University of BRISTOL

Bristol Composites Institute (ACCIS)

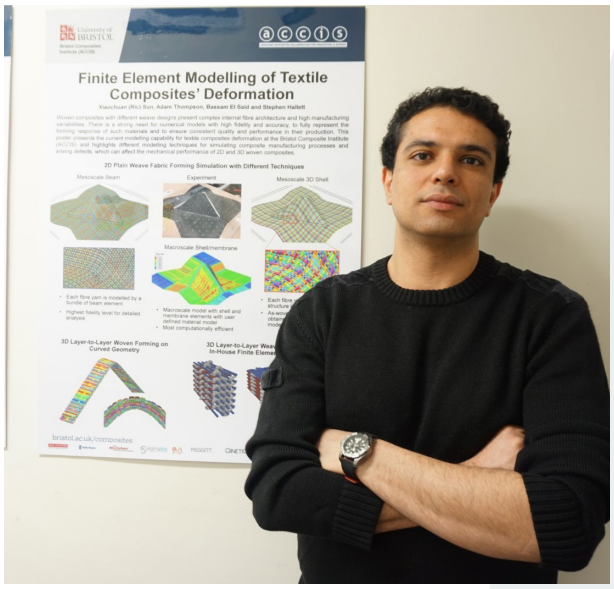
ADVANCED COMPOSITES COLLABORATION FOR INNOVATION & SCIENCE

Bristol Composites UTC

Industry funding accelerates technology deployment

Supported by ROLLS ROYCE

The partnership between Rolls-Royce and the Composites University Technology Centre (UTC) at the University of Bristol continues to yield technology transfer into industry from research projects that simultaneously launch young engineers' careers.



Rolls-Royce's sponsorship of the Composites UTC research programmes enables a pipeline of new technologies and skills, which is key for maintaining the company's operation at the technological frontier.

The support of Dr Bassam El Said's PhD project by Rolls-Royce on the modelling of 3D woven composites is one such technology transfer success story that began in 2011.

Modelling multiple scales

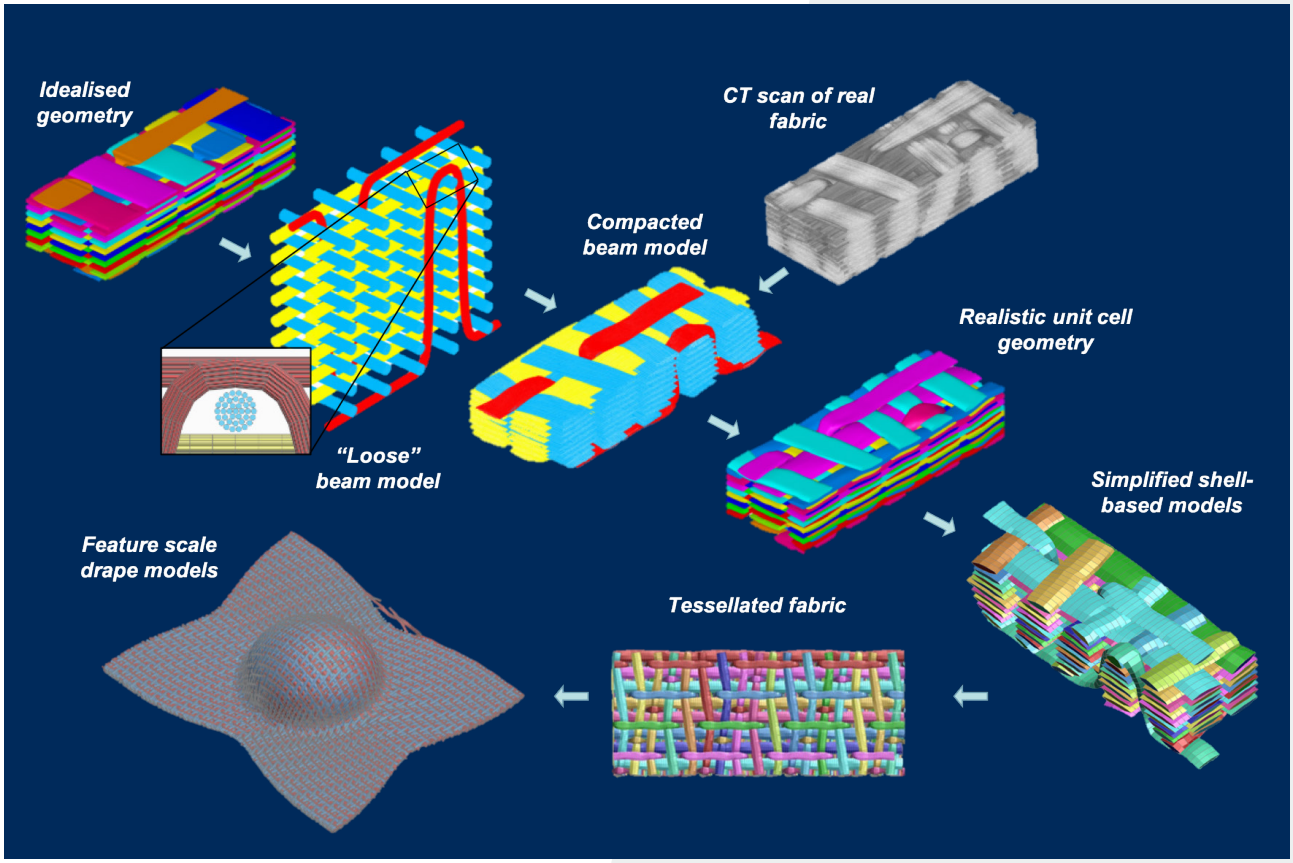
The weaving of fibres between layers is used to create 3D textile composites with superior impact resistance and damage tolerance. The exact internal fibre geometry of a composite determines the overall material properties; the snag is that it's computationally inefficient to produce detailed models of large components. And industry needs accurate models before new weaves can be utilised in full scale components.

