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ADVANCED COMPOSITES COLLABORATION FOR INNOVATION & SCIENCE

Full field imaging of composite structures combining DIC and IR thermography

Karthik Ram Ramakrishnan, Janice Barton

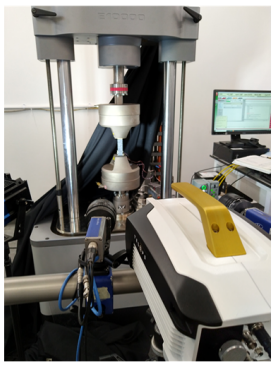
CONTEXT

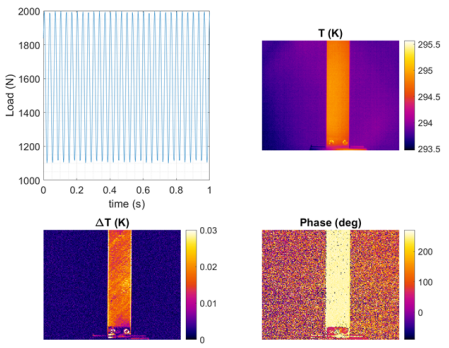
- Infrared Thermography (IRT) is the analysis of the surface temperature of a material using a thermal camera and evaluating defects or damage by localized variation in the temperature
- Impact damage in composite is accompanied by heat dissipation ⟹ temperature change on surface
- Surface temperature analysis using an infrared camera can be applied to better understand the damage mechanisms and energy absorption in composites

AIM

Combining Digital Image Correlation (DIC) and Infrared thermography to assess the damage evolution of composite materials for dynamic loading conditions

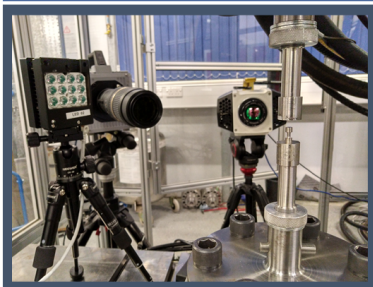
Thermoelastic stress analysis

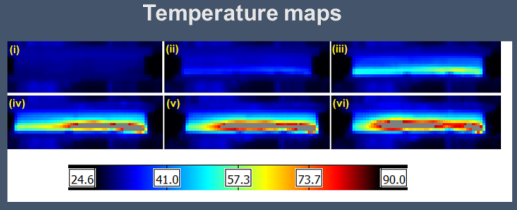


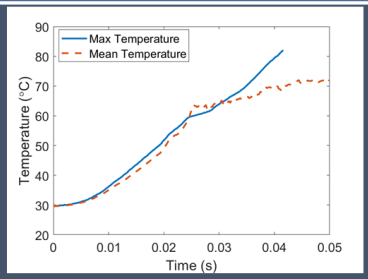


- Thermoelastic Stress Analysis (TSA)
  - Based on relation between change in principal stresses and small temperature changes
- Carbon Fibre composite with different layups
  - 0° UD, 90° UD, [0/90], [90/0], [45/-45]
- Cyclic loading using Instron Electropuls machine
- Telops High-speed IR camera and LaVision DIC camera

Medium rate testing

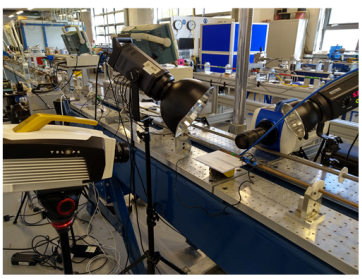


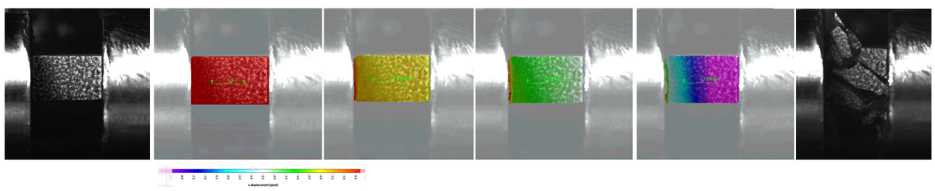




Different damage mechanisms such as fracture, damping caused by viscoelastic behaviour of the matrix or the frictional sliding between fibre-fibre and fibre-matrix interfaces cause heat generation in composites

High-rate testing





- High rate testing to be conducted using Split Hopkinson Pressure Bar
- Telops m3K high speed IR camera can image at 100,000 fps (in sub-window mode)