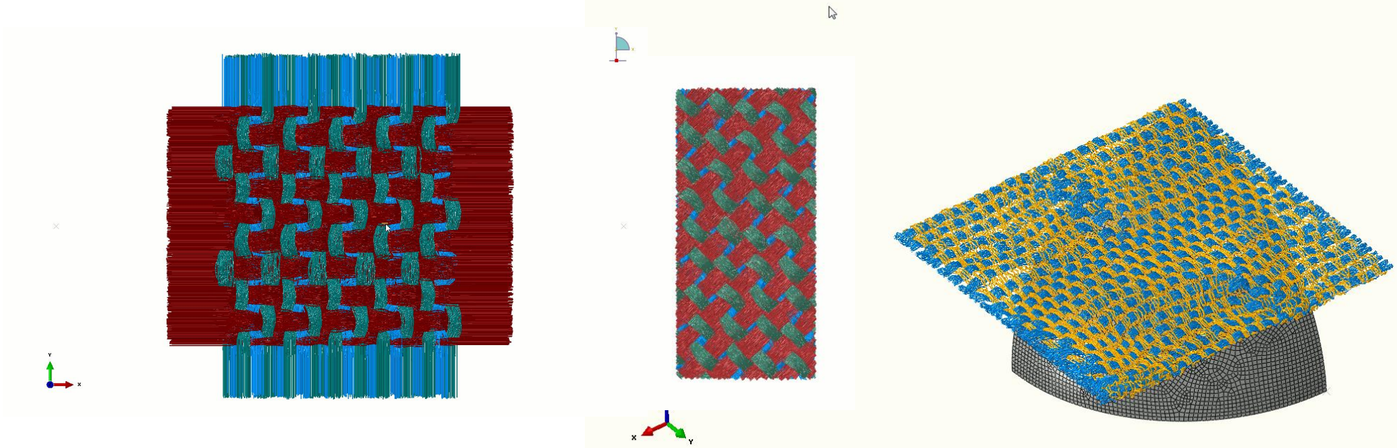
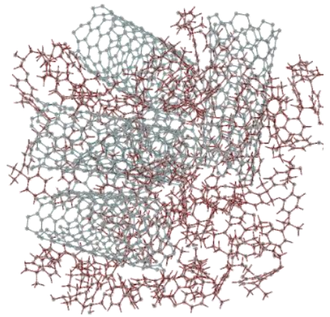
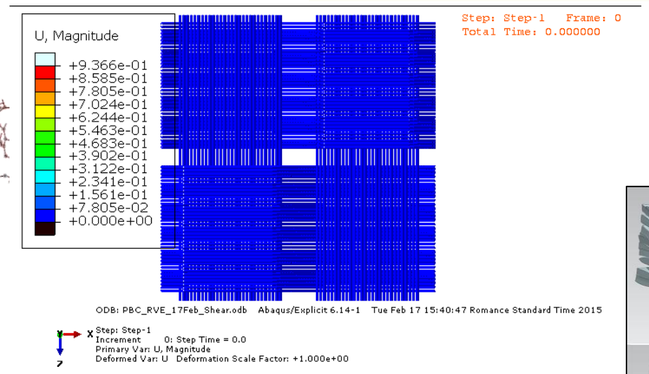
KEY AREA 4 > MECHANICS OF COMPOSITES

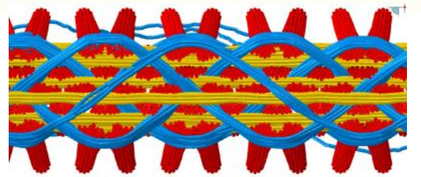
Multi-scale modelling and homogenization

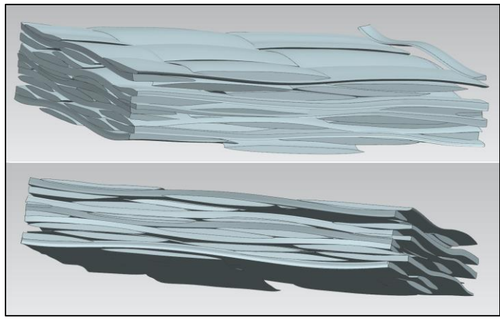
- Finite Element Molecular Mechanics (FEMM) method for concurrent multi-scale modelling of nanomaterials
- Simulation of dry fibre / dry yarn mechanics (biaxial tension and shear of 3D woven fabrics)
- Hybrid micro-meso-scale modelling of coated fabrics
- Improved meso-scale geometry models for nested textile composites (avoiding interpenetration)
- Meso-scale modelling of damage development in textile composites in the presence of nesting
- Multi-scale modelling of static strength of textile composites (focus on meso-macro homogenization)
- Analytical models for prediction of ply cracking and free-edge interlaminar stresses in general symmetric laminates under thermomechanical loading
- Development of EAS hybrid stress elements for accurate calculation of interlaminar stress fields in composites

