JOHNS HOPKINS
WHITING SCHOOL
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DEPARTMENT OF CIVIL AND SYSTEMS ENGINEERING

SEMINAR

Modeling Dynamic Fluid-Solid Interaction in Turbulent Flow during Rock Scour

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Scour by hydraulic plucking is a fundamental process in landscape evolution where large, competent rock blocks are eroded from a fractured rock mass by flowing water. This process also affects engineered structures interacting with water, such as dams and bridges, and often leads to operational and safety concerns since erosion of large volumes of material can compromise structure foundations and serviceability. This presentation will highlight how this interaction between a blocky rock mass and water is analyzed by directly modeling the solid and fluid phases using a coupled Discrete Element Method (DEM) and Lattice Boltzmann Method (LBM) approach. The highly turbulent flow conditions at which plucking often occurs are modeled using Large Eddy Simulation (LES) implemented in the LBM. Results show that this modeling methodology is able to capture the correct kinematic failure mode of block erosion in several scenarios without restricting the potential failure mechanism. This capability makes this scour assessment technique broadly applicable since site-specific characteristics can be directly incorporated in scour risk assessments.

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