UNIVERSITEIT GENT

FACULTY OF ENGINEERING AND ARCHITECTURE

Composites @ Ghent University

http://www.composites.ugent.be/

Ghent University
Department of Materials, Textiles and Chemical Engineering
Mechanics of Materials and Structures research group
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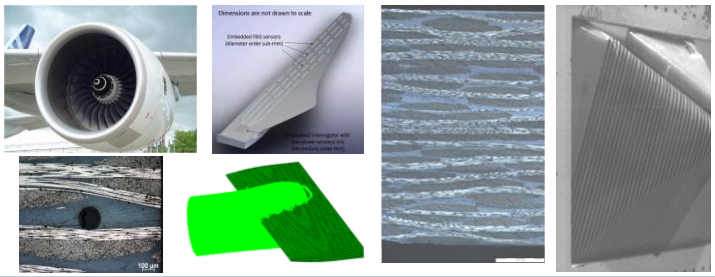
Our industrial application areas

AEROSPACE COMPOSITES

> bird strike (panels, fan blades, leading edge)
> impact (large- and small-scale drop weight, crushing)
> fatigue of thermoset and thermoplastic composites
> fusion bonded joints of thermoplastic composites
> ultrasound and thermographic inspection
> high strain-rate testing

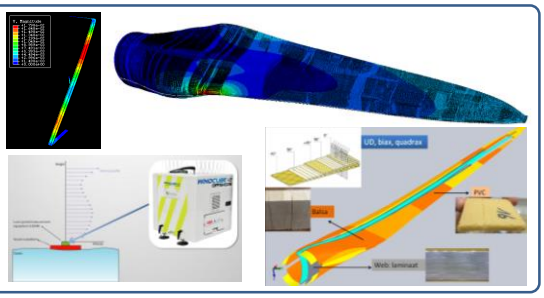


AUTOMOTIVE COMPOSITES

> fatigue of unidirectional and textile composites
> short and long fibre composites
> adhesive and hybrid joints
> axial crushing of composite crush cones
> carbon and glass thermoplastic UD tapes

COMPOSITES FOR WIND ENERGY

> detailed finite element modelling of large and small wind turbine blades
> numerical modelling of thick adhesive joints in turbine blades
> segmented blades for next generation 20 MW off-shore wind turbines
> effects of blade imbalance on dynamics of small wind turbines
> variable amplitude fatigue damage models
> stability of floating LIDAR's for offshore wind velocity measurement

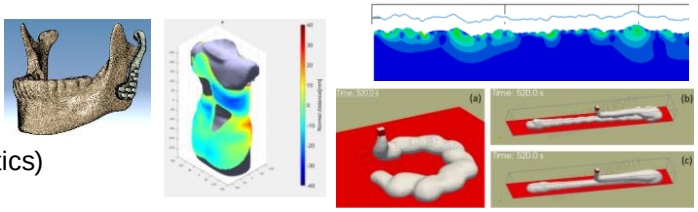


COMPOSITES FOR SPORTS

> static, dynamic and field testing of composite racing bicycles
> fatigue, damping and vibration of bicycle frames
> composites for sailing masts
> simulation of ball-surface interaction on artificial turf

ADDITIVE MANUFACTURING

> process simulation of additive manufacturing
> nondestructive testing of defected AM parts
> influence of voids and surface roughness on fatigue
> medical applications (titanium implants, orthotics, prosthetics)



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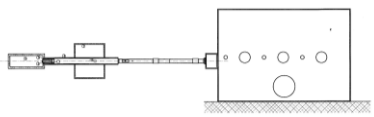
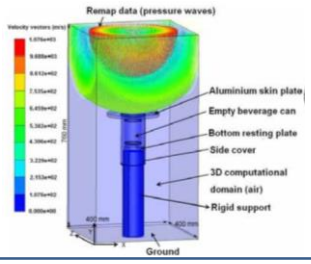
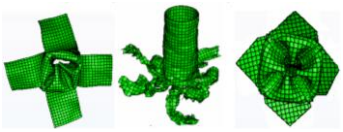
Our research areas

IMPACT OF COMPOSITES

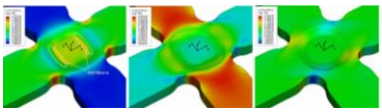
> bird strike
> crushing and energy absorption
> drop weight impact
> slamming wave impact
> air blast loading
> Charpy impact tests

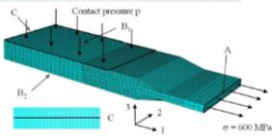




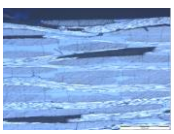


FATIGUE OF COMPOSITES

> tension
> compression
> rail-shear and bias tension
> three- and four-point bending
> resonance fatigue with electrodynamic shaker
> biaxial fatigue (shape optimization)

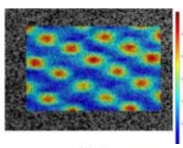
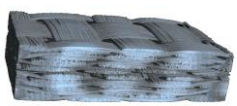
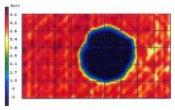



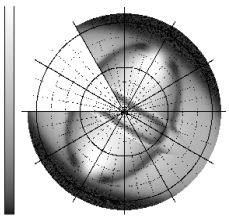


INSPECTION & MONITORING

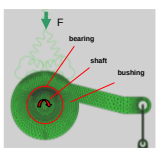
> optical fibre sensors (cure monitoring, multi-axial strains)
> Digital Image Correlation (DIC) algorithms
> ultrasound inspection (high frequency, air-coupled,…)
> micro-tomography (micro-CT)
> lockin thermography, vibrothermography
> optical microscopy and Scanning Electron Microscopy (SEM)

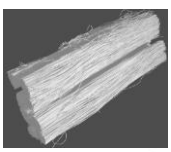






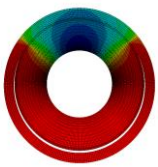
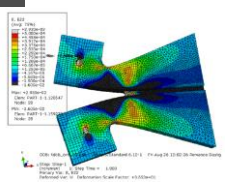
MECHANICS OF COMPOSITES

> multi-scale modelling (micro- to macro-scale)
> damage models for fatigue, impact,…
> adhesive and hybrid joining of composites
> topology and shape optimization
> homogenization methods for short fibre composites
> micromechanical testing in SEM
> varational methods for ply cracking and delamination
> simulation of dry fabric mechanics (compaction, draping)







ADVANCED FINITE ELEMENTS

> coupled visco-elasto-plasticity-damage-failure models for composites
> micro-meso-macro homogenization of unidirectional and textile composites
> higher-order mean-field homogenization methods for short fibre composites
> cohesive zone modelling for delamination, debonding and defragmentation
> (partial) hybrid and mixed solid-shell elements with interlaminar stress continuity
> Smoothed Particle Hydrodynamics (SPH) for bird strike, breaking waves, aircraft ditching
> multiphysics simulations (air ↔ composite, ultrasound ↔ composite, water ↔ composite)
> Arbitrary Lagrangian Eulerian (ALE) methods and adaptive node remeshing for material wear/erosion
> parallel computing on Linux workstations, HPC cluster with 2000+ cores and supernode (720 GB RAM)