

One important building block includes the development and validation of finite element modelling strategies to allow efficient but accurate stress and stiffness analysis of fibre-tow reinforced thermoplastic structures. Efficient and accurate finite element analysis forms the basis and is a prerequisite for a subsequent successful coupling with the to-be developed optimisation tools and routines.

As a starting point detailed 3D finite element analyses have been performed and shown to compare favourably with available experimental data. However, one conclusion that can be drawn from the results of the detailed 3D modelling is that the effects of stable cracking in the matrix (experimental observation) and the non-fatal transverse failure of the tow (from the simulations) are very hard to incorporate in a finite element analysis. Hence, the advantage of a good resolution of the stress state in the detailed 3D models is counteracted by the inability to model the progressive damage occurring in the structure. Hence, in an attempt to decrease the complexity and computational cost of the finite element models substantially with only a minor loss of accuracy, 2D models have been developed. In the 2D models, the surrounding polymer is modeled with shell elements while beam elements are used to represent the tow. Initial results indicate that this simplified modeling compares excellent to the detailed 3D analyses.

7. List of publications

a) Published

Below are publications that have been generated within the IPPC project, which as mentioned, is related to the APOMAT project:

MECHANICAL ANALYSIS OF MULTI-MATERIAL COMPOSITES MANUFACTURED BY INTEGRATED PROCESSING
P.-O. Hagstrand, M. D. Wakeman, F. Bonjour, P.-E. Bourban and J.-A. E. Månson
Proceedings of SAMPE 2002
Long Beach, California, USA, May 12-16 2002.

COST MODELLING OF A NOVEL INTEGRATED COMPOSITE MANUFACTURING CELL FOR INTEGRATED COMPOSITE PROCESSING
M.D. Wakeman, F. Bonjour, P.-E. Bourban, P.-O. Hagstrand, J.-A. E. Månson
Proceedings of the 23rd International SAMPE Europe Conference
Paris, France, April 9-11 2002.

ROBOTIC TOW PLACEMENT FOR LOCAL REINFORCEMENT OF GLASS MAT THERMOPLASTICS (GMTs)
M. D. Wakeman, P.-O. Hagstrand, F. Bonjour, P.-E. Bourban and J.-A. E. Månson
Composites Part A. 33 1199-1208 (2002)

MECHANICAL ANALYSIS OF THERMOPLASTIC POLYMERS REINFORCED WITH ROBOTICALLY PLACED CONTINUOUS FIBRE TOWS
P.-O. Hagstrand, N. Jansson, M. D. Wakeman, F. Bonjour and J.-A. E. Månson
Proceedings of the 14th International Conference on Composite Materials (ICCM-14)
San Diego, California, USA, July 14-18 2003.

b) Submitted for publication
c) In preparation