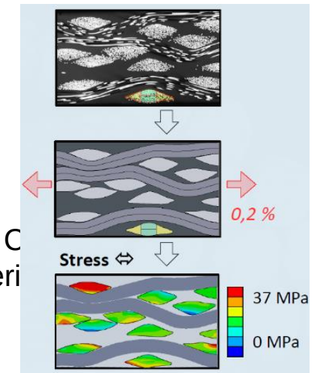


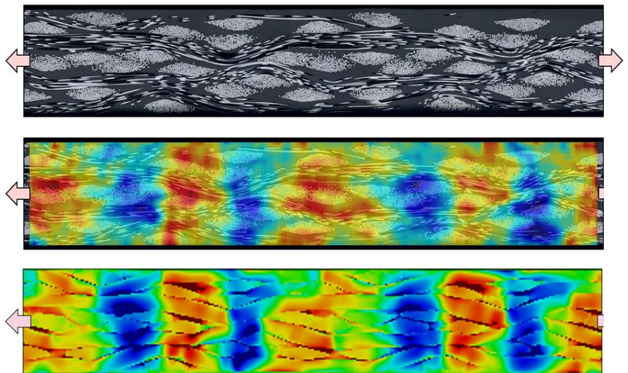


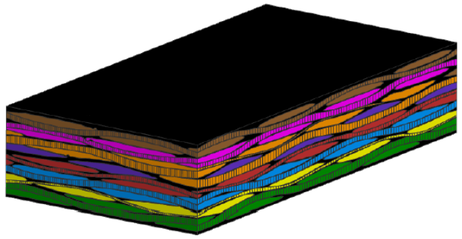












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COMPOSITES at Ghent University

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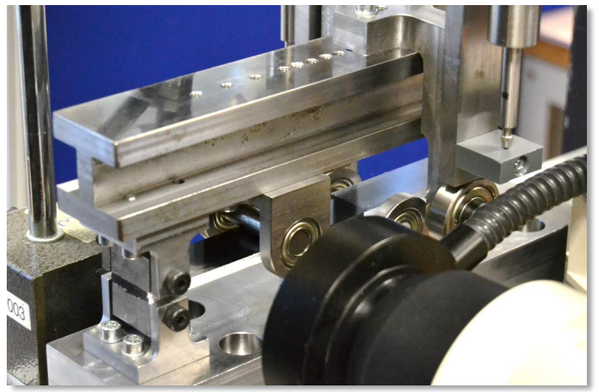
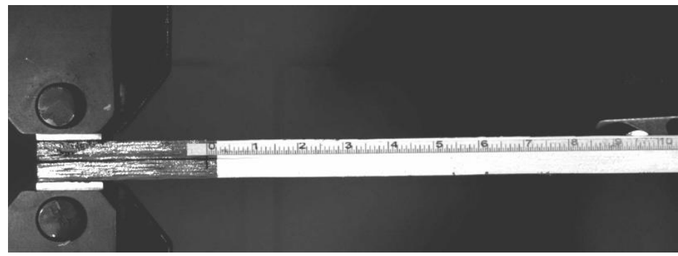
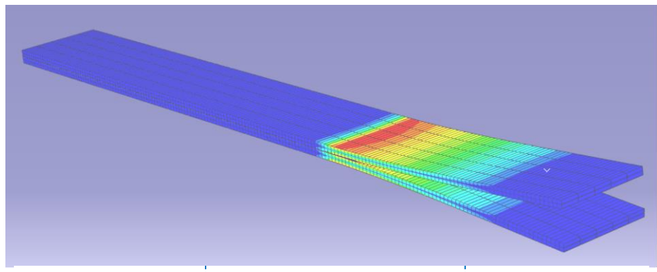
KEY AREA 4 > MECHANICS OF COMPOSITES

