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Sandfish numerical model reveals optimal swimming in sand RYAN MALADEN, Bioengineering Program, Georgia Tech, YANG DING, ADAM KAMOR, School of Physics, Georgia Tech, ANDREW SLATTON, Computer Science, Ohio State University, DANIEL GOLDMAN, School of Physics, Bioengineering Program, Georgia Tech — Motivated by experiment and theory examining the undulatory swimming of the sandfish lizard within granular media [1], we study a numerical model of the sandfish as it swims within a validated soft sphere Molecular Dynamics granular media simulation. We hypothesize that features of its morphology and undulatory kinematics, and the granular media contribute to effective sand swimming. Our results agree with a resistive force model of the sandfish and show that speed and transport cost are optimized at a ratio of wave amplitude to wavelength of ≈ 0.2, irrespective of media properties and preparation. At this ratio, the entry of the animal into the media is fastest at an angle of $\approx 20^{\circ}$, close to the angle of repose. We also find that the sandfish cross-sectional body shape reduces motion induced buoyancy within the granular media and that wave efficiency is sensitive to body-particle friction but independent of particle-particle friction.

[1]Maladen et. al, Science, **325**, 314, 2009

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