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Geometrical scaling effect for penetration depth of hard projectiles into concrete targets

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Highlights

- Replica scaling law holds true for DOP in rigid projectile penetrations as long as the scaling is done strictly, and the coarse aggregate with invariant size could account for the non-scaling effect in DOP found in penetration tests and empirical formulae.
- A 3D mesoscopic finite element model for concrete target is developed, and the influences of cement strength, aggregate strength, volume fraction of aggregate on the non-scaling effects of projectile penetrations are numerically studied.
- The non-scaling effect in DOP for different concrete targets with the same magnitude implied by the empirical formulae and the always held scaling law in the (semi-)analytical models may be unreasonable.
- A semi-analytical model for DOP prediction is proposed by further considering the non-scaling effect.

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