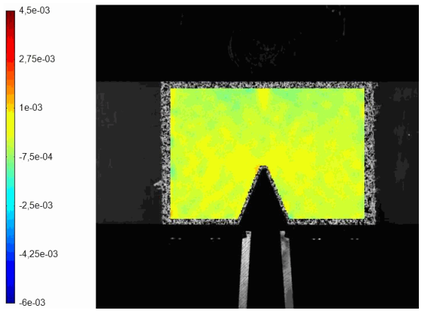
Fracture mechanics, joints and adhesives

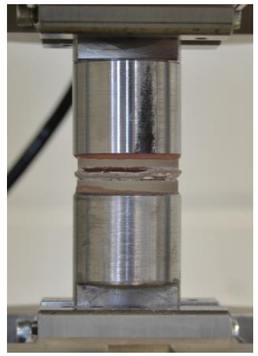
- Fusion bonding of carbon fibre-reinforced thermoplastic composites by infrared welding
- Simulation of mode I, mode II and mixed-mode delamination growth in composites and adhesive bonds
- Fracture mechanics testing and simulation of polymers (SENB, TDCB) and composites (DCB, ENF, ELS and MMB)
- Self-healing polymers and composites
- Electrospun thermoplastic nanofibres for interlaminar toughening of composites
- Pull-off dolly tests for strength of adhesive interfaces and coatings
- Characterization and modelling of Pressure-sensitive adhesives (PSA)
- Testing and modelling of PVB interlayers for laminated glass
- New on-site joining technologies for PTFE sealant rings on offshore oil rig platforms

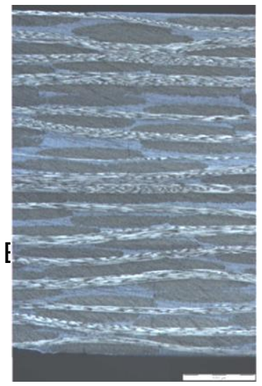


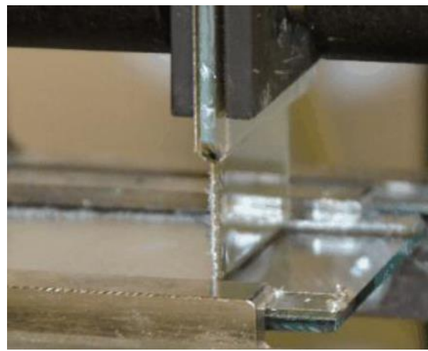












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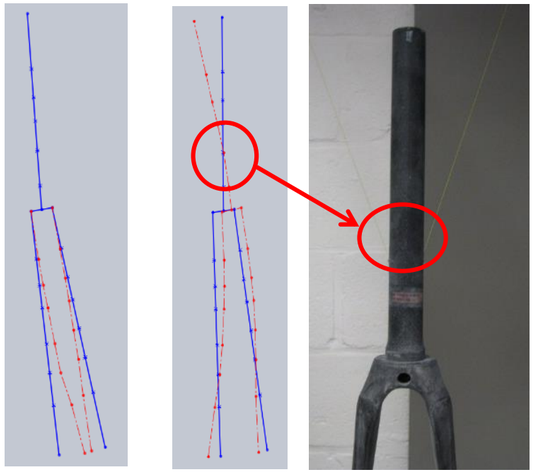
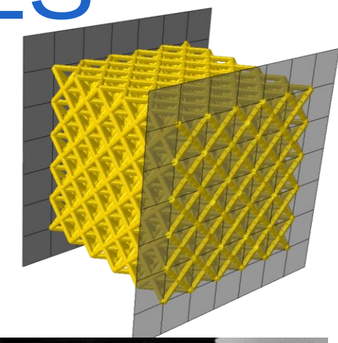
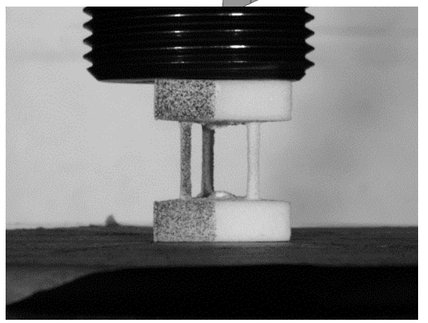
KEY AREA 4 > MECHANICS OF COMPOSITES

Sound and vibration

- Multi-scale modelling of the damping/vibration response of UD and textile composites (NVH – Noise/Vibration/Harshness)
- Frequency-dependent damping behaviour of lightly damped (composite) materials (laser vibration + acoustic excitation)
- Phononic crystals for selective frequency band gaps
- Making music instruments with composites and foams

