

Seminar series of the Graduate School GRK 2078

Referee: **Dr. Andreas Endruweit**
Associate Professor in Composites Manufacturing
The University of Nottingham /U.K.

Date: Tuesday, January 23, 2024

Time: 14:30-15:30h

Location: Zoom Online Event

Title: **Simulation of composites manufacturing based on advanced modelling of reinforcement properties**

Abstract

In the manufacture of components from composite materials, numerical process simulation is used to predict the product quality and to optimise the process cycle time. In particular, predicting the fibre arrangement and resin distribution in the finished component is of interest, as they determine the mechanical performance of the product. This presentation gives an overview of activities at the University of Nottingham in modelling realistic non-uniform fibre arrangements in different reinforcements and their effect on impregnating resin flow. For fabrics from continuous fibre bundles, deterministic local variations in the fibre arrangement, e.g. induced by shear during preforming, are combined with stochastic non-uniformity, which can be derived from fibre angle distributions observed in the reinforcement. For preforms from randomly orientated discontinuous fibre bundles, the local distribution of fibre bundles is derived from simulation of the automated spray-deposition manufacturing process. In both cases, local permeabilities can be approximated for the non-uniform reinforcements, and Monte Carlo simulation of the resin injection process allows the most probable flow scenarios to be determined and potential locations of dry spots to be identified. The predictions can be used to optimise process parameters and implement control measures to obtain the desired product quality. In ongoing work, stochastic process simulation is combined with in-process data acquisition during the resin injection to estimate the local permeability and fibre volume fraction of reinforcements employing a Bayesian inversion method. The resulting map of the local fibre volume fraction can be used to create a digital twin of an as-manufactured composite component.

You are cordially invited to take part in the event.

Prof. Dr.-Ing. Thomas Böhlke
(Spokesperson of GRK 2078)