Fact Sheet

US Army Corps of Engineers
U.S. Army Engineer Research and Development Center January 2004

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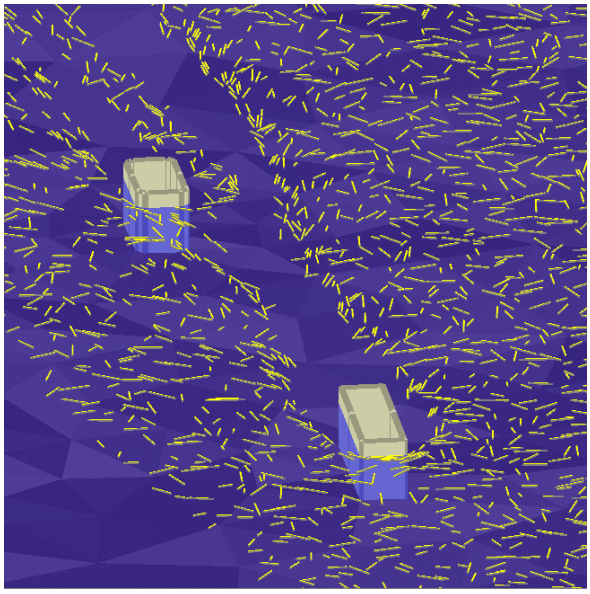
Computational Modeling of Ice and Debris

Purpose: To develop computational tools to simulate ice and debris problems in navigational channels and around locks and dams.

Background: Debris and floating ice are a significant problem at navigation locks that can lead to increased lockage time and require extensive manpower to combat. Our objective is to develop a set of discrete element based tools for simulation of particulate materials that impact the Corps of Engineers navigation mission including ice, debris, and rock. These tools will make it possible for Corps designers and engineers to simulate and study:

- Transit of ships and tows through ice and debris covered channels.
- Accumulation of ice and debris in and around navigation structures in complex flow fields.
- Evaluation of designs and operational guidelines for controlling ice and debris at locks and dams.
- Simulation of ships, barges, and mooring systems in lock approaches and lock chambers in the presence of ice and debris.



Showing log debris flowing past bridge piers upstream of Monongahela 4 L&D.

Facts: The tools are based on discrete element (DEM) computer codes developed at CRREL. The ice/debris DEM has been developed and run on water velocity and surface elevation fields calculated by the advanced hydraulic model ADH developed at CHL. We are integrating the DEM ice/debris modules with the ADH hydrodynamic model on the HPC. We have developed full ellipsoidal rock simulations that can be similarly integrated with ADH to model underwater deposition of rock for bed protection. We have begun prototype development of discrete element based barge and mooring models that will be compatible with the DEM used to model rocks, ice, and debris as well as the elements used to construct the model guard walls, piers, lock walls, and gates. This will allow simulation of impacts, forces and mooring dynamics caused by lock filling and emptying as well as ice and debris effects.

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