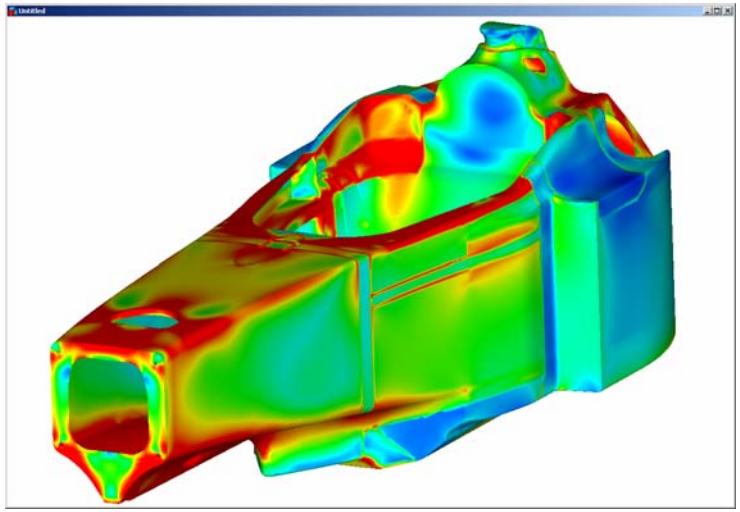
NEiNastran

Automotive Applications (Minardi F1 Team – Chassis Design)



The chassis design is the central theme in the structural design of the Minardi F1.

The monocoque chassis of a F1 car is a sandwich structure, made out of high performance carbon-epoxy composites facesheets and aluminium or aramidic honeycomb core. High modulus and high strength composites, with aerospace-class toughened epoxy resins are used in order to obtain the maximum safety-performance/weight ratio. All the attachment points (engine, suspensions, rollhoop, etc.) are made through inserts embedded in the lamination stack during the production phase. In order to minimize weight, thermal expansion differential, and maximize the adhesion, also the inserts are made out as thick (about 18mm) laminated composites plates (to be machined to the required dimensions/thickness).

Various general requirements regarding the global shape itself of the chassis, safety regulation requirements, and other performance requirements were simulated in the FEA environment. NEiNastran software package was used for static analysis (stress, stiffness), buckling (linear/nonlinear, especially on crash cones), and surface contact (rollbar crush). All the calculations were correlated with experimental measurements, thus enabling a continuous refinement of methodologies, material data, etc. In order to meet all the requirements, several optimization runs were made to modify the material choice, layup sequences, local reinforcements, foams, bulkheads, and inserts.

Minardi benefited from the use of NEiNastran due to a reduced modeling time, surface contact feature, robustness of the nonlinear analysis setup and solution, accuracy (results compared well with test results), and seamless data access (input-output data generated by NEiNastran and the previous Nastran package were shared without incompatibility issues).

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