UVA Hydraulic and Transport Engineering Lab for Sustainable River Resources

aka River Engineering

Some Applications:
Small and Large Dam Removal
River Restoration / Rehabilitation
In Stream Flow Calculation
Stormwater Management

Require:
Knowledge of the physical processes and forces operating to transport sediment and create turbulent flows
Lab Flume allows for geometric scaling and dynamic scaling to real rivers
Current research into how the river bed surface changes under low flows to increase its stability and resistance to transport

Creates a rough, armored surface and rocks rearrange into clusters
To understand the physical processes linking bed surface change to overall bed stability, the research investigates the turbulent flow patterns around the clusters. This is done using lasers and particle displacement to track movement in the fluid.
\[- \frac{\partial \bar{u}}{\partial x} + \nu \frac{\partial \bar{u}}{\partial y} + w \frac{\partial \bar{u}}{\partial z} = \]
\[- \frac{1}{\rho} \frac{dp}{dx} + \nu \left( \frac{\partial^2 \bar{u}}{\partial x^2} + \frac{\partial^2 \bar{u}}{\partial y^2} + \frac{\partial^2 \bar{u}}{\partial z^2} \right) - \left( \frac{\partial \bar{u}^{'2}}{\partial x} + \frac{\partial \bar{u}' \bar{v}'}{\partial y} + \frac{\partial \bar{u}' \bar{w}'}{\partial z} \right) \]

\[\tau_{ij, \text{turbulent}} = \begin{bmatrix}
(\tau_{xx} - \bar{u}^2) & (\tau_{xy} - \bar{u}' \bar{v}') & (\tau_{xz} - \bar{u}' \bar{w}') \\
(\tau_{yx} - \bar{v}' \bar{u}') & (\tau_{yy} - \bar{v}'^2) & (\tau_{yz} - \bar{v}' \bar{w}') \\
(\tau_{zx} - \bar{w}' \bar{u}') & (\tau_{zy} - \bar{w}' \bar{v}') & (\tau_{zz} - \bar{w}'^2)
\end{bmatrix}\]