

Licentiate Seminar

Modelling Mechanics of Fibre Network using Discrete Element Method

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Licentiate Seminar in Chemical Engineering

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Welcome to the Licentiate Seminar with Per Bergström, Industry employed PhD student and Research Engineer from Essity Hygiene and Health AB.

Abstract

Low-density fibre networks are a fundamental structural framework of everyday hygiene products, such as baby diapers, incontinence and feminine care products, bathroom tissue and kitchen towels. These networks are a random assembly of fibres, loosely bonded and oriented in the plane direction.

Designing such a complex network structure for better performance, better use of materials and lower cost is a constant challenge for product designers, requiring in-depth knowledge and understanding of the structure and properties on the particle (fibre) level.

This thesis concerns the development of a computational design platform that will generate low-density fibre networks and test their properties, seamlessly, with the aim to deepen the fundamental understanding of the micromechanics of this class of fibre networks.

To achieve this goal, we have used a particle-based method, the Discrete Element Method (DEM), to model the fibres and fibre networks. A fibre is modelled as a series of linked beads, so that one can consider both its axial properties (stretching and bending) and transverse properties (shearing, twisting and transverse compression). For manufacturing simulations, we developed the models for depositing fibres to form a fibre network, consolidating the fibre network, compressing to make a 3D-structured network, and creating creping. For testing the end-use performance, we have developed two models and investigated the micromechanics of the fibre network in uniaxial compression in the thickness direction (ZD) and in uniaxial tension in the in-plane direction. Read the whole abstract on miun.se/fscn.

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Place Campus Sundsvall lecture hall O111

Supervisor Prof. Tetsu Uesaka, Mid Sweden University

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Welcome!