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Wall Shear Stress in Oscillating Channel Flow Using Particle Image Velocimetry BLAKE LANCE, Utah State University, JESSE ROBERTS, Sandia National Laboratories, BARTON SMITH, Utah State University, SEAN KEARNEY, Sandia National Laboratories — Offshore wind and water power are renewable sources with the potential for significant power generation. But each generation mechanism has risks from ocean floor structures that can disrupt natural sediment transport by increasing local shear stress. The Sediment Erosion Actuated by Wave Oscillations and Linear Flow (SEAWOLF) flume was designed and built to replicate wave motion with both oscillatory and unidirectional components to study sediment transport. The rectangular test section provides optical access for Particle Image Velocimetry (PIV) measurements. Additionally series of pressure taps allow for differential pressure measurements. Sine-wave oscillations and unidirectional flow in more than a dozen combinations are measured and presented. Phase locked measurements of volume flow rates, velocity fields, and pressure are acquired over several hundred cycles and phase averaged. High spatial resolution PIV is used near the wall for direct shear stress measurements. Since the flow is unsteady, the pressure drop in the test section has both inertial and friction contributions. To isolate the friction term, the pressure resulting from the fluid acceleration is subtracted. The synced PIV and pressure measurements on smooth walls where the viscous sublayer is formed confirm the accuracy of this method. The pressure sensor then measures shear stress on rough walls where the viscous sublayer is disrupted or non-existent and where optical access is difficult.

Blake Lance
Utah State University

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