COMPUTATIONAL FLUID DYNAMICS: MATHS IN MOTION

Dr Oliver Oxtoby, a computational fluid dynamics (CFD) developer, uses mathematics to solve real-world problems. He develops tools that engineers and industry use in their design process to create more efficient and safer designs at a lower cost.

TYPICALLY, CFD DEVELOPERS generate numerical algorithms and the computer programs based on the algorithms, which can be used as a predictive tool for design engineers. This means that engineers can test multiple possible designs for the same cost as a handful of physical prototypes done in reality. "Ultimately, mathematical modelling is about making intelligent approximations to get useful answers in a finite period of time," explains Oxtoby.

Oxtoby's biggest project is to determine the effect of the weight and movement of fuel sloshing back and forth inside aircraft wings, on the wing structure and design. Ultimately, the aim is to contribute to the internationally competitive industry of aviation by designing more efficient fuel systems. Oxtoby and his team will do physical testing of their calculation at the University of Pretoria's Centre for Asset Integrity Management.

Oxtoby explains: "Considering that over fifty percent of the Airbus A380's take-off weight is fuel alone and that much of the fuel is carried in the wings of the aircraft, one can just imagine the impact this has on the behaviour of the aircraft. The value of an accurate fuel sloshing model in the design process, speaks for itself."

CFD experts typically work on a variety of projects. They would, for instance, be able to determine at which angle an aeroplane should ditch (to do a safe emergency landing on water). CFD is used in the health industry to model the flow of blood through arteries and is also used by teams that design ventilation systems. Oxtoby explains, "We create tools for industry so that it is able to craft designs that have a higher probability of being successful from the outset. This is how we endeavour to contribute to the competitiveness of South Africa's industries."

CFD development presents a good balance between applied engineering, advanced mathematics, physics and computer programming. "I enjoy working at the CSIR, because, as a researcher, you have the freedom to come up with your own ideas and if it is a practical idea, you are given the freedom to pursue it. The CSIR also has a broad focus, which means that there are no limits to the field you can work in," says Oxtoby.

– Nicole de Kock

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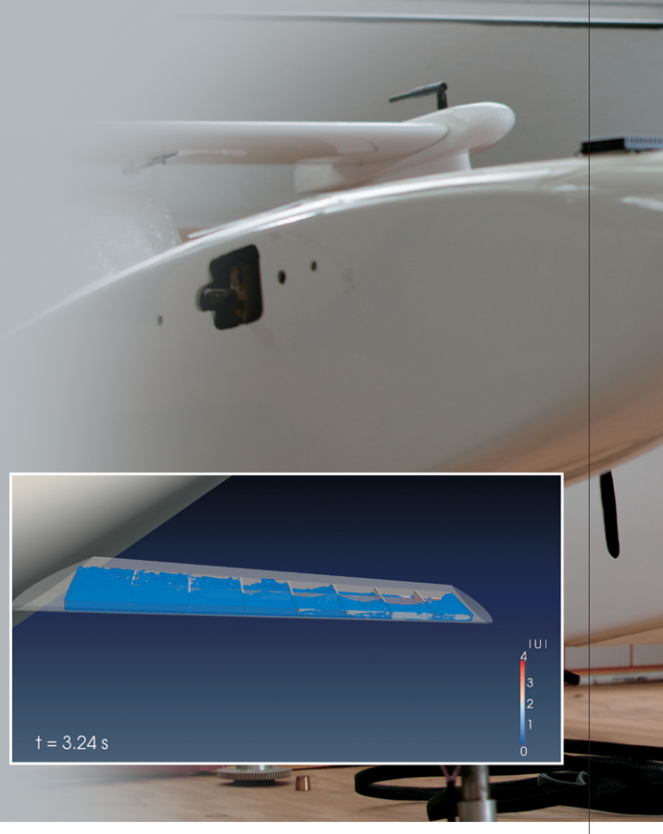
APPLIED MATHEMATICIAN

CHARACTERISTICS

An interest in mathematics, thinking creatively in order to solve problems that are out of the ordinary, applying immense attention to detail, because the slightest mistake may cause the entire algorithm to fail, as well as an interest in computer programming are required to become a CFD developer.

RELATED CAREERS

Applied mathematician, mechanical engineer, aeronautical engineer.



A computer-generated diagram of fuel sloshing back and forth in the wing of an aircraft.

