



## Harvard develops programmable knitted textiles with built-in sensing

Researchers at the Harvard John A. Paulson School of Engineering and Applied Sciences have developed a new class of programmable knitted textiles that can change shape and function as soft sensors. The research was published in the journal *Advanced Functional Materials*.

The new textiles use mechanical intelligence to switch between multiple stable three-dimensional shapes. Unlike conventional smart materials, they do not require continuous external force to maintain their shape.

The research team achieved this by using a knitting technique called plating. Elastic yarns are combined to create internal stresses within the fabric during manufacturing. These stresses allow the textile to "snap" between different configurations when pressure is applied, similar to a mechanical switch.

The researchers also integrated conductive yarns directly into the knitted structure. This enables the fabric to detect movement and act as a soft switch or motion sensor without adding rigid electronic components.

The team demonstrated several working prototypes. These include a multistable textile shell that changes LED lighting based on its shape, wearable sensors that monitor movement around joints such as the knee and elbow, and a reconfigurable lampshade with textile-based switches that control different lighting modes.

A key advantage of the technology is its compatibility with existing textile manufacturing. The programmable fabrics are produced using standard double-bed weft knitting machines, making the process suitable for large-scale production.

By combining programmable structures with integrated sensing, the innovation opens new possibilities for smart textiles that are both flexible and scalable.