# EXCEPTIONAL OUTLOOK

## Multi-scale visualisation – key to an enhanced understanding of materials

**Now it is possible to implement a user-friendly cross-model concept which enables the multi-scale visualisation of individual sets of simulation results. It was jointly developed by the Institute of Lightweight Engineering and Polymer Technology (ILK) and the Chair of Computer Graphics and Visualisation (both part of TU Dresden) within the framework of ScaDS Dresden/Leipzig – Competence Center for Scalable Data Services and Solutions.**

Computer-assisted methods play a vital role in the cost- and material-efficient design of lightweight structures, and are set to become an even more integral part of the development process in the future. In the case of fibre-reinforced composites, it is crucial that designs take their entire hierarchical structure into account – from fibres, matrices and rovings to reinforcing textiles, individual layers and multi-layered composites.

This hierarchical approach also needs to be applied as components are joined to form structures and multiple structures interact within the overall system. The availability of a suitable simulation model for each scale is therefore a prerequisite for targeted, efficient system development.

### In any case ...

The here presented solution is the first to facilitate the consistent visualisation of simulation results across all scales (Fig. 1). The browser-based software demonstrates the potential offered by multi-scale visualisation in terms of gaining an enhanced understanding of material behaviour. The example presented here uses simulation data generated during the development of an adaptive leaf spring within the framework of special research project SFB 639.

### ... and scale

As in the case of conventional tools, the software provides users with a 3D visualisation of previously computed results at the selected point in the loading process (Fig. 2). What is more, its zoom function is the first to enable users to switch between scales – and therefore between different sets of simulation data. Once a specific zoom value has been reached, the software automatically switches to the next coarser or finer scale while remaining at the same point in the loading process (Fig. 3). The continuous fade between scales (i.e. there is no cut in the zoom process) ensures that users do not become disoriented.

### Data on demand

The browser-based software can be used on any platform and does not need to be installed – all of the data required is available

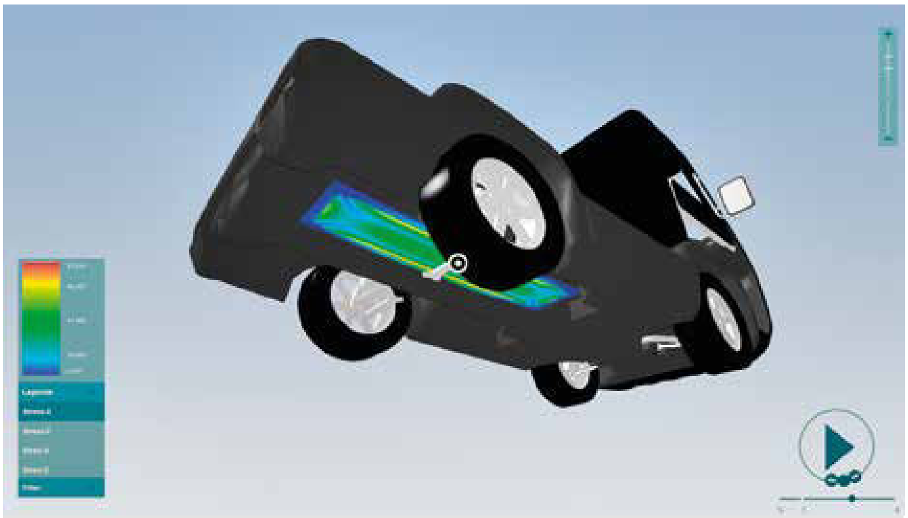

*Fig. 2: A rough 3D model of the demonstrator vehicle illustrates the application environment into which the simulated leaf spring is integrated.*

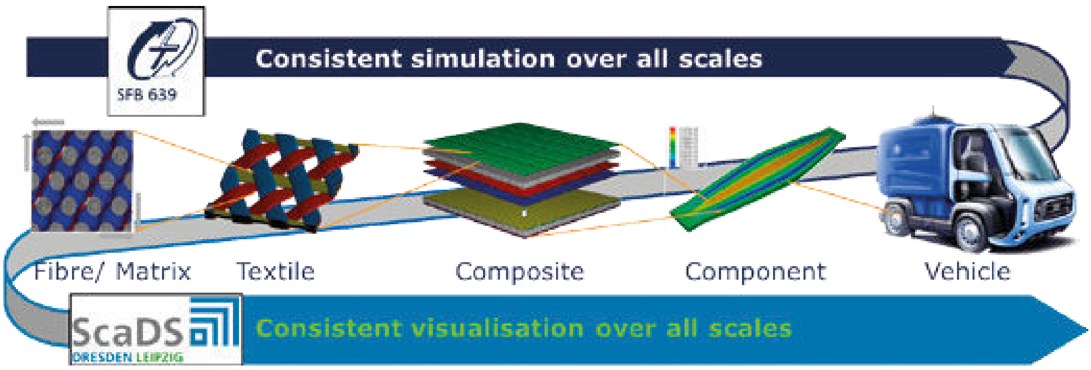


*Fig. 1: Multi-scale concept – Simulation and visualisation of material behaviour from individual fibre to overall vehicle.*

on a web server. The resultant avoidance of time-consuming data loading and program installation processes also ensures the rapid presentation of simulation results. The interface can be operated using a mouse or touchscreen, thus guaranteeing simple, efficient interaction with the software on a variety of devices.

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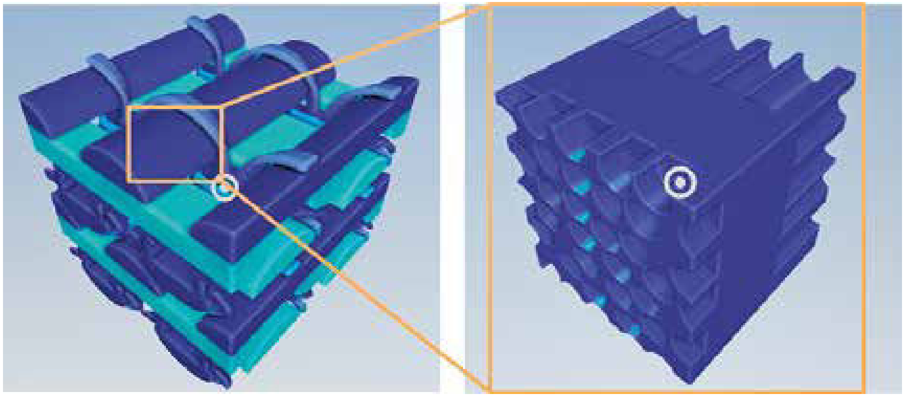

*Fig. 3: Left: Zooming in makes it possible to view the material stress at mesoscopic scale (textile). Right: By zooming in again the material can be viewed at microscopic scale (fibres/ matrix) at the same point in the loading process.*