WHAT DR OLIVER OXTOBY STUDIED

He studied a BSc (Hons) in applied mathematics and physics at the University of Cape Town in 2000. He then went on to do his Honours in applied mathematics as well as a PhD in applied mathematics. He graduated with a PhD in 2007.

WHERE TO STUDY

Universities that offer mechanical or aeronautical engineering, as well as applied mathematics as possible degree options would enable someone to become a CFD developer.

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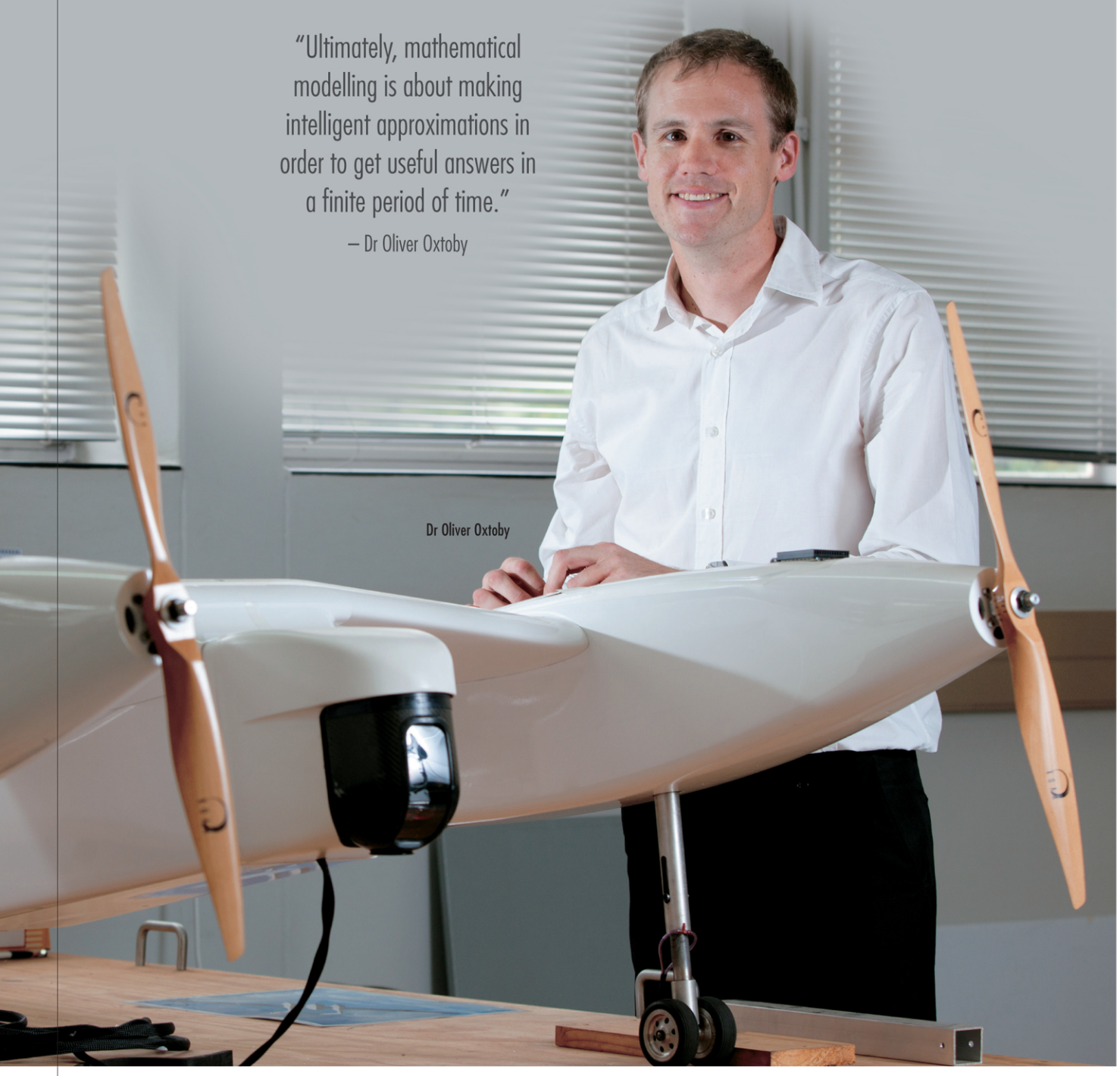

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