Defence of a Doctoral Thesis

Characterisation of Time-dependent Statistical Failure of Fibre Networks

Applications for Light-weight Structural Composites

Amanda Mattsson

Doctoral Thesis in Chemical Engineering
FSCN Research Centre
Faculty of Science Technology and Media
Mid Sweden University

Abstract

The future of a sustainable society requires that materials not only be renewable, but also leave as small a carbon foot-print in the environment as possible. One such product is light-weight composite material for transportation packages. Cellulose fibres have been and will continue to be ideal for this purpose.

The strength design of light-weight composites is becoming increasingly important. The challenge is to neither over- nor under-design, but instead to target the right strength under realistic loading conditions. The question then is: What is right strength? Under realistic loading conditions (e.g., fatigue, random loading, and creep), materials fail differently from what one expects from tests of static strength: materials often fail at much lower stresses than are measured in these tests, the failure is time-dependent, and time to failure is highly variable.

Therefore, to answer the above question, we have set up the following objectives: (1) Theoretically formulate time-dependent statistical failure (TSF), and examine the validity of the model; (2) Define material parameters describing the multi-faceted strength characteristics based on this formulation; (3) Develop an experimental method to determine the material parameters; (4) Investigate the impacts of fibre properties and network structures; and finally (5) Characterise containerboard (the fibre material used in corrugated boxes) samples in terms of the new parameters. The results for these five objectives are presented in the Doctoral Thesis. Read the whole abstract on **miun.se/fscn**

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Supervisor	Prof. Tetsu Uesaka
Co-Supervisor	Dr. Christina Dahlström
External reviewer	Prof. Sören Östlund
Examining committee	Prof. Douglas W Coffin
	Prof. Per Gradin
	Docent Rickard Hägglund

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