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Abstract: Canopies and parachute lines experience high stresses during the opening phase. The study aims to measure the strain on these components to enhance our understanding of these materials and their life span. To avoid altering the parachute structure and affecting data accuracy, measurements are conducted non-intrusively. This necessitates designing and implementing a discreet and robust interface between sensors and textiles. Additionally, this project involves developing an electronic measurement device capable of recording data from embedded sensors.

Different types of sensing technologies can be used to measure the strain or stress experienced by textiles raging from optical fibers [1] and metallic yarns [2] to piezoresistive films or polymers [3]. This study aims to develop flexible printed piezoresistive strain sensors.

The characterization of the sensors in static and dynamic strain is crucial for understanding the sensing capabilities of the system (sensor + substrate + connections) and for adapting the data processing and analysis based on the sensing system's gauge factor (GF). The GF represents the ratio of the relative change in electrical resistance to the mechanical strain, quantifying the sensitivity of a strain sensor. *Table 1* illustrates the measured GF at different testing speeds of the sensors deposited on the Meridional Ribbon.

	100 mm/mn	250 mm/mn	500 mm/mn	1000 mm/mn
Gauge Factor	6.4 [+/- 1.2]	3.3 [+/- 0.5]	8.9 [+/- 0.3]	9 [+/-1]

Table 1 Gauge Factor of carbon-based printed sensors on the meridional ribbon tensile tested at various testing speeds.

This study demonstrates the performance of printed piezoresistive sensors in measuring strain in textiles. The sensors exhibit a response close to linear when subjected to controlled strain at 10%, although this behavior is influenced by the properties of the ink and printing conditions. Additionally, the sensor's response is affected by the interface between the sensor and the textile, as well as the speed of the applied stress.

References:

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