Ref.: BE-IP-2026-02

INTERNSHIP PROPOSAL

Improvement of the simulation tool to predict the cure-induced deformation of composite parts

Cenaero, located in Gosselies (Belgium), is an applied research center providing to companies involved in a technology innovation process high fidelity numerical simulation methods and tools to invent and design more competitive products.

Cenaero's ambition is to be internationally recognized as a technology leader in modeling and numerical simulation, to be a strategic partner of large global industries as well as a real support to regional companies including innovative SME. Mainly active in Aeronautics, Cenaero wishes to increase the transfer and the application of its technology to surface transport, energy, health and sustainable development. Cenaero operates a top supercomputing infrastructure TIER-1 among the world 500 most powerful systems.

Cenaero research and engineering teams focus on modeling of manufacturing processes (Additive manufacturing, welding, machining, etc), structures and high-tech materials design and integrity analysis, computational fluid dynamics (CFD) and multi-disciplinary optimization (MDO).

One of the main axis of the High Performance Composite (HPComp) team is the process modeling. The HPComp team primarily focuses on the development of cutting edge numerical tools capable of predicting the response of composite structures and simulating their manufacturing processes. These tools can be used to develop more competitive products and/or manufacturing processes. The present proposal deals with the modeling of the cure-induced deformations of composite parts.

Context

The polymerisation reaction, or curing, which brings the liquid thermoset resin to solid, induces internal stresses within the part being produced. During this change of state, the part deforms due to thermal expansion and chemical shrinkage of the resin. The contact conditions with the mould and/or the pressure exerted on the part prevent these deformations from developing freely and internal stresses build up. Upon demoulding, part of the internal stresses is released, resulting in the appearance of distortions. Modeling such process involve complex coupled thermo-chemico-mechanical simulations. The curing simulation are performed at Cenaero via a User Material Subroutines used through a FE commercial software, Abaqus or Samcef.

Objective

The tool-part and inter-plies interactions are known to have a significant impac.t on the cure-induced deformation of composite parts. In order to avoid the costly and complex experimental characterization of those interaction laws parameters, Cenaero will use its own multi-disciplinary optimization platform called Minamo. The objective is to use Minamo to fit the parameters required to the model.

The internship offered will require the student: (i) to familiarize him/herself with the User Material Subroutine written in Python by Cenaero, (ii) familiarize with Minamo, (iii) set up the optimization chain to fit the parameters required for the interplies and tool-part interaction laws. A detailed report of the internship activities will need to be provided at the end of the internship.

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Duration

The length of the internship can range between 4 and 6 months. The intern is required to work full time at Cenaero premises.

Contact

Interested candidates should send a cover letter, quoting reference number of the offer (BE-IP-2026-02), and a resume to rh_be-ip-2026-02@cenaero.be