Computational Fluid Dynamics Modeling with \textit{FLOW-3D}

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What is FLOW-3D?

• a powerful and highly-accurate CFD software package
• fluid dynamics modeling
• for industrial, engineering, and scientific applications
• for use in design phase or improving processes
• 30+ years experience
• proven
FLOW-3D examples

Simulating Flow Over Stepped Spillways
Assisted Spillway and Stilling Basin Design
FLOW-3D examples

Modeling Local Bridge Scour during Flood Event: The Houfeng Bridge Failure in Taiwan
FLOW-3D examples

Simulating Cross-Bar Block Ramps with FLOW-3D
FLOW-3D examples

Pump Performance at Sump Intakes
FLOW-3D examples

CFD Modeling of Flow into the Aerated Grit Chamber of a Water Reclamation Plant
Flow Over A Weir

Time = 0.000 sec
Fish Passage Design
FLOW-3D examples

Fish Passage Design
Contaminant Dispersion
Spillway Modeling
Landslide Analysis
Floating Offshore Platform
Fuel Tank Filling
Piston Pump
Sediment Scour – Bridge Piers
Scour Development – Bridge Piers
Case Study

Computational Fluid Dynamics Analysis of Suspended Sediment Sampler Efficiency
Objectives

Research objective:
The evaluation and verification of accuracy of FISP physical sediment samplers.

US DH-81

ISOKINETIC: water velocity at intake nozzle = ambient stream velocity
Background

Figures from FISP Report No. 5 (1941), “Laboratory Investigation of Suspended Sediment Samplers”
Methods

Advantages of CFD:

• lower cost
• control of flow conditions
• control of particle characteristics
• know “true” values
• flow field visualization
• improve designs

Disclaimer: The use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.
Technical Drawing of Nozzle

Fig. 9 - Standard nozzle intake diameter 0.25 in.

modified from FISP Report No. 5 (1941), “Laboratory Investigation of Suspended Sediment Samplers”
3-D Rendering of Nozzle

.stl file (STereoLithography)
FLOW-3D: Geometry

1, 2, 3 = flux planes
FLOW-3D: Flux Planes

pressure contours

z

x
FLOW-3D: Mesh
FLOW-3D: Boundary Conditions

- **Upstream**: ambient velocity
- **Sides**: stagnation pressure with ambient velocity
- **Downstream**: zero pressure
Variables:

- Intake efficiency (0.2–3.0)
- Ambient velocity (5 ft/s, 3 ft/s, 2 ft/s)
- Sediment size (0.45 mm and 0.15 mm)
  - spherical particles with SG = 2.65
- Turbulence (low, medium, high)

- Temperature (constant at 20°C)
- Design tolerances
- Particle-size distribution
- Other characteristics
Preliminary Results

Data are provisional and subject to revision.

3-D simulation output (x-velocity) with particles.
Preliminary Results

Data are provisional and subject to revision.

velocity magnitude and particle
Preliminary Results

Data are provisional and subject to revision.
Questions?

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