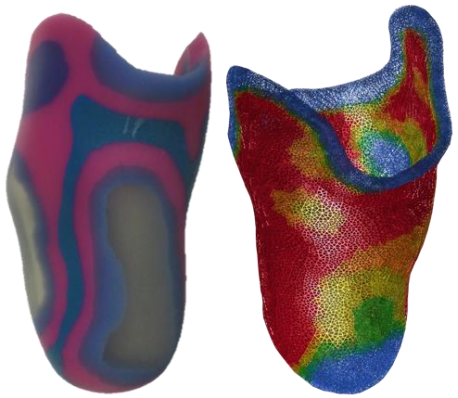
Moerman K, **Solav D**, Sengeh D, Herr H. "Automated and Data-driven Computational Design of Patient-Specific Biomechanical Interfaces." https://engrxiv.org/g8h9n/

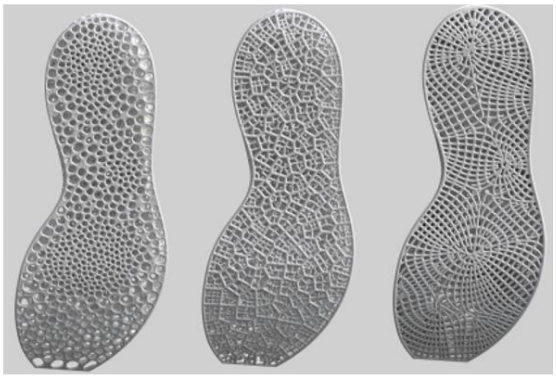
# Functionally graded lattice structures



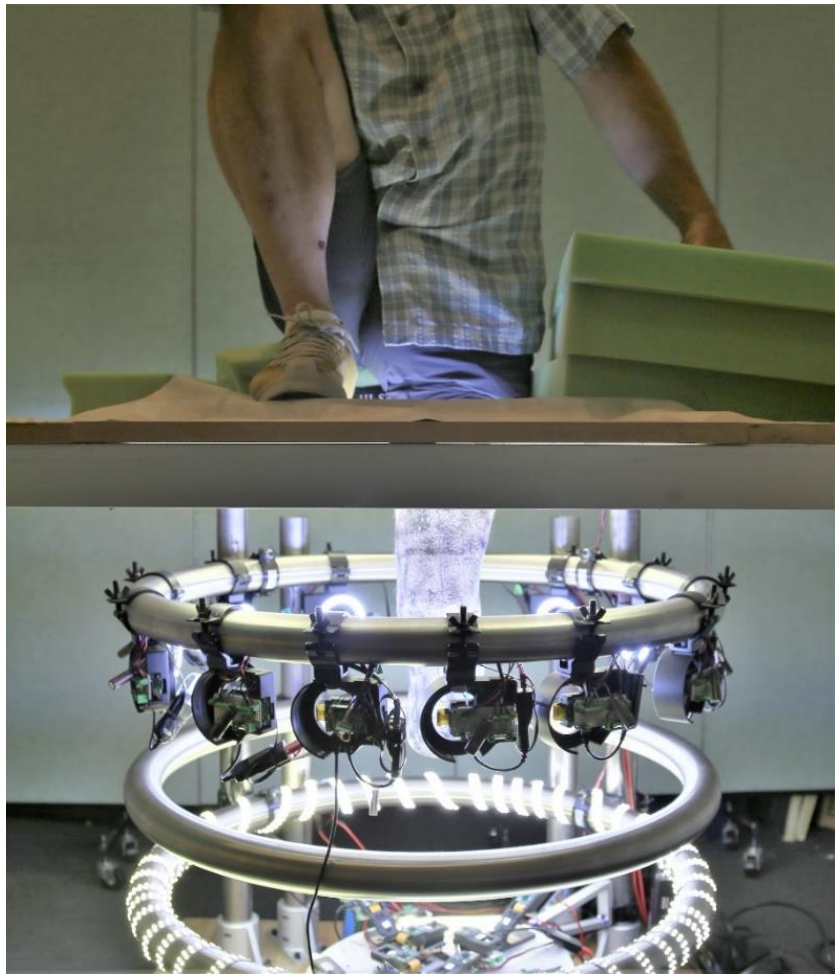

- Hyperelastic
- Large deformations
- Anisotropic
- Conformability to complex shapes





