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Soft Robotics for Safeguards Applications in Radiations Environments

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To improve inspection capabilities, limit radiation exposition to inspectors, and minimize the number of repetitive tasks that are done by hand in a growing number of facilities the IAEA has welcomed the investigation of robotics for safeguards applications. Traditional hard robotics have long been employed in the nuclear field, however electronic failure in high radiation environments can severely limit operating time. The developing field of advanced soft robotics, which employs soft materials, such as silicone polymers, and soft actuators, such as liquid metals, has the potential to leverage the capabilities of remote technologies while minimizing the failure rate common to hard robotics. Idaho National Laboratory has partnered with Oregon State University's (OSU) School of Nuclear Science and Engineering (NSE) and Oregon State Universities Robotics departments to develop and test a prototype soft robotic arm for international safeguards applications. The soft robotics manipulators under investigation offer significant dexterity and mechanical compliance with high degrees-of-freedom, allowing for large contact-area, multi-point gripping, which is particularly advantageous for grasping and emplacing objects.¹ This technology has potential applicability in a range of safeguards inspection tasks, including tag and seal application, environmental sampling and spent fuel verification. The research currently underway at Oregon State University includes the design and construction of a prototype soft robotic arm that can operate under water with integrated touch and deformation sensors to enable closed-loop control of grasping and turning. Testing of the material includes examining the effects of high radiation environments on the system components including: impacts to system function, potential activation of the effector, material degradation with exposure to various radiation fields, and the potential for material reuse.

Which "Key Question" does your Abstract address?

TEC5.1

Topics

TEC5

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