

## The University of Electro-Communications

Chofu, Tokyo, Japan

# Advancing Academic Research to Help Society

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SEED MS



### What is a snake robot?

What comes to mind when you hear the phrase “snake robot”? As you know, a snake is a creature with a simple shape and no limbs, but it can dart in any direction, scale trees, and glide through water. Since the 1970s, people have been analyzing the characteristics and movements of snakes that allow their slender bodies to slip into narrow spaces, researching ways to create snake robots that can perform work in places people cannot enter. Now, these robots are used to inspect attics and beneath floors in houses and inside pipes in factories. They are also serving as disaster response robots.

I am fascinated with making things move, so I was drawn to the deep complexity of snake robots the moment I first saw one. I got involved in snake robot development to try to achieve motion that is much more efficient and surpasses an imitation of snakes.

### THK's products are essential for our snake robots

I am researching “smart motion” controls for snake robots at the University of Electro-Communications. As shown in the picture below, the robot we developed is formed out of many connected joints and wheels. It can enter narrow spaces and use the length of its body to traverse steps up to 1 m in height. In general, segmented robots have difficulty climbing steps; the tires get caught around the edge of the step, causing the robot to stop mid-movement. However, ours is configured to only issue commands for the movement of the head. The sensors attached all over the body detect the distance between the underbelly and the floor, and the robot gets over steps by taking measurements from the portion raised in the air and moving the joints with the proper timing. As a result, it can climb steps with simple maneuvering.



The T2 Snake-3 features a **SEED MS** on the side of each joint (indicated by the arrow)

For a robot to be used in high or tight spaces, there are size and weight restrictions. Our compact, lightweight design was made possible by the **SEED MS**. The **SEED MS** is in charge of both information coming from the sensors and motors as well as commands being received remotely from the operating computer. By concentrating data there, it acts as an information pathway to shorten communication time. I learned about the **SEED MS** when I went to an academic conference for robots a few years ago. The product that was being displayed in a nearby booth was exactly the size I was looking for. Now, it has become an essential component for small robots. The core of the snake robot is the movement generated through countless sensors and motors, and the **SEED MS** has enabled us to create an elegant wiring system for it.

### Future developments

The Sendai Framework for Disaster Risk Reduction 2015–2030 outlines priorities including strengthening disaster risk management and preparedness, recovery, rehabilitation, and reconstruction. Toward that end, our snake robot has checked concrete wear in attics and inspected beneath floors and inside pipes. In fact, it was used during the heavy rains in western Japan to search inside homes that collapsed from landslides. My aim is for the simple structure of this robot to prove useful in everyday life in the future, broadly contributing to society through the development of robots that can do things like wrap around people and give them massages, or clean places that are narrow or have steps.