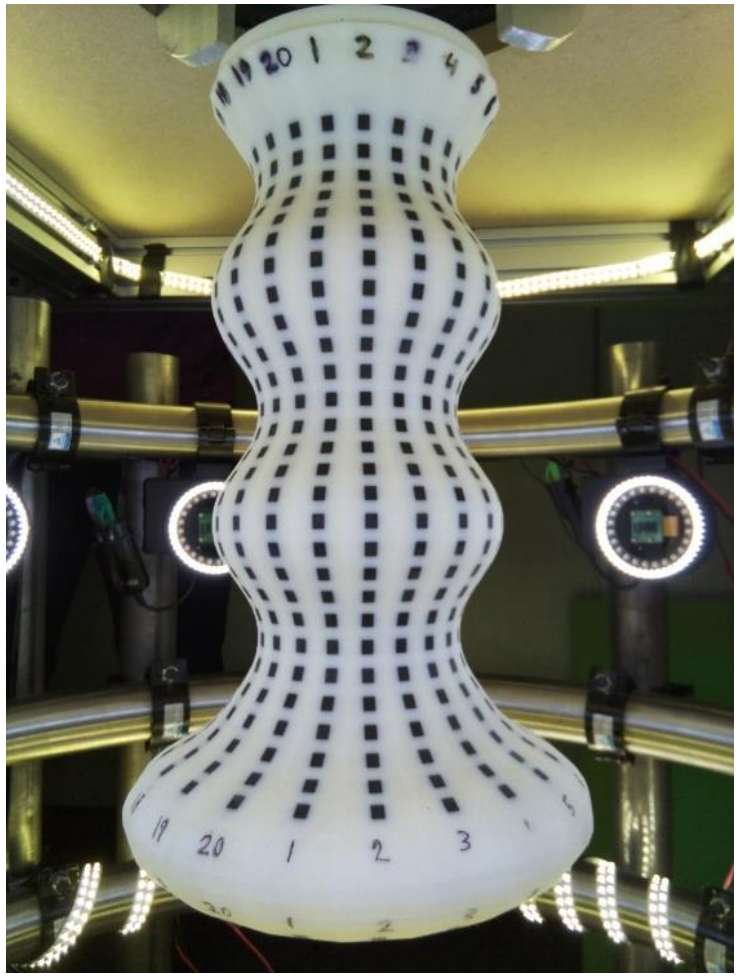
# Multi-camera 3D digital image correlation

