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Natalie Mayer, Jens Prowe, Tamas Havar, Roland Hinterhölzl, Klaus Drechsler

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Structural analysis of composite components considering manufacturing effect

Natalie Mayer[1]*, Jens Prowe[2], Tamas Havar[2], Roland Hinterhölzl[1], Klaus Drechsler[1]

[1]Faculty of Mechanical Engineering, Institute for Carbon Composites, Boltzmannstr. 15, 85748 Garching, Germany
[2]AIRBUS Group Innovations, Department of Structure Engineering, Production and Aeromechanics, 81663 Ottobrunn, Germany

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An improvement of a structural simulation for composite structures is realized with data sets from process simulations. A main challenge is to provide a mesh-independent interface for finite element (FE) data conversion. In this work, the FE data conversion for structural analysis is discussed. All relevant material parameter and model data can be exchanged with a mesh-independent method, between different process simulation tools and tools for a subsequent mechanical analysis. This approach is based on mapping algorithms and a common data format definition. An approximated FE field value is transferred into the target mesh with respect to the corresponding coordinate system and the material structure. In this paper, different models for subsequent material prediction of sheared woven fabric composites are considered and validation results for several analytical meso-modeling strategies of stiffness properties for such fabrics are demonstrated.

1. Introduction

Analysis and design of composite structures are dependent on material modeling, FE analysis strategies and manufacturing constraints. Process simulation and structural analysis are needed for a detailed prediction of the behavior of a composite component. A virtual process chain is a challenge for different fields of engineering using several FE solvers and materials [1, 2]. Particularly, the different process simulations are mostly not integrated into each other and structural analysis [3, 4]. The manufacturing process changes e.g. fiber orientation and thickness values and effects thereby the fiber volume content of used materials. Therefore, a prediction of the as-built material properties of unidirectional (UD), non-crimp (NCF), woven and braided fabrics for a structural analysis has to be realized with different analytical and FE-based approaches [5, 6].

For woven fabrics different models for twill, plain or satin structures have been investigated [7, 8]. The waviness and

* *Corresponding author.* Tel.: +49-89-289-10394; fax: +0-000-000-0000.
E-mail address: mayer@lcc.mw.tum.de

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