



## INTERNSHIP PROPOSAL

# Numerical simulation of an RTM process: development and optimisation

Cenaero, located in Gosselies (Belgium), is a private non-profit applied research center providing to companies involved in a technology innovation process numerical simulation methods and tools to invent and design more competitive products. Internationally recognized, in particular through its research partnership with Safran, Cenaero is mainly active in the aerospace (with an emphasis on turbomachinery), process engineering, energy and building sectors.

Cenaero provides expertise and engineering services in multidisciplinary simulation, design and optimization in the fields of mechanics (fluid, structure, thermal and acoustics), manufacturing of metallic and composite structures as well as in analysis of in-service behavior of complex systems and life prediction. Cenaero also provides software through its massively parallel multi-physics platform Argo and its design space exploration and optimization platform Minamo.

Cenaero operates experimental facilities in composite manufacturing and prototyping as well as the Tier-1 Walloon supercomputing infrastructure with 14,000 computing cores (see [tier1.cenaero.be](http://tier1.cenaero.be) for details).

The high performance composites team is specialized in the numerical simulation of mechanical responses of composites structure, the cure simulation and the optimization of composite structures.

### Context

The Resin Transfer Molding (RTM) is one of the industrial processes to manufacture composite parts. The carbon fibers are placed into a mold and a liquid resin is injected inside the mold. The mold is heated, the resin is polymerized and then the final composite part is obtained. Tracking the resin front inside the mold during the injection step is important to avoid defects in the part, like dry zones or race tracking ...

Cenaero has developed a tool for the numerical simulation of RTM process. It aims at solving the governing equations (Darcy's law and mass conservation) using the finite volume method and the volume of fluid method. The actual code is restricted the case of 2D elements in order to model simple 3D surfaces.

### Objective

The purpose of the internship is following.

1. Extend the developed method to case of 3D elements. This task includes solving the governing equations over a 3D domain and adapting the volume of fluid method.
2. Test the development with a complex industrial case.
3. Identify the industrial needs in terms of optimization of RTM process and the state of the art of current numerical tools to define the most promising use of a simulation code.
4. Tune the RTM process in terms of inlets and outlets positions in order to reduce the injection time and avoid the manufacturing defects, using the Minamo optimization software.

### Duration

3 to 6 months.

### Contact

Interested candidates should send a cover letter, quoting reference number of the offer, and a resume to [rh\\_be-ip-2024-001@cenaero.be](mailto:rh_be-ip-2024-001@cenaero.be)

