UNIVERSITI TEKNOLOGI MARA
Kolej Pengajian Kejuruteraan

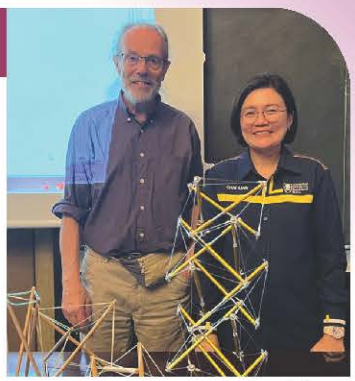
E-NEWSLETTER

SCHOOL OF CIVIL ENGINEERING

JULY-DEC 2024 VOL. 5

eISSN 2785-8227

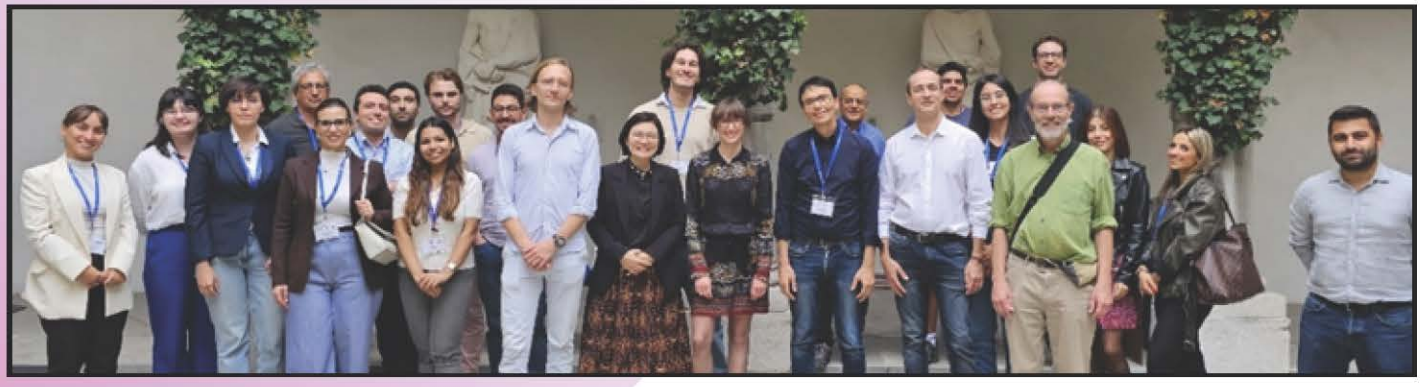
COURSE "TENSEGRITY SYSTEMS: FROM BIOMECHANICS TO MECHANICAL METAMATERIALS"



The course "Tensegrity Systems: From Biomechanics To Mechanical Metamaterials" was organised by International Centre for Mechanical Sciences (CISM), a non-profit organization, founded in 1968 to favour the exchange and application of the most advanced knowledge in the mechanical sciences, in interdisciplinary fields like robotics, biomechanics, environmental engineering and in other fields (mathematics, information and system theory, operations research, computer science, artificial intelligence).

The course was conducted in lecture hall in CISM Palazzo del Torso - Piazza Garibaldi 18 - 33100 Udine, Italy, from 16-20th September 2024. Invited by CISM, the course was delivered by five lecturers: Oh Chai Lian from School of Civil Engineering, College of Engineering, University Teknologi MARA, Shah Alam, Malaysia, Anna Al Sabouni-Zawadzka from Warsaw University of Technology, Warsaw, Poland, Fernando Fraternali from University of Salerno, Fisciano (SA), Italy, Andrea Micheletti from University of Rome "Tor Vergata", Rome, Italy, Kévin Garanger from University of California, Irvine, CA, USA; and Graham Melvin Scarr from Ezekiel Biomechanics Group, Nottingham, UK. Each of the lecturers has delivered 6 modules of their lecture.

This course is aimed at illustrating the peculiar mechanical behaviour of tensegrity systems in the large displacement regime and their application for the development of mechanical metamaterials, space structures, and mechanical models of biological systems. The course covers thematic blocks of tensegrity and biotensegrity.Highlights are Post-buckling response of tensegrity planetary landers; 3D tensegrity metamaterials;2D tensegrity and 3D tensegrities with extremal properties, Tensegrity metamaterials; Bandgap response; Wave dynamics of stiffening-type tensegrity metamaterials; Softening-type tensegrity metamaterials; Origami tensegrities; Basic concepts of tensegrity dynamics; Tensegrity space structures; Biotensegrities mimicking the anatomy and physiology of living organisms; Form-finding of linear biotensegrities; Mathematical modelling of the shape change of biotensegrities; Nonlinear biomechanical character of tensegrity: nonlinear biotensegrities, soft matter mechanics in living organisms, the fascia connection (ubiquitous of the fascial connections, kinematic chains), muscles mechanics, biotensegrity dynamics, mechanics of walking and running in a biotensegrity model etc.



There are a total of 36 participants that attended either physically or in an online mode. The participants are from Italy, Poland, Canada, USA, France, The Netherlands and Brazil. The course was conducted interactively between lecturers and participants, with discussion and practical works, in addition to a series of lecture. The students eagerly show their interest in finding configuration of a two-stage Class 1 3-struts tensegrity model, in one of the hands-on activity with Ir. Dr. Oh Chai Lian. She also shared the shape change strategy of biotensegrity model in achieving prescribed targets (see one of the numerical example), which has potential application as deployable tensegrity structures or robotics.

Author: Ir. Ts. Dr. Oh Chai Lian