MESO-SCALE VOID PREDICTION DURING RTM MOLD FILLING

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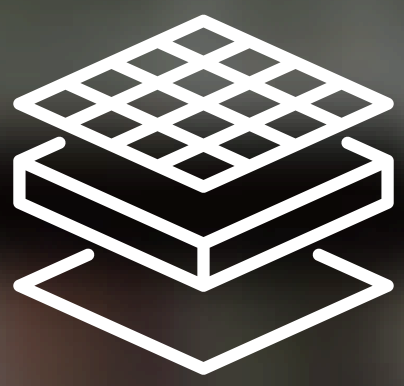
1 WHY ARE VOIDS IN COMPOSITES RELEVANT?



Composite materials are made by **combining different materials**, achieving properties that they could not reach on their own

They are critical in industries like aeronautics, automotive and civil engineering, where **strength and reliability are key**

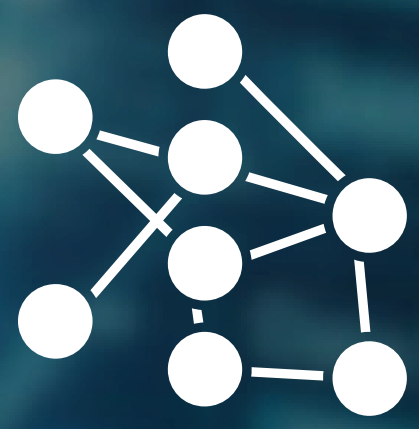
When producing them, **tiny air pockets** (voids) form inside the material, and their **location, size and quantity** can greatly reduce the strength and durability of the final material

THE ROLE OF HPC RESOURCES

2

Testing how voids form in real materials is **costly and time-consuming**, specially when using advanced techniques like Resin Transfer Molding (RTM)

Their behaviour depends on multiple factors that are interconnected and **evolve while manufacturing the material**

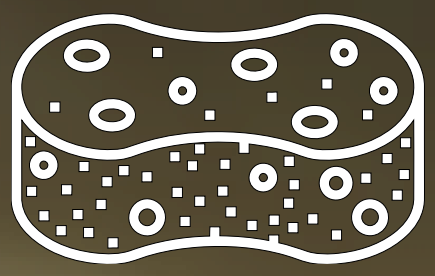


HPC simulations have allowed to make tests **more systematically** while also **reducing costs**

3 ZOOMING UP TO WHERE QUALITY IS DETERMINED

The simulations zoomed the materials **up to the mesoscale**, where the **spaces between fibers** can be seen

This interspace is **where resin flows and air gets trapped**, so controlling how voids form here is critical for the **final material's quality and performance**



The specific material they tested showed that the amount of voids (porosity) was **significantly lower than traditional woven fabrics**

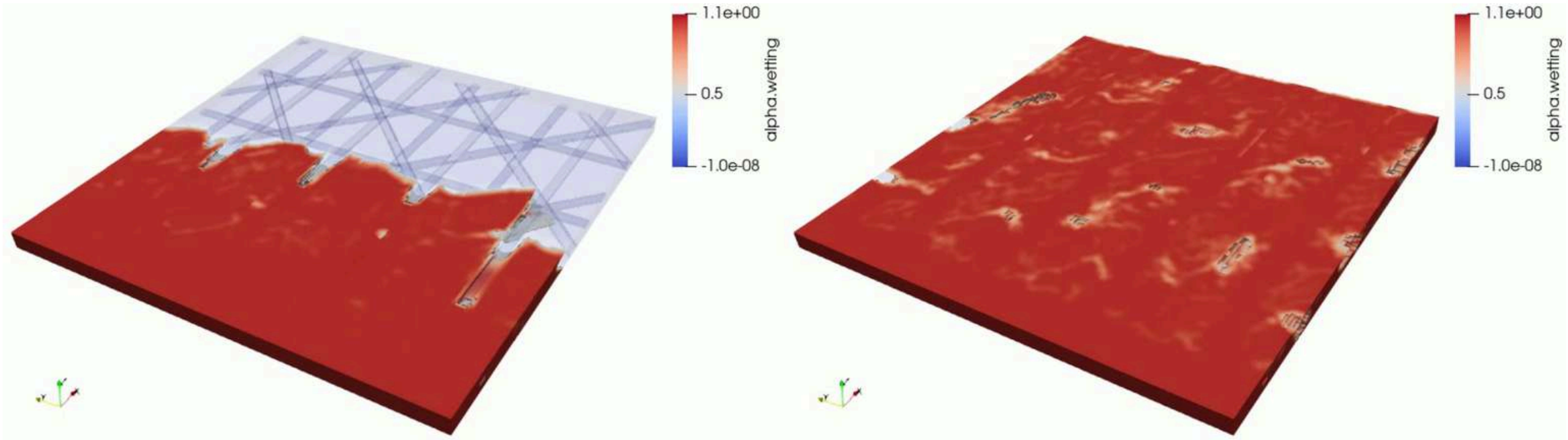
A NEW WAY TO PREDICT VOID FORMATION

4

Based on the results, the team developed an AI model that **predicts void formation**

The model can make the predictions for **any combination of materials and process properties**, without having to relaunch all the simulations

It has been developed within the CAELESTIS European Project and opens the door to **produce composites in a smarter, faster and more reliable way**



[The video (available on YouTube).](#) shows how the filling process changes depending on the capillary conditions

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