ICIRA 2024 Special Session Proposal

Title of the Proposal:

Mini-Invasive Robotics for In-Situ Manipulation

Technical Outline of the Session and Topics:

Outline of the Session:

Mini-invasive robotics for in-situ manipulation revolutionizes the paradigm of maintenance for industrial equipment by performing inspection, repair, modification, or enhancement on a target object without changing its position or state, posing enormous potential and significance for industrial sectors. However, these operations are highly challenging due to the deep cavities, physical constraints, and unstructured environments. To address these challenges, the research community has developed various manipulators and end effectors, such as crawling robots, continuum robots, and other portable robotics. These robots can adapt to complex environments, including long-narrow tunnels, large-curved surfaces, and other hard-to-reach areas, and perform complex in-situ manipulation tasks. This session mainly addresses the emerging theory and technology for mini-invasive robotics for in-situ manipulation, covering but not limited to the following topics.

Topics of the Session:

- *Continuum robotics: The design, modeling, estimation, control, and planning of continuum robots that mimic the motion of snakes and worms and perform in-situ manipulation tasks, such as endoscopic examination, debris clearance, machine detection, and repair.*
- *Crawling robotics: The actuation, adhesion, design, control, and integration of crawling robots that can adhere to and detach from various surfaces and perform in-situ manipulation tasks, such as inspection and maintenance of pipelines, bridges, and aircraft.*
- *Portable robotized machine tools: The design, modeling, and control of portable robotized robotics, such as parallel robots, legged robots, and wheeled robots, for in-situ manipulation tasks, such as manufacturing, repair, and drilling.*
- *Robotics tactile sensing: The principles, materials, structures, fabrications, and applications of flexible tactile sensors for robotic manipulation, as well as the enhancement of human-robot interaction and user experience.*

- *Innovative design: The novel design and modeling methods for manipulator mechanism and sensing structure, such as compliant mechanism, origami/kirigami, bistable/multistable structure, conformal design, and programmable design.*

Contact details of the Session Organizers

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