



PRESS RELEASE (2025/07/17)

Thin-film electronics that can move and become their own connectors

Researchers develop prototype thin-film electronics that can dock and undock themselves

Fukuoka, Japan—Publishing in the journal [*npj Flexible Electronics*](#), researchers from Kyushu University have developed prototype thin-film electronic modules that can automatically connect and disconnect with each other.

Flexible electronics is a growing field of research because of its potential application in wearable sensors, soft robotics, and medical devices.

"Today, most of these devices are made as fixed, one-piece systems. For some time now our group has been developing kinetic electronics, thin-film devices with actuators and circuits so they can move, attach, and function together," explains Associate Professor [Fumihiro Sassa](#) of [Kyushu University's Faculty of Information Science and Electrical Engineering](#), who led the study. "In this study, we worked to develop an electromechanical docking mechanism between these thin-film modules that can connect and disconnect with each other when needed."

In their prototype, the actuator and electrical circuit are integrated on the same thin film. The actuator layer is composed of polypropylene and polyimide, two materials with different thermal expansion coefficients, meaning that they expand at different rates when heated. By incorporating this film with a gold microheater, the film can be heated, causing it to bend.

"We developed a few different variations of docking methods with the device. For example, one of them can loop and hook onto each other. Another one has a claw-like attachment that can lock onto another device and stay locked even when the power is turned off," continues Sassa.

These new devices open new avenues at the intersection of electronics and robotics, where circuit-integrated actuator films not only bend, but are modular and can actively connect and reorganize their functions.

"These devices are still in their early stages, so there are many things we need to work on," concludes Sassa. "I hope this research leads to the development of devices that can—like living organisms—self-assemble, adapt, and even repair themselves."

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For more information about this research, see "Electromechanical docking and undocking mechanisms for thin-film robotic and electronic modules based on kinetic electronics," Shunsuke Uchima, Jiani Cai, Kenshi Hayashi, and Fumihiro Sassa, *npj Flexible Electronics*, <https://doi.org/10.1038/s41528-026-00606-9>

About Kyushu University

Founded in 1911, [Kyushu University](#) is one of Japan's leading research-oriented institutions of higher education, consistently ranking as one of the top ten Japanese universities in the Times Higher Education World University Rankings and the QS World Rankings. Located in Fukuoka,

on the island of Kyushu—the most southwestern of Japan’s four main islands—Kyushu U sits in a coastal metropolis frequently ranked among the world’s most livable cities and historically known as Japan’s gateway to Asia. Its multiple campuses are home to around 19,000 students and 8,000 faculty and staff. Through its [VISION 2030](#), Kyushu U will “drive social change with integrative knowledge.” By fusing the spectrum of knowledge, from the humanities and arts to engineering and medical sciences, Kyushu U will strengthen its research in the key areas of decarbonization, medicine and health, and environment and food, to tackle society’s most pressing issues.

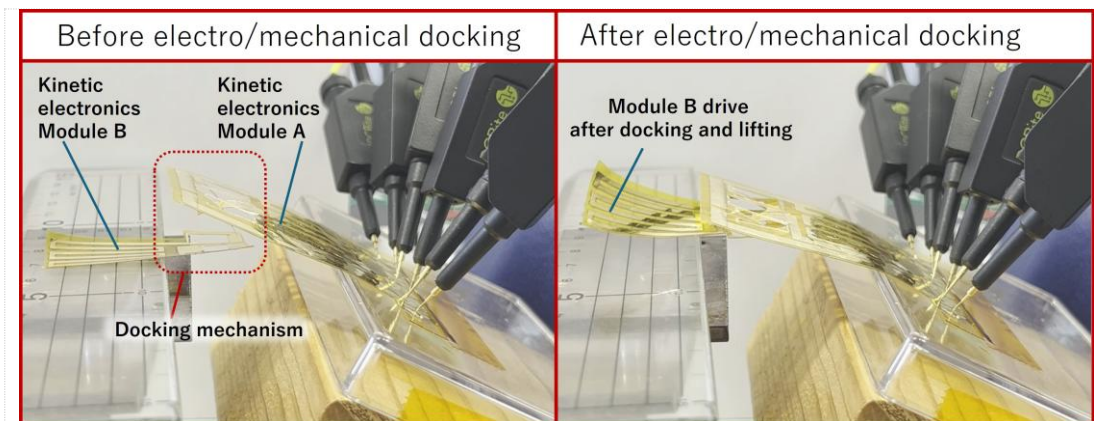


Fig. 1. Automatic docking between two thin-film electronic devices. Kinetic electronics module A, which integrates an electrical circuit and an actuator, deforms in response to an electrical input and connects mechanically and electrically to thin-film circuit module B via the docking mechanism. Before connection (left image), the two modules are separate; after connection (right image), Module A holds and lifts Module B, and by supplying power through the connection point, it can independently drive Module B to deform. (Fumihiro Sassa/Kyushu University)

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