

## **Optimization of interlocking structures made of flax fibre composites to improve its energy absorption capability**

### **ABSTRACT**

This study presents an investigation about the effect of size variation on mechanical performance of square core interlocking structures, by using finite element analysis (FEA). The material used in this study is flax fibre reinforced polypropylene (PP) composite. Abaqus software was used for modelling and visualizing number of six interlocking honeycomb structures with different cell sizes and heights. In the first analysis, Abaqus/standard was performed on the perfect models by applying quasi-static loading to identify the imperfection shape and obtaining the buckling Eigen-modes for the models, then the Eigen-modes from abaqus/standard were imported to abaqus/explicit to run post-buckling analysis and simulate the overall imperfection behaviour of models. The numerical results from the finite element analysis simulation were used to plot load-displacement curve to each model. The area under the load-displacement curve represents the total absorbed energy, energy absorption per unit mass indicates the specific energy absorption, and the highest value of specific energy absorption represents the optimum size. The findings demonstrated that the square interlocking structure exhibits good energy absorption performance in some geometrical cases, and also revealed that the natural fibre composites have unique energy absorption capability under quasi-static loads.

**Keyword:** Flax fibre materials; Interlocking structure; Size effect; Finite element