NEXT GENERATION RTM SIMULATION SOFTWARE

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Flow analysis software for the Resin Transfer Moulding and Resin Infusion processes has been commercially available for more than 20 years. The introduction of full 3D flow analysis and the development of model-based process monitoring and control functionality has created new possibilities but also introduced new challenges.

The addition of scripting, multithreading and networking capabilities, designed to use feedback from in-mould sensors to match the simulation model with the actual injection, is currently being used by us to create a variety of new features and applications, like parametric model generation for complex parts (see figure 1), the addition of custom pre- and post-processing features and distributed processing to run multiple simulations in parallel on networked computers. Implementing such applications puts high requirements on the stability and speed of the solver (and mesh generator), the high level scripting language and robustness of multithreading and networking.

We have designed and implemented a new solver module for 3D non-isothermal reactive flow. This module includes 1D line, 2D shell and 3D volume elements. The Finite Element Method is used to discretize the equations for conservation of mass, energy and momentum, the flow front is tracked using the Control Volume Method. An unconditionally stable streamline upwind implicit method is used for the convection terms in the energy and reaction rate equations. The new solver is implemented as an object that can be individually managed, created and destroyed on the fly, which makes it possible to work with several models simultaneously in a single multithreaded application.

This presentation outlines the motivation and requirements of the design for the new software platform and gives an overview of the implementation. This will be illustrated by several examples.

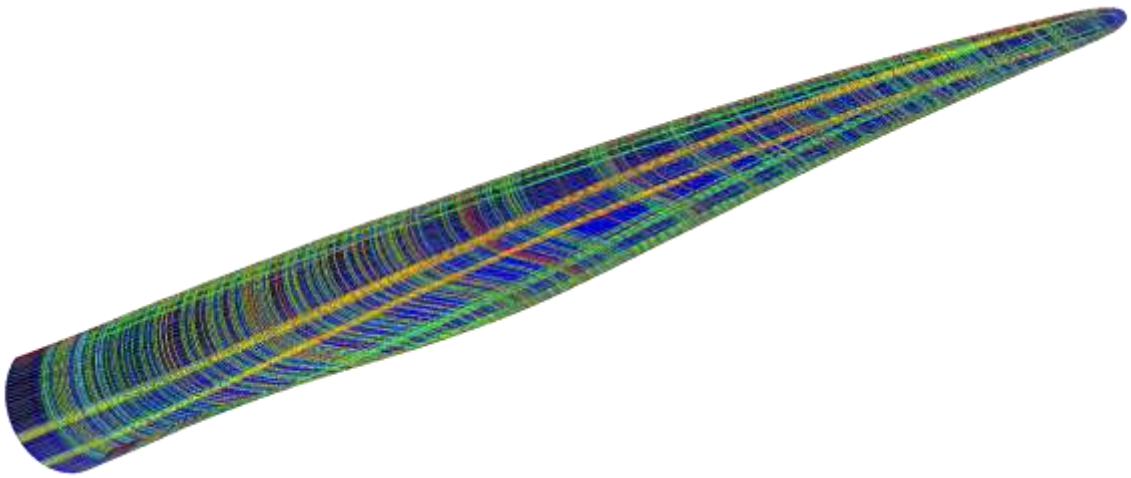

Figure 1: Flow model of a wind turbine blade in RTM-Worx, generated by a SALT script from mold geometry (surface model) and ply definitions (tabular data). Colored lines indicate ply edges.