21 RaspberryPi camera rig



Speckled residual limb

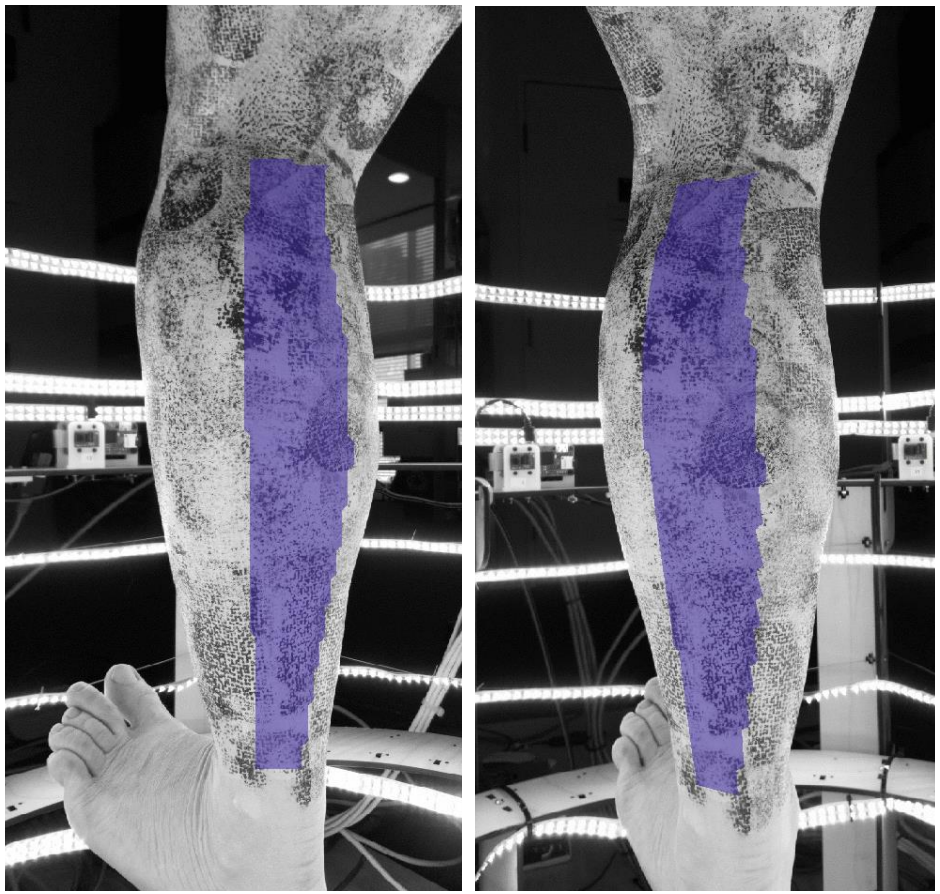
3D-printed calibration target

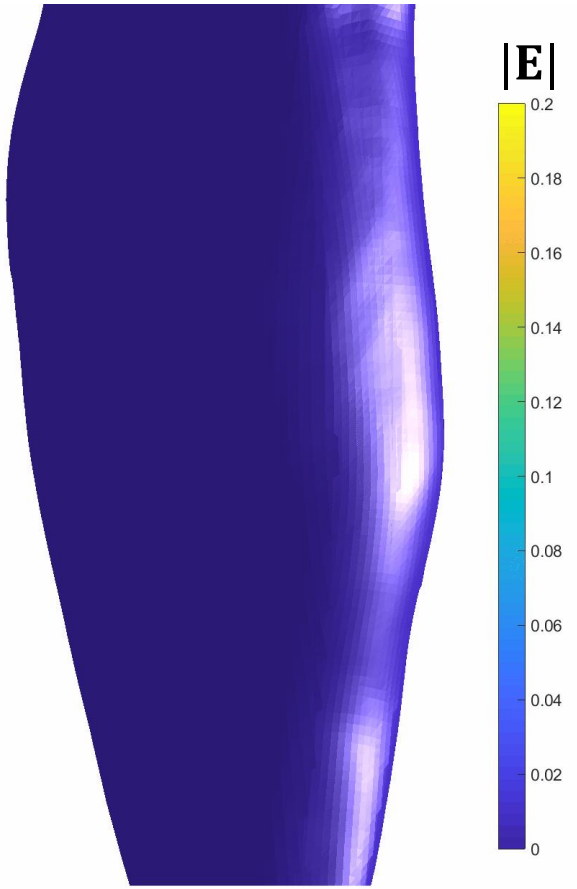


- D Solav et al. "MultiDIC: An open-source toolbox for multi-view 3D digital image correlation." *IEEE Access* 6 (2018): 30520-30535.
- D Solav et al. "A framework for measuring the time-varying shape and full-field deformation of residual limbs using 3-D digital image correlation." *IEEE Trans Biomed Eng* 66.10 (2019): 2740-2752.

