Abstract Submitted
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Consecutive sphere water entry and impact force reduction: post hoc ergo propter hoc![1] RAFSAN RABBI, Utah State University, NATHAN SPEIRS, KAUST, AKIHITIO KIYAMA, Utah State University, JESSE BELDEN, Naval Undersea Warfare Center, TADD TRUSCOTT, Utah State University — An object impacting a quiescent water surface experiences severe deceleration that can be very high in the first few moments of surface penetration. This sudden impact acceleration is potentially catastrophic to the impacting object, and can even be fatal for a person jumping from a far enough height. We propose a way of reducing this high-water entry impact force by employing a consecutive two-sphere water entry system. Two vertically separated spheres free-fall onto a water pool, with the first sphere creating a subsurface air cavity during impact and the second sphere falling through different stages of this cavity depending on the varied separation distance between the spheres. The cavity-sphere interactions lead to reduced impact force for the trailing sphere, which in turn can be characterized into five different two-sphere entry modes using a dimensionless time known as the 'Matryoshka' number. We report up to ˜78% impact force reduction compared to a quiescent single sphere drop, and reveal how different cavity dynamics contribute to variations in force reduction for consecutive two-sphere water entry.

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