Compression of pillow-shaped paperboard packages

Author: Pontus Thuresson

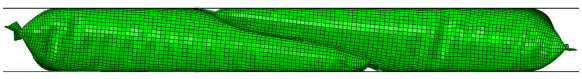
Original title: Modeling of pillow-shaped paperboard packages subjected to compression
Link: `http://www.solid.lth.se/education/masters-thesis/published/`

During transportation, packages are often stacked in columns causing high loads in the bottom layer. One may try to organize the packages in such a way that these loads are reduced. The question, though, is how this should be done?

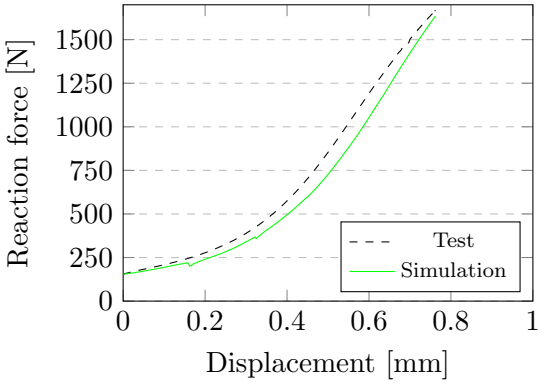
The thesis treats pillow-shaped paperboard packages filled with liquid that are compressed in various ways between two metal plates. The packages, called Tetra Fino® Aseptic are a member of the Tetra Pak product range.

The company experiences issues with package damage during transportation, whereby it is necessary to find a robust packing pattern. This issue provides the background for this thesis.

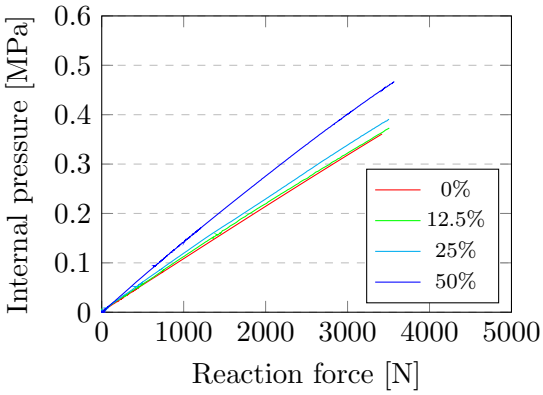
The purpose of the thesis is to place packages in different patterns in order so see which pattern that could withstand the highest load. This is done both physically and virtually by means of simulation. The simulations are supposed to mimic the physical tests as closely as possible. As a limitation to the many packing patterns that may be chosen, this thesis focuses on placing the packages with different shortside overlaps, 12.5%, 25% and 50%.



It is concluded that a modeled package on a large scale basis, such as force-displacement response, behaves like a physical package, whereas small scale details may not be captured. Furthermore, patterns using a smaller overlap has better robustness than a pattern with larger overlap. This is seen in the physical testing, and simulations of the internal pressure show that this is higher for larger overlaps.



From simulations it is concluded that the number of package layers should theoretically not influence robustness of the pattern. In reality, however, statistical aspects will most likely case the robustness to decrease with an increasing number of layers.



The possible contribution that this thesis may bring is that it provides a way of modeling packages in different patterns. Hence, it might be possible to use the method to try other types of patterns and hopefully be able to compare them and find the best alternative among the samples.