# Open-source software for multi-view 3D-DIC

## Lagrangian strain norm |E|






**MultiDIC**

https://github.com/MultiDIC


1. D Solav et al. "MultiDIC: An open-source toolbox for multi-view 3D digital image correlation." *IEEE Access* 6 (2018): 30520-30535.
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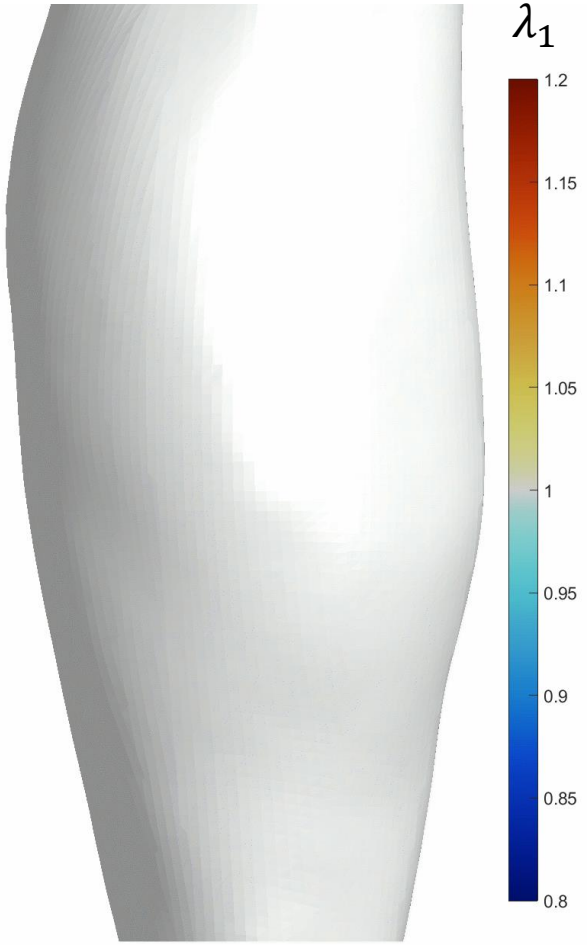
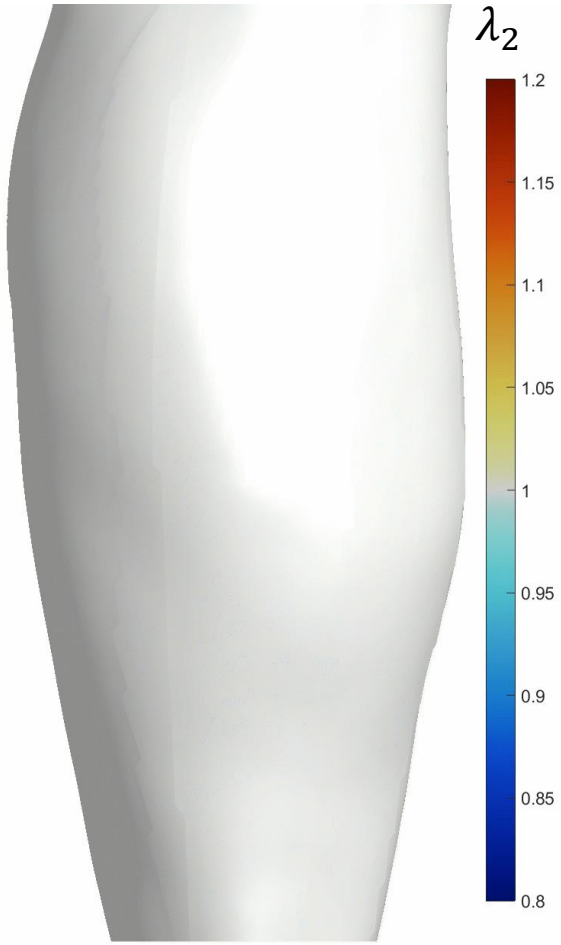
# Open-source software for multi-view 3D-DIC

