ESAFORM Webinar Series 2022

Macroscopic Forming Simulation of Dry and Impregnated Textiles

Prof. Dr.-Ing. Luise Kärger
Digitization in Lightweight Design, Institute of Vehicle System Technology (FAST)
Karlsruhe Institute of Technology (KIT), *Email: Luise.kaerger@kit.edu*

Date/time: 28th September 2022 / 16:00 CET
Registration link:
https://videoconf-colibri.zoom.us/meeting/register/tZwtc-yvqD8jEt128kNuE22reyvJxnvYot3o

Abstract
Continuously fibre-reinforced polymers (CoFRP) offer a great lightweight potential due to their excellent mechanical properties at low density. The forming process is the initial manufacturing step of CoFRP components and forms the two-dimensional textile material into three-dimensional shape. It thus defines the final structure of the fibres. This final fibre structure has a significant impact on the structural performance and underlines the importance of forming simulation for CoFRP product development. For industrial needs, efficient methods for forming simulation at component level are required, particularly for large and complexly shaped multi-ply components. Such macroscopic approaches regard textile products as homogeneous even though they do not represent a homogeneous continuum on micro- and meso-scale. Instead, the multi-scale deformation behaviour of textiles is governed by the relative slip between the almost inextensible fibres. Thus, the resulting deformation mechanisms at macro scale need to be captured by appropriate material models.
This webinar gives an insight in current-state macroscopic forming simulation approaches. Following an introduction to the governing deformation mechanisms, different types of textile materials and forming technologies are considered, e.g. woven and unidirectional non-crimp fabrics (UD-NCF) and pre-impregnated UD tapes. All continuous-fibre textiles have in common that they are highly anisotropic with very low shear and bending stiffness. Additionally, material-specific modelling challenges arise due to the specific characteristics of the fibre architecture, stitching or pre-impregnation.

Biography

Prof. Dr.-Ing. Luise Kärger holds a Full Professorship at Karlsruhe Institute of Technology (KIT) in the field of Digitisation in Lightweight Design. She has 20 years' experience in composite simulation, with a special focus on composite process simulation since 2012. She completed her PhD in 2007 at the German Aerospace Center (DLR) in Braunschweig, Germany. In 2014, she was awarded as Leader of the Young Investigator Group "Green Mobility", funded by the Vector Foundation. Since 2022, she receives a Heisenberg grant, which led to her current position as full professor and Director of the Institute of Vehicle System Technology (FAST) at KIT.