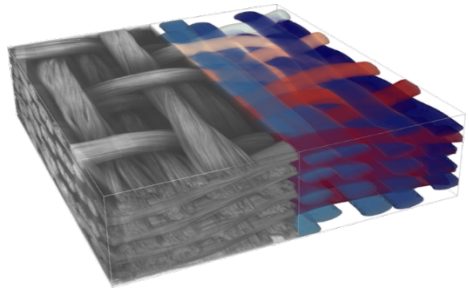
Characterizing the spring back effect of 3D woven composites

Postdoctoral Research Fellow



Numerical model and tomographic image of 3D woven composite [1]

A novel application of woven composite materials in aeronautics are the fan blades of the LEAP engine, developed by the Safran Group. The 3D woven nature of this material is what makes it so interesting for applications involving complex loads. Specifically, the design of the 3D architecture provides locally optimized mechanical properties. To ensure fidelity to the targeted mechanical performance, it is of key importance that the final geometry is consistent with the design.

The heterogeneous nature of the material leads to a buildup of residual stresses during the Resin Transfer Molding (RTM) process that causes an unwanted spring back effect. Quantifying this behavior at the macro scale would optimize the development of new geometrically complex parts. Ultimately, it would allow for the development of new non-destructive analysis techniques.

The objective of this post-doc project is to develop a method that would provide insights into this phenomenon by revealing the (residual) stress state of a part. This would require using inverse methods on full field measurements, obtained from x-ray tomography scans of parts at various stages of production. The key challenge is to combine all the experimental data with the numerical and theoretical models.

To address this challenge, we are searching for someone with the following interests:
(present or to be developed)

- Woven composites: visco-elasticity, homogenization
- Numerical methods: Digital Volume Correlation (DVC), inverse methods

The project involves academic and industrial partners:

- Jan Neggers MSSMAT CentraleSupélec
- Arturo Mendoza Safran Tech
- Julien Schneider Safran Aircraft Engines
- Stéphane Roux LMT ENS Paris-Saclay

Contact: jan.neggers@centralesupelec.fr

- This Post-Doc project is for a duration of 12 months at MSSMat/CentraleSupélec (Paris-Saclay). The starting date is from September to December 2020.

References:

[1] Mendoza *et al.* "Measuring yarn deformations induced by the manufacturing process of woven composites" *Composites Part A* (2019)