VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Seyedreza Kashef Tabrizian**

The public defense will take place on **Friday 23rd August 2024 at 4:00 pm** in room **D.2.01** (Building D, VUB Main Campus)

To join the digital defense, please click here

ENABLING AUTONOMOUS HEALING IN SOFT ROBOTICS

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Abstract of the PhD research

Most people think of robots as smart machines working in factories or stores. But, interacting with these metal robots can feel intimidating. On the other hand, when we interact with animals, it feels natural and comfortable because, like us, they have soft and flexible bodies. This is why scientists are developing soft robots made from flexible materials that can move more naturally, like bending and twisting. These robots are designed for safe and close interaction with humans and to work in changing environments where they need to adapt.

While soft materials can handle shocks well, they can be damaged by sharp objects or stretched too far. Soft robots often work in unpredictable conditions, increasing this risk. In nature, human and animals heal their wounds. Similarly, soft robots need to heal themselves. This can be done by using self-healing materials that can repair damage through special chemical reactions.

Just like our bodies sometimes need help to heal wounds—like using disinfectants or stitches—soft robots also need assistance to heal efficiently. However, we aim for robots to be fully autonomous and self-sufficient. My PhD research focuses on the question: "How can soft robots perform their healing process autonomously, without human help?"

I explored various stages of the damage-healing process and developed integrated systems for soft robots to heal themselves. These robots can sense damage (like how we feel pain), close large gaps, activate self-healing materials, and monitor their condition during and after healing.

Finally, this technology was introduced to Festo, a leading automation company, where it is now being further explored by their research and business development teams.