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Design and Characterization of a Smart Composite Fabric for Knee Brace

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Abstract : In Paralympic sports, athletes often depend on some form of equipment to enable competitive sporting, where most of this equipment would only allow passive physiological supports and discrete physiological measurements. Active feedback physiological support and continuous detection of performance indicators, without time or space constraints, would be beneficial in more effective training and performance measures of Paralympic athletes. Moreover, occasionally the athletes suffer from fatigue and muscular stains due to improper monitoring systems. The latter challenges can be overcome by using Smart Composites technology when manufacturing, e.g., knee brace and other sports wearables utilities, where the sensors can be fused together into the fabric and an assisted system actively support the athlete. This paper shows how different sensing functionality may be created by intrinsic and extrinsic modifications onto different types of composite fabrics, depending on the level of integration and the employed functional elements. Results demonstrate that fabric sensors can be well-tailored to measure muscular strain and be used in the fabrication of a smart knee brace as a sample potential application. Materials, connectors, fabric circuits, interconnects, encapsulation and fabrication methods associated with such smart fabric technologies prove to be customizable and versatile.

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