

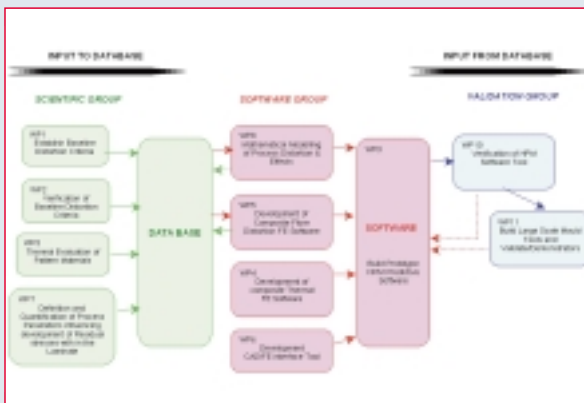


HIGH PRECISION COMPOSITES MOULDING PREDICTION OF DISTORTION USING ANALYTICAL METHODS (PRECIMOULD)

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Scientific Understanding of the Principles for Composite Part Accuracy

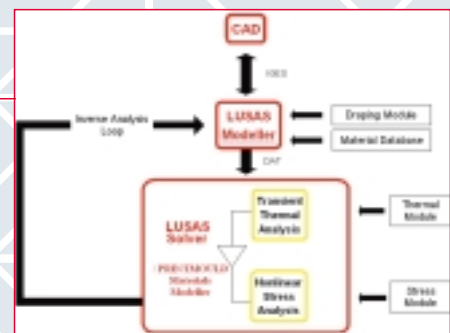


PRECIMOULD Project Research Approach

- Composite materials employed in precision tooling and structures allow the manufacture of complex shapes. However during their cure and post cure dimensional changes occur which lead to distortion and errors.
- The purpose of the project is to predict the inverse corrected mould and pattern geometries to account for process distortions. This will enable the manufacture of accurate, complex, 3D composite mouldings with a reduction in production cost - through 'right first time' mouldings (reducing scrap, rework and assembly time).
- In the Scientific group the prime factors causing process distortion and their governing material parameters were identified. From this, the PRECIMOULD database was defined and generated to support the novel CAD-FE analysis tool.

CAD-FE Analysis Software for Corrected Tooling Geometry

- At the centre of the solution is the PRECIMOULD visco-elastic materials modeller developed in the Software group and imbedded in the LUSAS Finite Element System (with full coupled thermal-structural analysis capability).
- The full distortion analysis incorporates resin polymerisation shrinkage, anisotropy in the laminate CTE, form tool CTE effects, complex geometry stiffness coupling and process specific non-equilibrium moulding conditions.
- Chemorheology and Cure Kinetics analysis are employed, in a transient thermal analysis, to describe the state of the resin from the onset of the process cycle to (where applicable) full post cure. The matrix state as resin through vitrification, the cure exotherm temperatures and level of resin shrinkage are all modelled.
- The verification phase of the project is now in progress will full scale test mouldings.



PRECIMOULD Software Strategy

