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Wave Modeling in Harbors, Inlets, and Near Structures Using CGWAVE

Description

CGWAVE is a general-purpose wave prediction model for simulating the propagation and transformation of ocean waves in coastal regions and harbors, and appropriate for modeling the most significant physical processes in channels, inlets and harbors, open coastal regions, around islands and structures. CGWAVE is based on frequency domain solution of the mild-slope equation (MSE), which represents the depth-integrated equations for the conservation of mass and momentum for waves propagating in water of variable depth. The model is operational in Surface-water Modeling System (SMS) for generating model's finite element mesh and analysis and visualization of model results.



Animation of surface waves generated using CGWAVE

Benefits

While CGWAVE can simulate the combined effects of wave refraction and diffraction, this model is unique for its ability to represent wave diffraction, wave reflection and standing waves (harbor oscillations) in nearshore applications. The model may be used for simulation of both short and long waves, monochromatic or spectral waves, in large spatial areas. A highly parallelized version of the model may be used on supercomputers for simulating spectral waves or modeling waves over very large domains (greater than 1,000,000 nodes). Model may be forced with the incident waves specified at its open ocean boundary. The incident waves may be periodic or non-periodic, or unidirectional or multidirectional. The numerical model solves for the integral wave parameters such as the wave height, wave direction and phase, and wave kinematics (optional). Time-dependent sea-surface elevation can be created in the SMS post-processing stage if required in military or civil applications. Animation of the evolution of surface waves is done in SMS using model output files. Two- and three-dimensional animation of model results showing the variation of waves in space and time may be produced in SMS. These allow the modeler to quickly check model I/O as well as observe complex behavior of waves in an intuitive manner.

Documentation and Support

How to Use CGWAVE with SMS: An Example for Tedious Creek Small Craft Harbor, CHETN I-68.

Application

Some recent applications of the model include nearshore wave climate studies in Kahului Harbor, and Kawaihae Harbor in Hawaii; Pago Pago Harbor, American Samoa; Brookings Harbor, Oregon; Morro Bay, California; Grays Harbor and Diffraction Mound in Half Moon Bay, Washington; Grand Haven and Pentwater Harbors in Michigan; and Tedious Creek, Maryland.

Point of Contact

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