## Principal stretches (magnitude and direction)

1st principal stretch



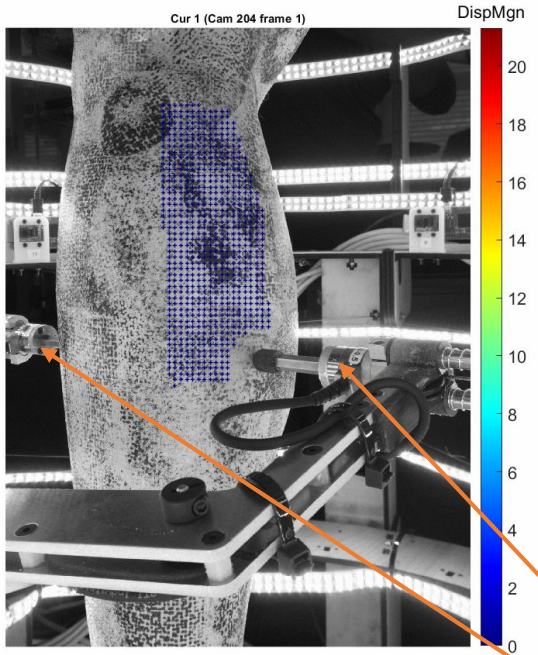

2nd principal stretch

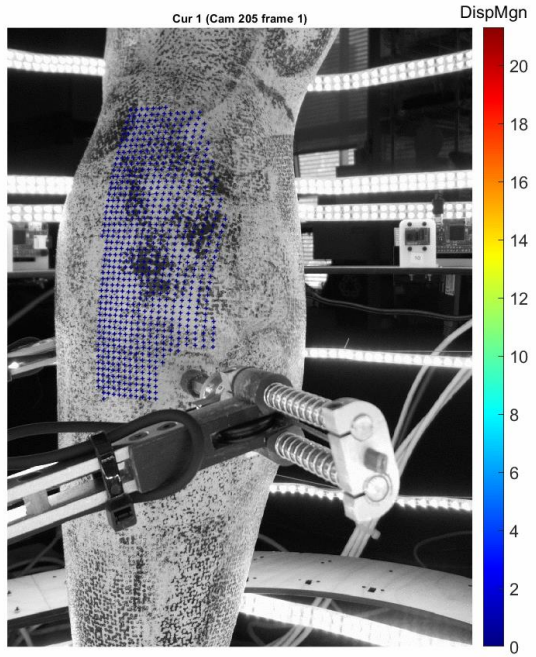



**MultiDIC**

https://github.com/MultiDIC

