

Crack prevention in corrugated paper boards

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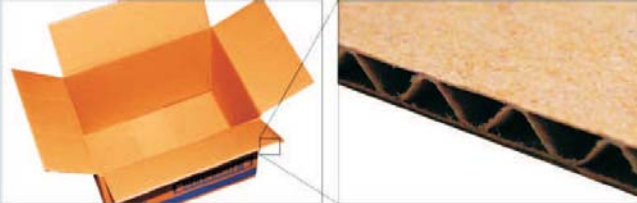
Crack Prevention in Corrugated Paper Boards

B.K. Thakkar, R.H.J. Peerlings, M.G.D. Geers

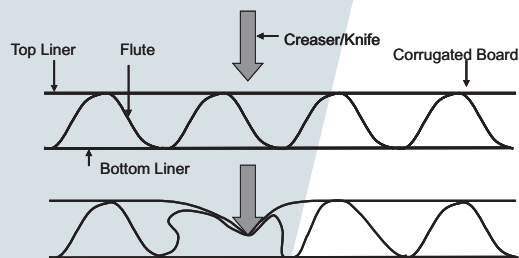
Eindhoven University of Technology, Department of Mechanical Engineering

Introduction

Packaging boxes are made by creasing and folding corrugated board to impart stiffness. For proper folding of corrugated board, neat fold lines (creases) are required to be created. These creases weaken the section along the fold line to facilitate a neat fold.

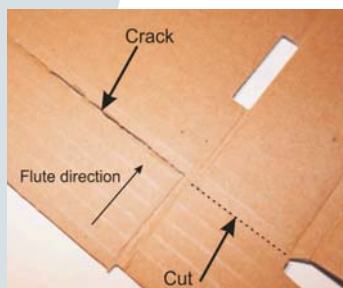


A schematic of the creasing process is shown in the figure below.



Problems

- The top liner cracks during creasing if the crease is too deep.
- The bottom liner cracks during folding if the crease is too shallow.



- Paper is highly sensitive to temperature and humidity.
- Fiber orientations of paper vary even in its width.

Project Goal

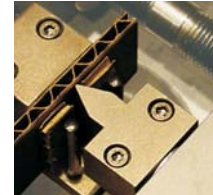
Prevent cracking of corrugated board during creasing and folding operations. This shall be accomplished by:

- Thoroughly understanding the mechanical behavior of corrugated boards.
- Modifying the current creasing and folding process to prevent cracking of corrugated paper boards.

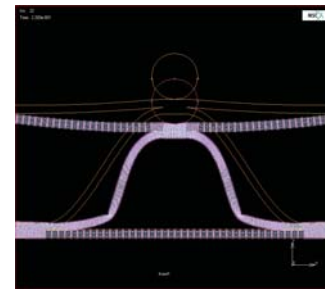
/department of mechanical engineering

Experiments and Finite Element Simulation

The experimental creasing test setup consists of a corrugated board held firmly against an anvil, on which a creaser (knife) indents a crease. The creasing test setup is shown below:

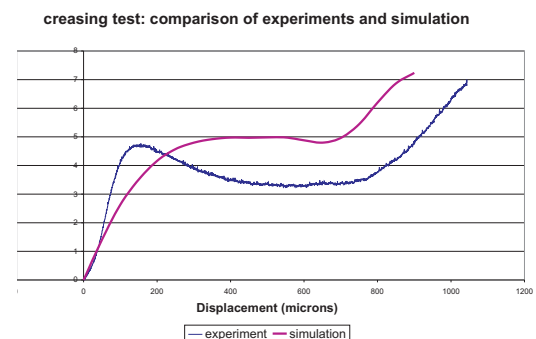


The finite element model for the creasing simulation is shown in figure below:



Results

The experimental load-displacement curve for the creasing process along with the simulation is shown below:



The finite element simulation for creasing process is in good qualitative agreement with experimental observations. However, quantitatively, the simulation deviates from experiments, specially in the post-buckling regime.

Conclusions

Paper, the constituent material of corrugated boards is mechanically characterized. The creasing process can be simulated well in a finite element analysis framework. However, more accurate characterization of paper is required and micro-mechanical model for cracking in paper is required to be developed.