Technische Universität Braunschweig

MUSEN

Circular Production: How Computational Engineering can support a sustainable and circular economy

Lecture of

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One of the biggest challenges of today's society is the climate protection and to reach for sustainability. This involves the transformation from a rather linear economic model towards a circular economy. The question therefore arises as to how the recycling of materials and the resulting circular material flow can be taken into account in engineering for a proper product development and (computational) engineering of the corresponding production process.

Methods of Computer Aided Engineering (CAE) support by standard nowadays product development along all phases. Within virtual process chains, structural analyses under different loading conditions as well as the simulation of manufacturing processes are carried out using finite elements or further computational techniques to optimise design, processes and tooling. A major challenge in the transformation from a linear production to circular production is the consideration of the recycling steps in the virtual process chain. Furthermore, the uncertain material properties resulting from the recycling and the subsequent use of recycled materials must be taken into account during the engineering phase.

The presentation gives a brief overview of circular economy and how it affects product and production engineering. Using the example of a component made of fibre reinforced plastics, the production and the recycling of the component is illustrated. Based on this process chain, existing approaches to model and analyse recycling process as well as production processes with recycled (unknown) material properties are explained. Based on the existing literature, the extent to which new foundations in the field of computational engineering can be explored to support circular production will be discussed.