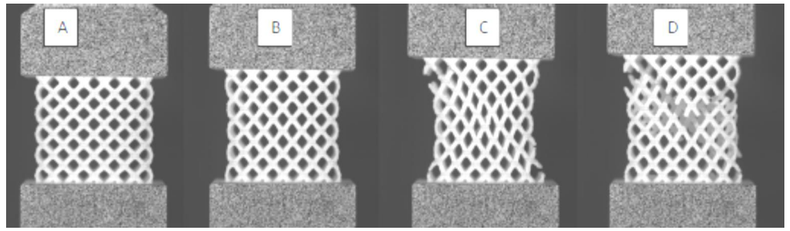


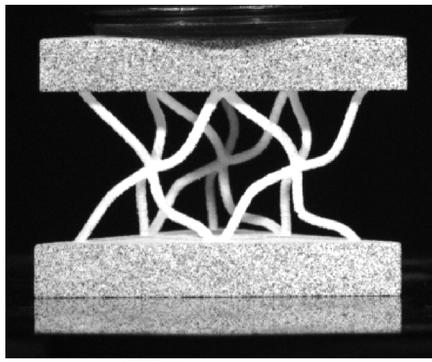


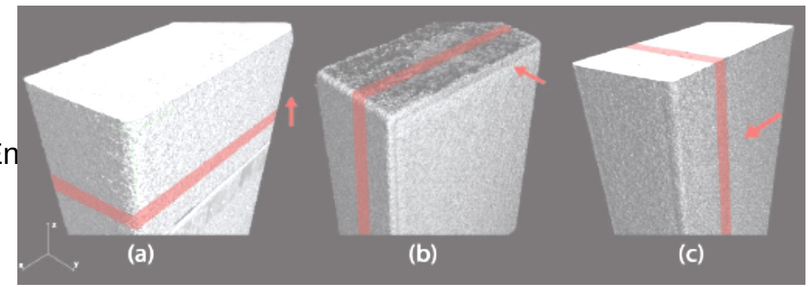


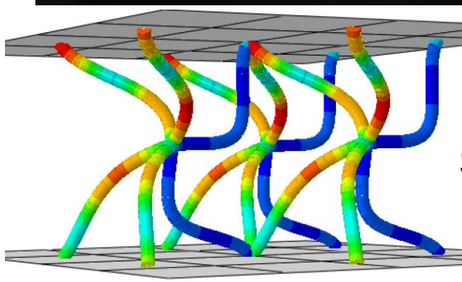
3D printed materials

- Mechanical characterization of nonlinear visco-elastic response of 3D printed polymers and lattices
- Multi-scale homogenization of the effective properties of 3D printed lattice/cellular structures
- Topology optimization strategies for 3D printed solid and lattice/cellular structures
- Stand-alone Discrete Element Method (DEM) solver for million+ particle interactions in ceramic sintering process









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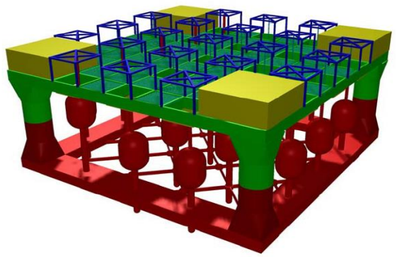
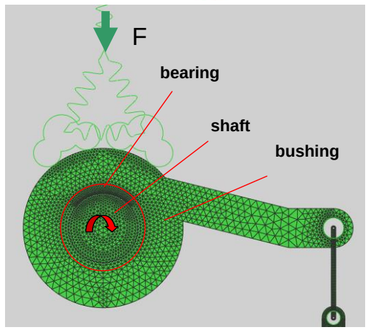
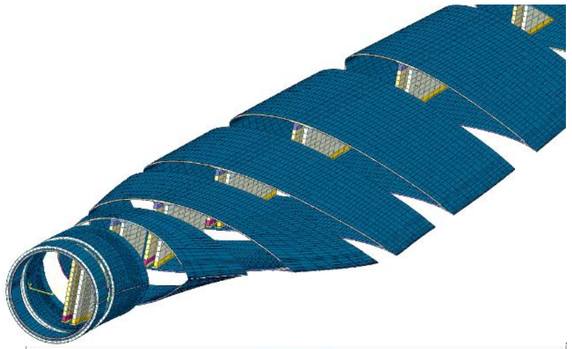
KEY AREA 4 > MECHANICS OF COMPOSITES

