

# Constitutive Model and Draping Simulations of Self-Reinforced Polypropylene (SRPP) Fabrics

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**Abstract.** SRPP is a self-reinforced polymeric composite in which the reinforcement and the matrix consist of the same polymer, namely polypropylene. The effect of the clamping conditions on formability of SRPP and SRPP-based hybrid composites was investigated experimentally at KU Leuven [1]. Three clamping options were considered: full edge, spring and corner. These conditions triggered different degrees of stretching, shearing and draping of the preforms. As the result, the formed hemispheres exhibited different wrinkling patterns. The present work focuses on the development and validation of an FE model for thermoforming of SRPP. The modelling approach is based on the hyperelastic law developed by Charnetant et al. [2]. Material properties required to fit the model were obtained from the tensile and picture frame shear tests performed at forming temperatures and bending test of a non-consolidated fabric at room temperature. To understand how wrinkles developed during forming, intermediate forming trials were conducted. Samples were deformed to 1-4 cm heights using a hemispherical mould with a 4.5 cm diameter. The formation of wrinkles as the material was drawn into the mould can be observed in Figure 1 (b), (d) and (f). These results are slightly non-symmetrical because of the difficulties associated with aligning of the panel when spring clamping was used. Comparison between the experimental and simulation results of the panels supported by springs are shown in Figure 1. From Figure 1 (a) and (b) both results show that there are no wrinkles at the early stages of deformation. Once the material is deformed by 2 cm (Figure 1 (c) and (d)), the wrinkles all around the circumference begin to appear. When 4 cm of deformation is attained (Figure 1 (e) and (f)), clear folds can be observed at the four sides. Overall, good qualitative correlation between experimental and modelling results is observed.

**Acknowledgements:** MS is grateful to the ESAFORM mobility grant, which enabled the collaboration between INSA Lyon and KU Leuven to take place. MS would also like to thank the SLC lab for their help with the forming trials. MS, LG and YSW gratefully acknowledge SIM (Strategic Initiative Materials in Flanders) and VLAIO (Flemish government agency for Innovation and Entrepreneurship) for their support of the ICON HYTHEC project. YSW also extends his gratitude to the FWO Flanders for his postdoctoral fellowship. The authors would also like to acknowledge the funding provided by Toray Industries (SVL is the current holder of the Toray Chair for Composite Materials at KU Leuven, while IV is the emeritus holder).

## References

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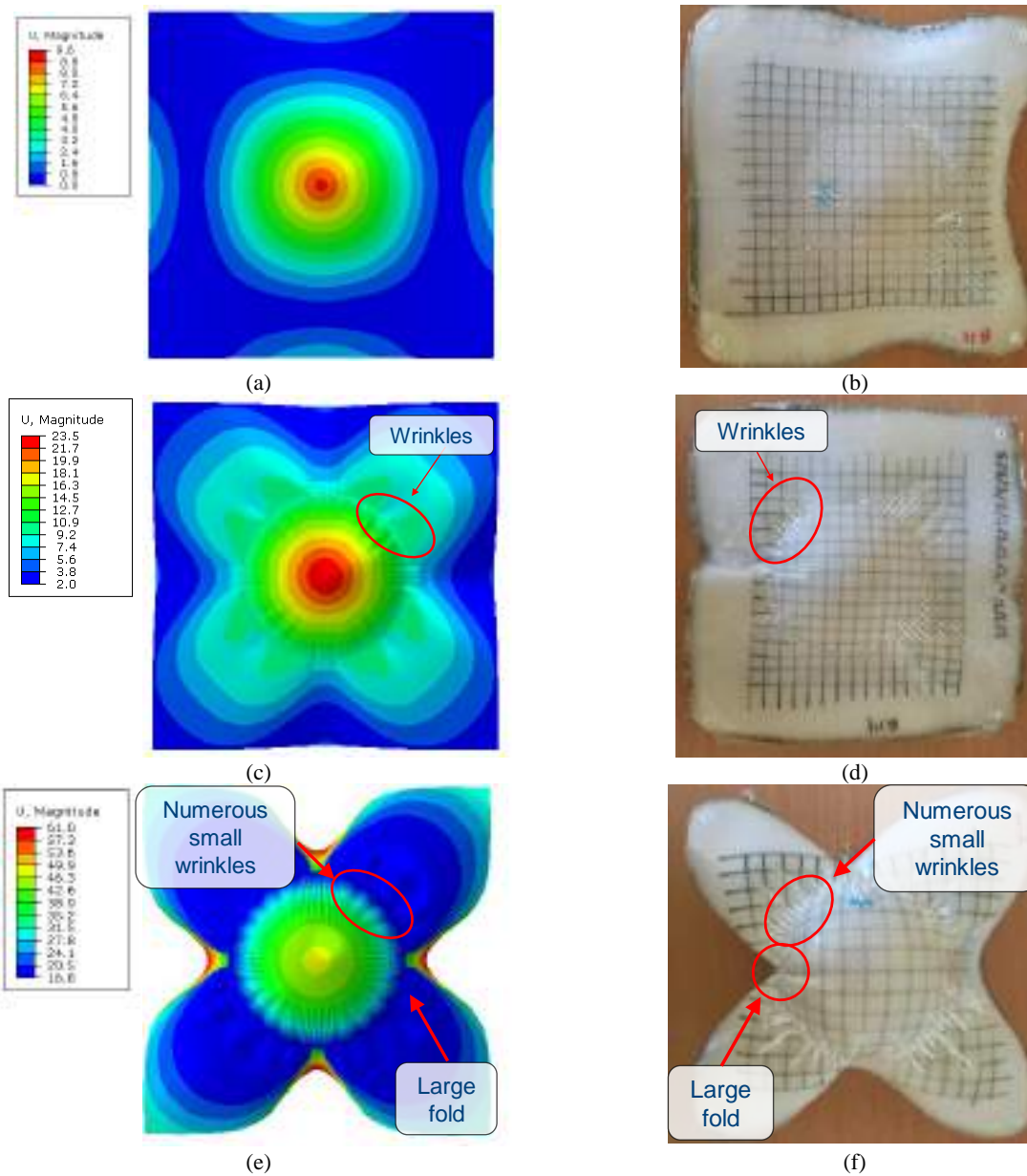


Figure 1 – Simulation and experimental results of the intermediate forming stages of SRPP supported by springs: 1 cm high dome (a) simulation and (b) experiment; 2 cm high dome (c) simulation and (d) experiment; and 4 cm high dome (e) simulation and (f) experiment.