

From Programmable Materials to Soft Machines: A Decade of Progress in 4D Printing and Soft Robotics

Speaker: **Dr. Ali Zolfagharian**
Deakin University, Australia

Date: Oct. 20th (Tue), 2026

Time: 10:45-12:00

Venue: Seminar room 1, 4F, East-Wing, BKC Campus,
Ritsumeikan Univ., Noji-Higashi 1-1-1, Kusatsu



Abstract:

Over the past decade, 4D printing has evolved from an emerging concept in programmable materials into an enabling technology for adaptive structures and soft machines. This presentation reflects on this progression through advances in smart materials, shape-morphing structures, soft robotics, and more recently nonplanar, rotary, and multi-axis additive manufacturing. Particular attention is given to how 4D printing enables structures to change shape, stiffness, and mechanical functionality in response to external stimuli, with applications spanning biomedical devices, soft actuators and robots, automotive systems, energy absorption, and vibration mitigation. Recent developments in rotary and conformal 4D printing further extend these capabilities to cylindrical metamaterials, multistable structures, and complex curved geometries that are difficult to realise through conventional planar fabrication. Looking forward, the convergence of 4D printing with robotic manufacturing, artificial intelligence, and programmable mechanical architecture offers new opportunities to transform printed materials into increasingly autonomous, adaptive, and functional soft machines.

Biography:

Dr Ali Zolfagharian is recognised for his research on smart materials, 4D printing and soft robotics. He is the recipient of the JSPS Invitational Fellowships for Research in Japan (2026), the Australian Research Council (ARC) DECRA (2024), the Vice-Chancellor's Award for Career Excellence in Research and Innovation (2023), and has been among the top 2% cited scientists listed by Stanford University and Elsevier for successive years (2021-2025), the Alfred Deakin Medallist for Best Doctoral Thesis (2019) and the Alfred Deakin Postdoctoral Fellowship Awardee (2018) and was nominated and shortlisted by the Australian Academy of Science's John Booker Medal 2025 for recognising outstanding EMCR excellence in science. Dr Zolfagharian has also been selected among 20 of the future research leaders and the newly minted cohort for the inaugural Deakin Research Accelerator Program (2026-2027) by the SEBE Faculty and Pro Vice-Chancellor, Research Planning and Governance. He is co-founder of the 4D Printing Society and Soft Robotics Australia, editor-in-chief of 4D Printing, and co-

editor of the Smart Materials in Additive Manufacturing V1, V2, and V3 book series published by Elsevier. He established the 4D Printing and Robotic Materials lab in 2018 at the School of Engineering, Deakin University, Australia, and has thus far received >A\$1.3 M in research funding, leading to successful outputs, including >200 articles, 8 book chapters, and 6 books. He is currently on the editorial board of Smart Materials in Manufacturing, Soft Science, Designs, and Materials Research Express.

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