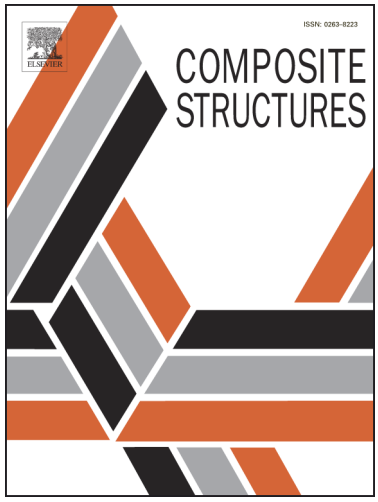

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PII: S0263-8223(19)30980-8
DOI: https://doi.org/10.1016/j.compstruct.2019.111720
Reference: COST 111720

To appear in: *Composite Structures*

Received Date: 18 March 2019
Revised Date: 15 October 2019
Accepted Date: 21 November 2019

Please cite this article as: Arora, S., Majumdar, A., Butola, B.S., Soft Armour Design by Angular Stacking of Shear Thickening Fluid Impregnated High-Performance Fabrics for Quasi-Isotropic Ballistic Response, *Composite Structures* (2019), doi: https://doi.org/10.1016/j.compstruct.2019.111720

Soft Armour Design by Angular Stacking of Shear Thickening Fluid Impregnated High-Performance Fabrics for Quasi-Isotropic Ballistic Response

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Abstract

Conventional soft armour panels are developed by stitching multiple layers of orthotropic high-performance fabrics aligned symmetrically atop each other. This research explores the concept of angular stacking of neat and STF impregnated woven fabric plies such that the panel responds to an impact quasi-isotropically, rather than orthotropically. Seven sets of 3-, 4- and 5- layered panels were stitched from neat and shear thickening fluid (STF) impregnated *p*-aramid and ultra-high molecular weight polyethylene (UHMWPE) woven fabrics by stacking them in varying angular orientations. The panels were then evaluated for their energy absorption capacity against ballistic impact. It was found that the more the number of angular orientations of fabrics within a panel, the better the energy absorbing capacity. The beneficial effect of angular stacking was more pronounced (19% to 58%) in case of STF impregnated fabric panels than that of neat ones highlighting the synergistic effect of stress wave propagation in multiple directions and engagement of secondary yarns through shear thickening. For panels with 3 and 4 layers of fabric plies, angular orientations of [0/30/60] and [0/22.5/45/67.5], respectively, were found to be the best.

Keywords: *aligned orientation; angular orientations; ballistic response; shear thickening fluid; soft armour*

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