



Identification of material and structural parameters of corrugated board in production and converting processes

Tomasz Garbowski¹, Aram Cornaggia², Tomasz Gajewski³, Jakub K. Grabski⁴

Modern engineering trends prioritize sustainable materials, with corrugated board at the forefront, analysed from Multiscale and Multiphysics perspectives [1]. This study delves into modelling corrugated board, structured as a composite of flat and corrugated papers, requiring assessments of orthotropic properties and structural geometry [2]. We investigate the mechanical responses of corrugated board, considering production processes [3]. Through detailed mechanical testing and numerical homogenisation [4,5], our research focuses on identifying parameters in structural topology, mechanics, and fabrication processes. Employing Inverse Analysis and Artificial Neural Networks [6], the study develops a comprehensive methodology for parameter identification and understanding the mechanics of corrugated board. This approach enhances quality control in production and offers insights for future corrugated board research.

Keywords: Parameter identification, Box Strength Estimation, corrugated board mechanics, Inverse Analysis.

References:

- [1] Simon JW, 2020, A review of recent trends and challenges in computational modeling of paper and paperboard at different scales, *Arch Comput Methods Eng*, 28, 2409-2428.
- [2] Rogalka M, Grabski JK, Garbowski T, 2023, Identification of geometric features of the corrugated board using images and genetic algorithm, *Sensors*, 23, 6242.
- [3] Cornaggia A, Gajewski T, Knitter-Piątkowska A, Garbowski T, 2023, Influence of humidity and temperature on mechanical properties of corrugated board – Numerical Investigation, *Bioresources*, 18, 7490-7509.
- [4] Biancolini ME, 2005, Evaluation of equivalent stiffness properties of corrugated board, *Comp Struct*, 69, 322-328.
- [5] Garbowski T, Gajewski T, 2021, Determination of transverse shear stiffness of sandwich panels with a corrugated core by numerical homogenization, *Materials*, 14, 1976.
- [6] Gajewski T, Grabski JK, Cornaggia A, Garbowski T, 2024, On the use of artificial intelligence in predicting the compressive strength of various cardboard packaging, *Pack Techn Sci*, 37, 97-105.

¹ Department Biosystems Engineering – Poznań University of Life Sciences (e-mail: tomasz.garbowski@up.poznan.pl).

² Department of Engineering and Applied Sciences – University of Bergamo (e-mail: aram.cornaggia@unibg.it).

³ Institute of Structural Analysis – Poznań University of Technology (e-mail: tomasz.gajewski@put.poznan.pl).

⁴ Institute of Applied Mechanics – Poznań University of Technology (e-mail: jakub.grabski@put.poznan.pl).



SAPIENZA
UNIVERSITÀ DI ROMA



POLITECHNIKA
LUBELSKA
LUBLIN UNIVERSITY
OF TECHNOLOGY



utc