



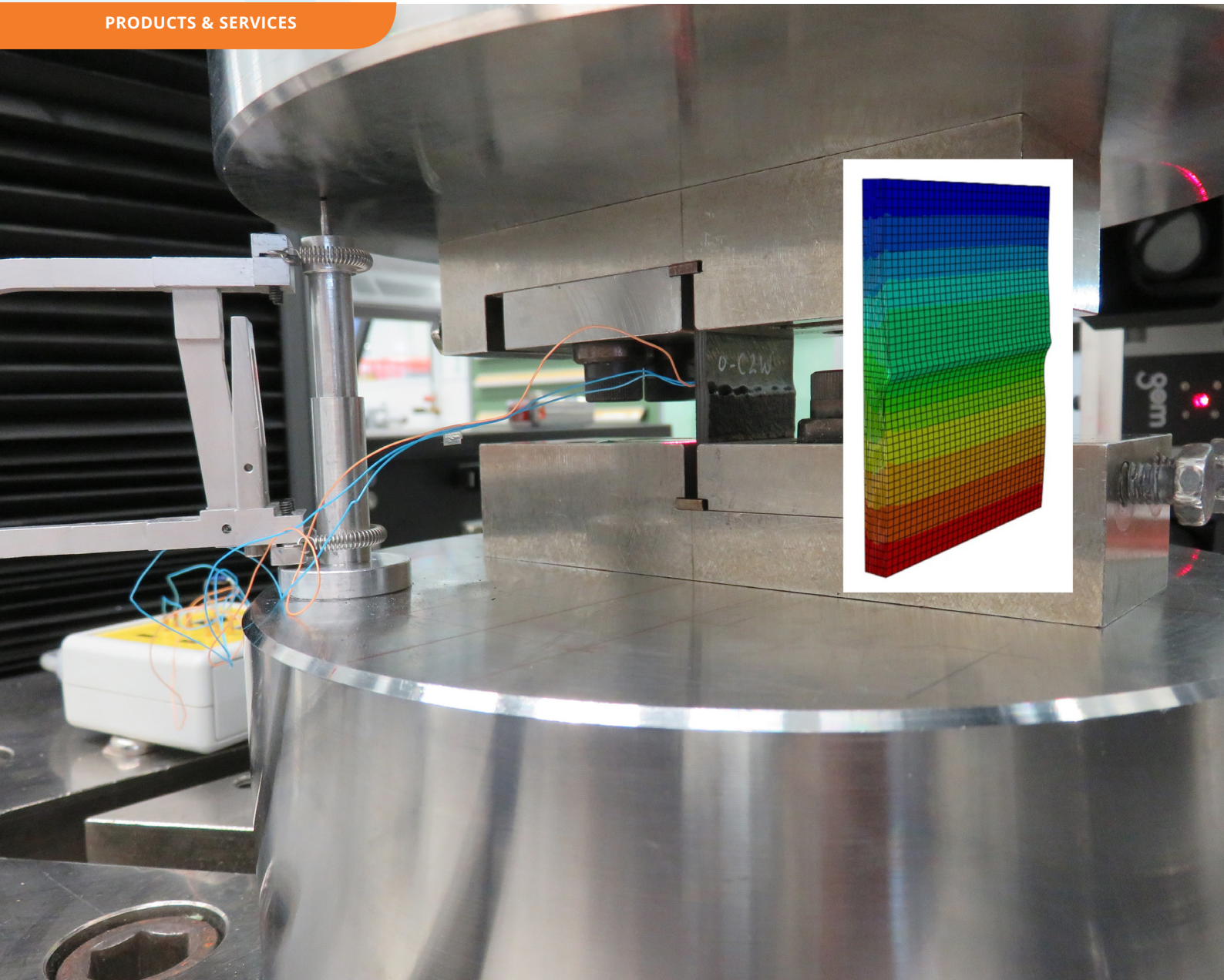
Dedicated to innovation in aerospace

AEROSPACE VEHICLES DIVISION

COLLABORATIVE ENGINEERING SYSTEMS

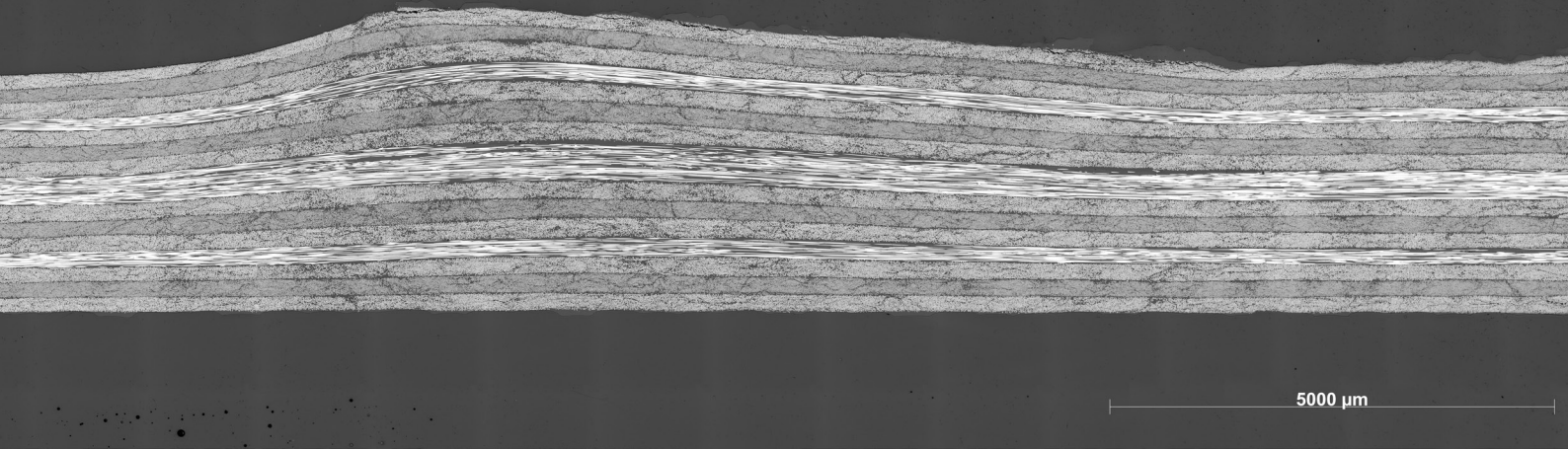
Virtual testing of coupons

PRODUCTS & SERVICES



Virtual testing of coupons to predict material allowables

Do you need to qualify a new material and are you planning a large qualification test programme? Do you need help to accelerate this material qualification process and do want to have insight in strength and stiffness before physical testing or even replace some coupon tests by simulations? NLR can predict the strength and stiffness of coupons by virtual testing before physical testing is carried out and can validate the virtual tests with physical test data afterwards. Even manufacturing defects like fibre waviness can be taken into account in virtual tests of composite coupons to predict the reduction in strength and stiffness.



WHAT YOU NEED

- Allowables of your material
- Reduction in time, costs and risks of your coupon test programme for a new material
- Insight in effect of manufacturing defects on strength and stiffness
- Exploration of design space of composites to optimize performance

WHAT WE DELIVER

- Virtual allowables of your material
- Accelerating and reducing risks of physical test programme by virtual testing and replacement of certain coupon configurations with simulations
- Prediction of effect of manufacturing defects on strength and stiffness by analytical and/or numerical methods
- Fast and efficient exploration of design space by virtual testing of different composite layups

OUR CAPABILITIES

NLR can test coupons virtually with FEM software tools like Abaqus and Digimat-VA to predict accurately the strength and stiffness. Also fast analytical methods are available to estimate the strength and stiffness of coupons. NLR can also predict the effect of manufacturing defects in composite coupons like fibre waviness, porosity and delamination with the help of non-destructive inspection (NDI) test data of the defect type and can validate the virtual coupon tests with physical test data. Further sensitivity analyses can be performed to determine the sensitivity of coupon strength and stiffness to variations in material properties, composite layup angles and defect parameters.

OUR CAPABILITIES

NLR has extensive experience with virtual and physical testing of coupons. In a recent project the compression strength and stiffness of unnotched compression (UNC) coupons with and without out-of-plane (OP) waviness were predicted before physical testing was carried out with the help of NDI test data and validated afterwards with coupon test data.

PRODUCTS & FEATURES

- Accurate virtual testing methods to predict material allowables.
- Sensitivity analysis to determine sensitivity of strength & stiffness to input parameters.
- Fast analytical methods to estimate coupon strength and stiffness.