Related programmes and teams
Data-centric engineering
AI for science and government (ASG)

Streamlining jet engine design and manufacture

To analyse the performance of jet engines, aerospace engineers use computer models to simulate the engine's components and the intricate, super-heated airflow through them. But the sheer complexity of these models means that they can take days or even weeks to run, slowing down the speed with which engineers can test new designs.

Researchers led by Andrew Duncan and Pranay Seshadri in the Turing's data-centric engineering programme have been working with Rolls-Royce to use statistical methods from data science to streamline these models. A key achievement has been the development of algorithms that rapidly home in on the model variables that are most important to the problem. For instance, if the engineers want to make the engine's fan blades more efficient, this new technique will tell them which of the blades' 300+ design variables to focus on. The overall result is that engineers can reduce the number of variables in their models, so that the models run quicker, speeding up the development of more efficient engines. These use less fuel, resulting in a lower carbon footprint, and Rolls-Royce is now using this technique in the design of its future jet engines.

The principles of this work can also be applied to the engine manufacturing process, providing a potential way to cut waste and costs. And looking ahead, the researchers say that their tools could speed up component design in more radical flight concepts such as zero-emission planes.

Read our impact story for more information.

"This work has the potential to change the way we design and manage our manufacturing processes."

Shahrokh Shahpar
Fellow in Aerothermal Design Systems
Rolls-Royce

The Turing redesigns the Finite Element Method

Another big story in the data-centric engineering programme this year was the radical redesign of a well-known mathematical method by researchers led by Mark Girolami, the Turing's Programme Director for Data-Centric Engineering.

The Finite Element Method (FEM), which provides numerical solutions to mathematical equations of complex systems, has been routinely used in engineering and the physical sciences for more than 70 years. The new version, described in a **paper in *PNAS***, reconsiders the FEM from a statistical perspective, and allows data to be integrated with the FEM. This will be important in advancing data-driven models that simulate real-world objects. "It lays the mathematical foundations of the digital twin revolution," says Girolami.