# Indentation device synchronized with the imaging rig

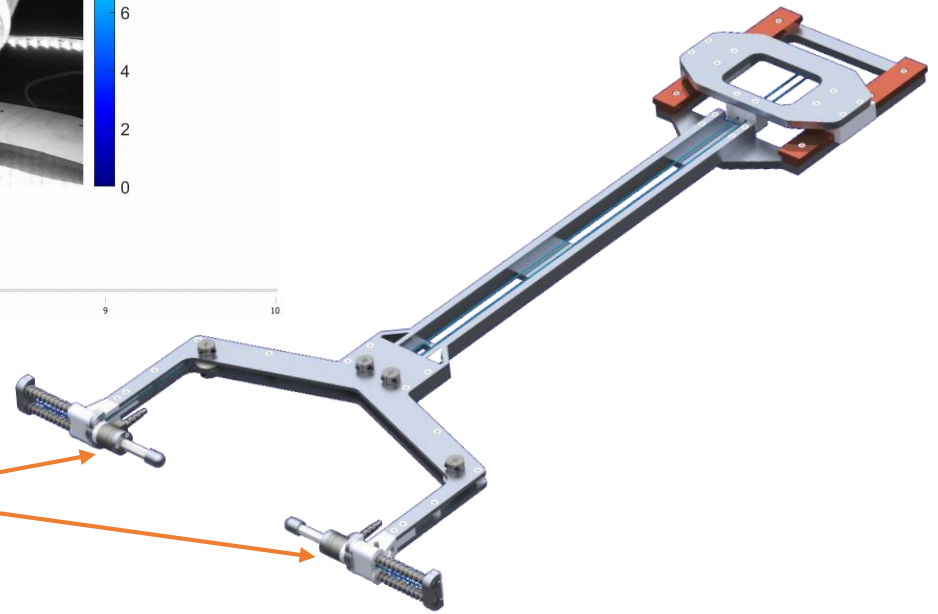




6-axis force/torque transducer
ATI Nano 17

Custom hand-held indenter

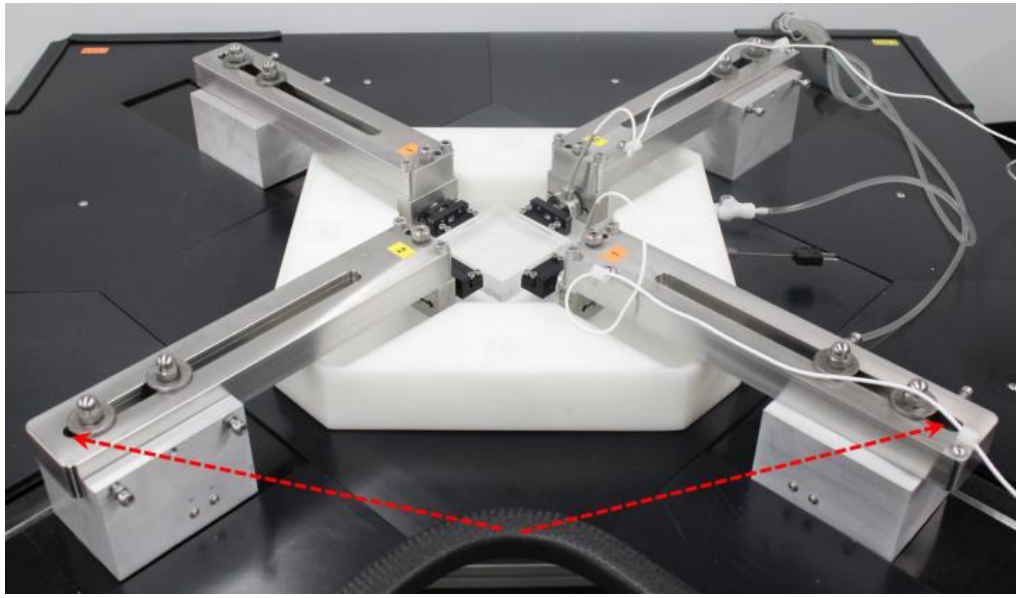


# Additive manufacturing and mechanical properties measurement

Sinterit Lisa Pro (SLS)