Dr El Said explained: ***"The problem is that 3D woven composites have very complex architectures and we don't have the numerical tools to design and predict how they'd behave... that's where my PhD came in."***

During his PhD, Dr El Said reduced the scale of detail in areas of less importance, and increased it in others, so creating a multi-scale model to predict internal architectures. *"It was a challenge to take multi-scale modelling from the theoretical into a tool for application,"* said El Said.

UTC director and Dr El Said's PhD supervisor, Professor Stephen Hallett, added: *"The commercial software couldn't handle the complexity and so Bassam also developed custom code for predicting both stiffness and strength."*

Simulation of realistic meso-scale geometry for 3D woven textile composites – Bassam El Said's PhD



Getting technology ready

Towards the end of his PhD Dr El Said was awarded an EPSRC funded Impact Acceleration Award, which he used to convert his programme for modelling weave designs into a useable tool that was subsequently passed to Rolls-Royce engineers in 2015.

Professor Hallett said: "*It was a significant step to get one of our numerical tools to pass Rolls-Royce's technology readiness gate review and be formalised within the company.*

"The tool has been used by Rolls-Royce teams in Germany and the US. However, its greatest use so far has been on a different class of composite materials, as the technology was found to be just as useful for ceramic matrix composites."

The multi-scale modelling tool is now being further developed in UTC projects funded by the Aerospace Technology Institute, for application in both ceramic matrix and 3D woven composites.

As a research associate in the UTC from 2015, Dr El Said applied his modelling skills to the design of composites, and in June 2018 he won a prestigious Vice Chancellor fellowship.

Dr El Said said: "*Having taken multi-scale modelling from woven to automated fibre placement, I thought, why not develop a general multi-scale modelling capability that can pretty much work on anything. That is the idea of my fellowship, a multiscale modelling capability that works like lego-blocks, assembling in certain way to model any material on any number of scales.*

The UTC pipeline

Dr El Said explained that he "can't imagine being on the same career path anywhere else." Pointing to the strong technical knowledge within the UTC core team as a huge asset in driving research progress, and that the group's multitude of connections has provided him fantastic opportunities for collaboration.

He also explained that the technical customers within Rolls-Royce were invaluable in guiding his research to focus on real industrial problems that the engineers faced.

"We align ourselves with the state of the art, to help ensure that the technologies we build today will be used by Rolls-Royce tomorrow," added Dr El Said.

Further information

Visit:
bristol.ac.uk/composites/collaboration/utc

Email: **work-with-accis@bristol.ac.uk**