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Stitched actuators for smart garments

A new e-textile actuator uses shape memory materials integrated into conventional coverstitches to create functional, nearly invisible actuation in garments.

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Applications

- Garment-based soft joint braces
- Dynamic compression garments
- Wearable accessibility solutions
- Shape-changing garments (e.g., shapewear, aerodynamic & performance wear, etc.)

Key Benefits & Differentiators

- **Easy to manufacture:** Utilizes traditional coverstitch sewing equipment and techniques to produce actuators in seconds, unlike conventional actuation methods like servo motors or pneumatics
- **Functionally integrated:** The use of shape memory material within the ubiquitous and stretchy coverstitch structure creates an actuator that is nearly invisible and an intrinsic part of the garment itself, rather than a foreign component
- **Variety of design levers:** Offers new methods for creating selectively stiffening, tensioning, or shaping effects by varying materials, stitch patterns, and fabric substrates.

Technology Overview

The integration of actuation into garments is typically achieved with bulky, complex, and difficult-to-manufacture components such as servo motors, pneumatics, or intricate smart material structures. These solutions are often conspicuous, aesthetically challenging, and not well-suited for seamless integration into everyday clothing, which limits their application in commercial, military, and medical fields. Consequently, existing textile-based actuation systems are often considered foreign additions to a garment rather than an inherent part of its design.

Researchers at the University of Minnesota have developed a new e-textile actuator that utilizes shape memory materials (e.g., shape memory alloys) integrated into conventional coverstitches. By replacing one or more of the constituent threads in a coverstitch with a shape memory material, the technology creates an actuator that is seamlessly integrated into the fabric. The resulting stitched trace changes stiffness, displacement, or tension in response to temperature changes, providing a new way to achieve selective stiffening or shaping effects. This approach enables the production of functional, aesthetically conventional, and low-profile actuators that are far easier to manufacture than existing solutions.

Phase of Development

TRL: 5
Prototypes have been manufactured and tested with various fabric substrates and shape memory alloy stitch patterns.

Technology ID
2023-242

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Researchers

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