MODEL BASED PROCESS OPTIMIZATION AND CONTROL FOR RESIN INFUSION

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The quality of composite parts manufactured by the resin infusion process is sensitive to material and process variations during the impregnation of the preform. Process robustness can be improved using flow analysis to optimize the injection strategy, e.g. location of gates and vents, and by tracking and controlling the resin flow through the preform using sensors in the mold. This work proposes the integration of 3D non-isothermal flow analysis with process monitoring and control. The material parameters can be adjusted, using a non-linear optimization method, to match the simulation with feedback from the sensors. With the updated flow analysis model, process parameters can be adjusted, in a second optimization run, to control resin flow and cure. The model, material and process parameters, feedback from sensors, adjusted material and process parameters are stored in a manufacturing database to access both engineering and production information in a unified way and to do the optimization off-line and on-line in real time. Results will be presented for implementation and validation of the system applied for infusion of complex 3D parts, in cooperation with the industrial partners in the ECOMISE project.