SOARING AHEAD IN AEROSPACE DISCOVERY

XMU's breakthroughs in advanced aerospace engineering are thrusting China's industry into the limelight.

With the launch of Tan Kah Kee-1, XMU became the first university in the world to have built and flown its own double waverider.

From high-speed aircraft flight testing to near-field electrospinning technology, XMU's School of Aerospace Engineering (XSAE) is committed to cutting-edge research to advance aerospace technologies, leading to novel theories, designs and techniques that have boosted industry in China.

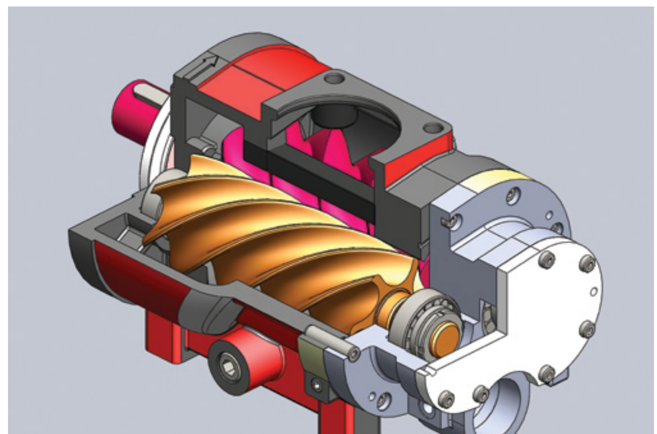
High-speed aircraft exploit the compression lift effect and ride on their own shockwaves. This design needs an accurate understanding of the 3D curved shock flow field, which has been a bottleneck in the development of this technology. One XSAE team was the first university group to build and operate a double waverider, the 'Tan Kah Kee-1', which rides on two shockwaves, one underneath, and the other in the inlet of its engine. XSAE's second-order curved shock theory addressed the problem, leading to improved aerodynamic performance and tactical capabilities of high-speed aircraft.

To improve wind tunnel testing, another XSAE team has developed a novel way to support and manipulate aircraft models using flexible cords as a kinematic chain. This intelligent support system enables integrated static and dynamic tests, expanding capabilities.

Carbon fibre reinforced polymer (CFRP) is a critical material in modern aircraft, given its advantages in weight, strength, and corrosion resistance, but is prone to defects. XSAE researchers have developed a non-destructive technology for revealing defects. A team has tapped eddy currents, generated by a specially designed probe, to find flaws. They calculated the general conductivity tensor and used 3D finite element analysis to overcome the difficulty of low electrical conductivity of carbon and the complexity of electrical anisotropy. Their inspection tool shows improved efficiency and effectiveness.

Aiming for precise processing of spiral surface components, which are central to aircraft compressors, XSAE researchers have developed new techniques of segmented grinding, based on a mathematical model to calculate the cutter location points. The technology reduces the error of rotor tooth profile to below 0.02mm, allowing for precise use of large screw rotors on conventional grinders.

The team has also developed fitting and redesigning technology based on digital graphics to reduce errors for grinding. Successfully commercialized, the technology yields more efficient and energy-saving rotary-screw compressors.



An energy-saving model for twin rotary screw compressor

Another XSAE team focuses on improving processes for preparing porous metals which are promising for aerospace applications.

They have developed unique multi-tooth cutting tools to produce ultra-long metal fibres of 80-120 micrometres. This technique has resulted in a high daily yield, making it commercially viable. Using low temperature and selective laser sintering technologies, the team has also developed technologies to convert fibres of copper and stainless steel into porous metals that can be wicking structures in heat pipes, allowing for scaled-up manufacturing.

Additive manufacturing is another frontier in aerospace engineering. An XSAE team is developing micro/nano-additive technologies, which create materials with unparalleled precision and functionality.

Having devoted sustained efforts to understand a microscale electro-hydraulic coupling mechanism, spray jet formation and whiplashing, and material deposition behaviours, the team made major advances in electrospinning technologies. They developed a near-field electrospinning process, which uses electro-hydrodynamic phenomena to create continuous micro and nano fibres, enabling controlled depositing of solid nanofibres.

They also proposed a method for an integrated process to manufacture graphene from graphite blocks, and then create micro devices. ■