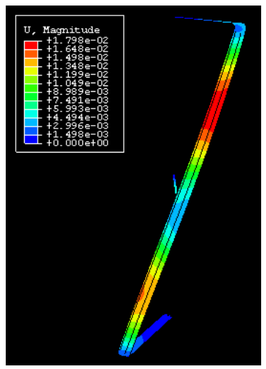
(Large-scale) industrial applications

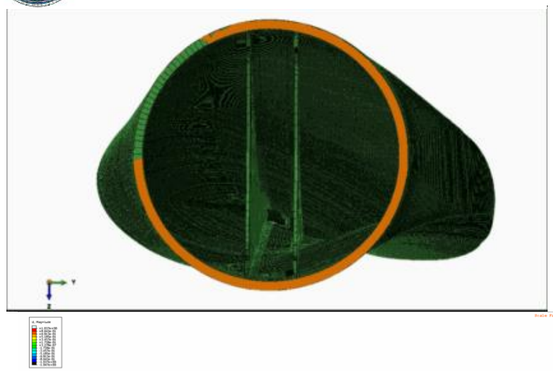
- Design of composite floating point absorbers for wave energy converters -> problem of slamming and fluid-structure interaction
- Certification testing of friction pads for largest ball joint in storm surge barrier
- Numerical simulation of contact and wear in composite bearings for large load applications
- Development of automated meshing tools for large (segmented) wind turbine blades
- Blade design for small-scale roof-top wind turbines
- Test set-ups for stiffness and (fatigue) strength of bicycle frames, front forks and wheels
- Mechanical characterization of vibration and damping behaviour of racing bicycles -> Small and large shaker testing of bicycles + rider and field testing







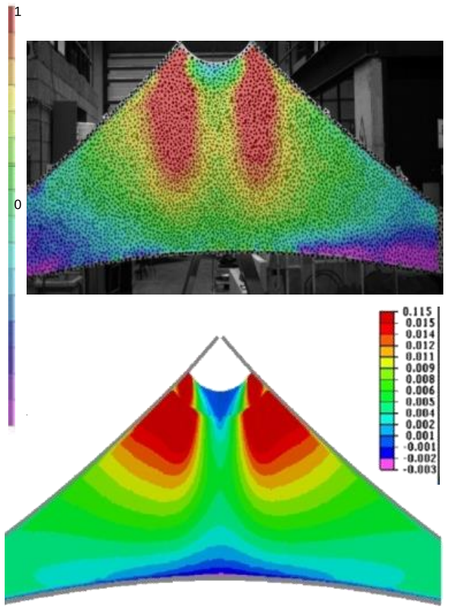


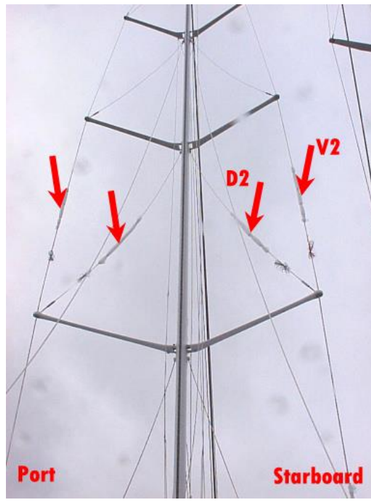


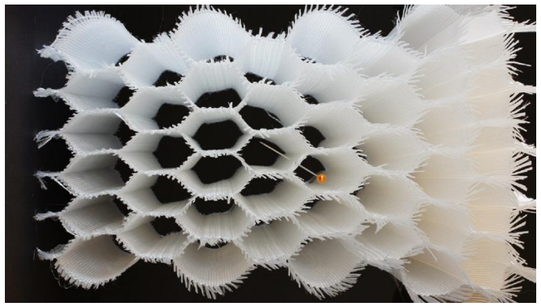
KEY AREA 4 > MECHANICS OF COMPOSITES

(Large-scale) industrial applications

- 3D woven fabrics for lightweight sandwich panels
- Vitrimers for recyclable and free-forming composites
- Composite heat exchangers -> thermomechanical design of short-fibre thermoplastic composites at high temperatures and pressures
- Improved fatigue life prediction of large wind turbine blades by combined in-service load monitoring and finite element simulations
- Finite element simulation of deployment of structural membranes for application in architectural tent structures
- Wide experience with outdoor field testing and battery-powered measurements on locations without electrical grid connections (sailing yachts, wave energy, bicycles,…)







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