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Faculty of Engineering
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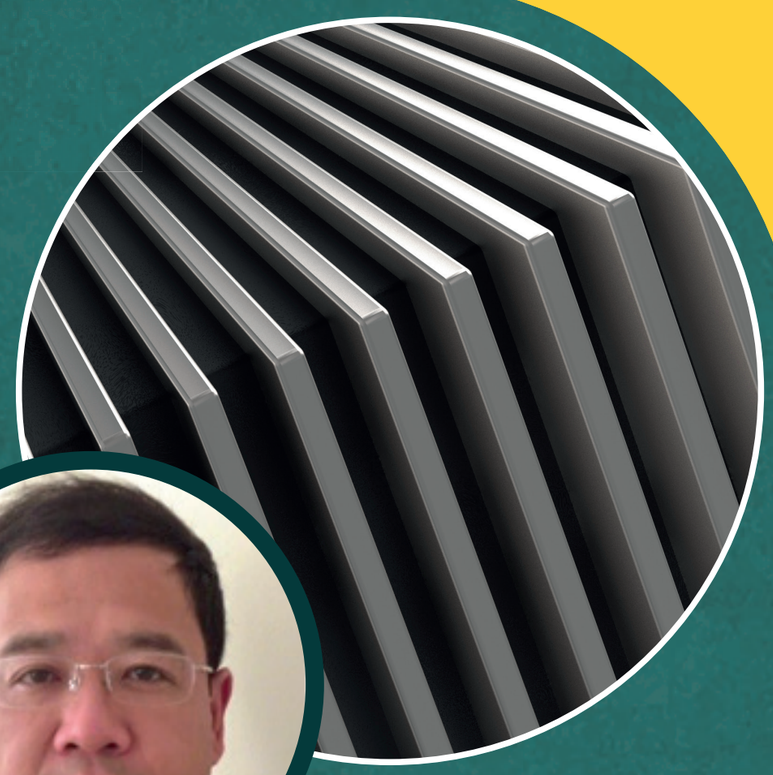
Distinguished Public Lecture (Online)

Compact Folding of Flat Arrays Composed of Panels with Uniform Thickness



Date: 30 March 2022 (Wed)

Time: 4:30 pm-5:30 pm (HKT); 8:30 am-9:30 am (UKT)

via Zoom https://hku.zoom.us/j/93930017545 (Meeting ID: 939 3001 7545)

Professor Zhong You
Professor of Engineering Science
Department of Engineering Science, University of Oxford, UK

About the Speaker

Professor Zhong You obtained his Ph.D. from Cambridge University in 1994 and currently working at the department of engineering science, University of Oxford. He is a Fellow of Magdalen College, University of Oxford and serves on the editorial board member of many renowned journals, including ASME Journal of Mechanisms and Robotics (Associate Editor), IMechE Journal of Mechanical Engineering Science Part C, and International Journal of Sustainable Materials and Structural Systems. Professor Zhong You's research is concerned with the design and realisation of novel deployable and origami structures, a type of unconventional structures capable of large shape changes. His work was selected for the Science Day Exhibition at the Buckingham Palace in 2007, organised by the Royal Society. SCIENCE introduced Zhong's research work in their "profile" section. Zhong developed a flow diversion stent to treat cerebral aneurysms. Oxford Endovascular, a university spin-off company, was founded to commercialise this technology. In 2015, Zhong published his ground-breaking work on thick panel origami in SCIENCE.

Abstract

Many aerospace arrays have large flat profiles composed of regular polygonal panels. They need to be packaged into small volumes for launch, and subsequently deployed to seamless flat surfaces once in orbit. Examples of such structures include solar arrays and reflectarray antennas, which are made from rigid thick panels. It is always very challenging to package such arrays compactly without any voids, especially when they are composed of panels with uniform thickness and are designed to have bi-directional deployment with a small number of degrees of freedom. In this talk, I shall demonstrate a kirigami based approach that enables compact folding of such arrays without any voids.

Origami and kirigami have great advantages in folding large thin sheets into compact volumes. However, when thick panels are involved, origami based approaches often lead to large gaps along the hinges or uneven surfaces in deployed states. In the newly proposed approach, a thick-panel deployable kirigami element is first introduced using the Hamitonian circuit in which eight panels with shapes of isosceles triangles and parallelograms are connected together by revolute joints. It is effectively an eight-link closed kinematic chain, named as an 8R element, that can be folded compactly without any voids. After that, four such elements are coupled together to form a deployable structure with a single degree-of-freedom. More 8R elements can be added to tessellate a plane. Although slits are introduced in the tessellation to accommodate thick panels during the folding process, they are completely closed in the fully deployed states. Therefore, a completely flat array made from thick panels with uniform thickness is obtained that retains the compact folding property of its constituent elements.

Registration is required:

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An electronic certificate of attendance will be issued to registered participants after the public lecture.

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