11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

NUMERICAL MODELING AND ANALYSIS OF STF-BASED LIQUID ARMOR MATERIALS UNDER BALLISTIC IMPACT

Kwon Joong Son[1], Hee Keun Cho[2] and See Jo Kim*[3]

[1]American University in Dubai
P.O. Box 28282, Dubai, United Arab Emirates
kson@aud.edu

[2] Andong National University
1375 Gyeongdong-ro, Andong, Gyeongsangbuk-do 760-749, Republic of Korea
hkcho@andong.ac.kr

[3] Andong National University
1375 Gyeongdong-ro, Andong, Gyeongsangbuk-do 760-749, Republic of Korea
sjkim1@andong.ac.kr

Key Words: *Liquid Armor, Shear-Thickening Fluids, High-Strength Fabrics, Ballistic Impact, Finite Element Method, Hybrid Particle-Element Method.*

Liquid armor refers to high-strength fabrics saturated with shear-thickening fluids (STF) that exhibit increasing viscosity at high shear rates. STF-based dissipative augmentation of conventional fabrics has improved their ballistic performance in impact protection applications without deteriorating their original flexibility and lightweight. Current design work on liquid armor systems mainly depends on experimental methods. Hence reliable computational methods can substantially reduce the relatively high cost of experimental design approaches. Computational research by the authors focuses on the development of numerical models including geometric discretization schemes, material constitutive models and contact algorithms well-suited to the simulation of liquid armor systems under ballistic impact. This research also includes their implementation into two Lagrangian computational methods: finite element methods (FEM) and hybrid particle-element methods (HPEM). The long-term goal is to aid the computational design of advanced STF-based armor systems with the experimentally validated numerical models against impact tests and yarn pull-out tests.

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