**Materials**:
PA12, PA11, Polypropylene
TPE, Flexa (grey/soft/bright) TPU

Planar bi-axial testing system

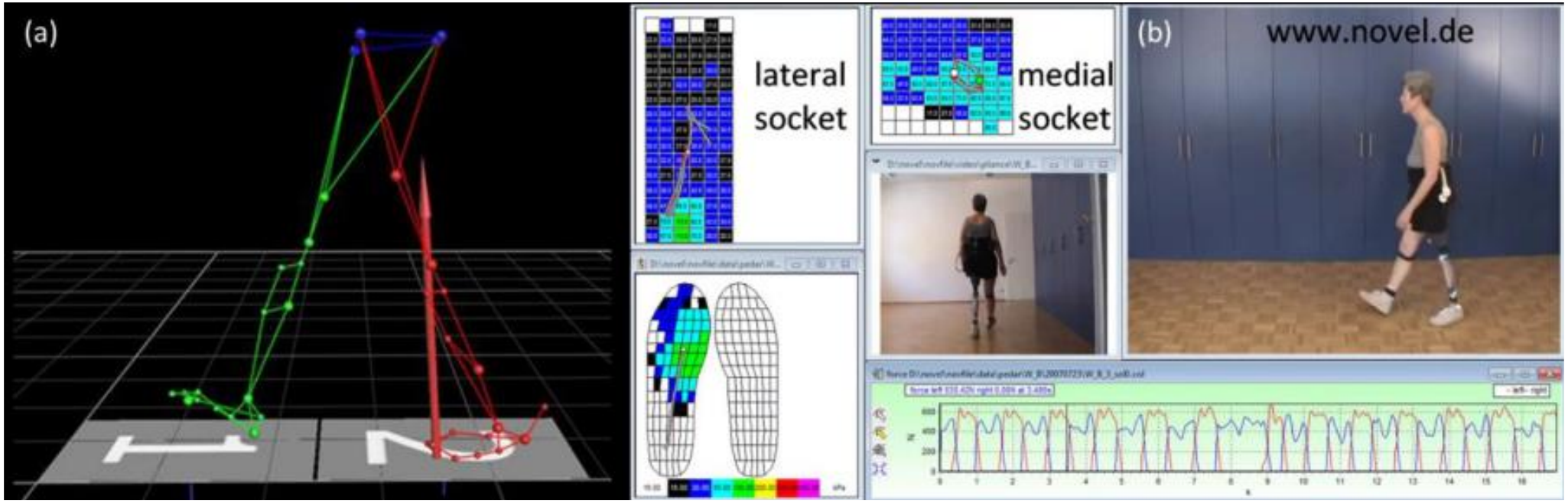


**Load cells**: 200 N and 2 kN
**Speed**: up to 353 mm/sec at 2 Hz

# Biomechanical evaluation

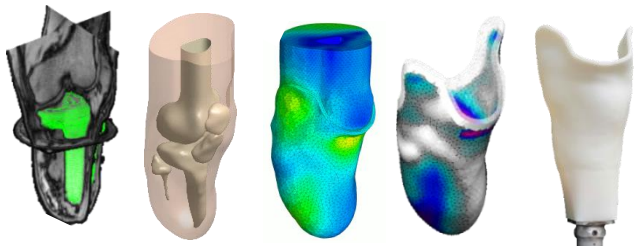
## Human motion analysis

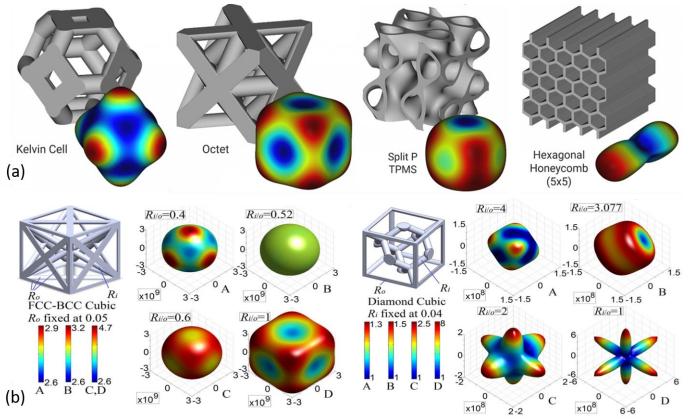
## Skin pressure distribution

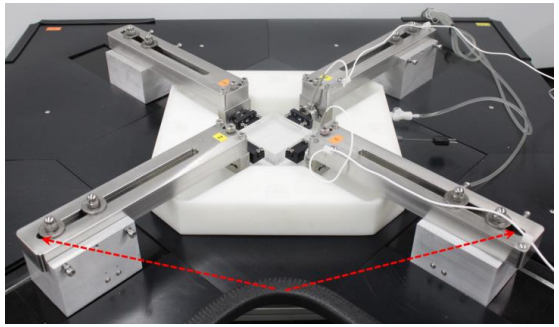



- Joint angles and moments
- Ground reaction force
- Foot center of pressure
- Electromyography

- Capacitive technology
- Shoe insoles
- Mats for prosthetic sockets
- Mats for braces in different sizes





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