



ANNEXURE-I : Hydrodyn-NAVSOF



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Design criteria for marine structures are established after careful consideration of various operational, functional, and navigational requirements such as

- Overall dimension and configuration
- Deck elevation
- Water depth alongside plus dredge and scour allowance
- Deck, cargo, and equipment loads
- Berthing loads – design vessels, speed and approach angles
- Mooring loads – design vessels, wind, wave and current action

Bringing a berthing vessel to rest, as against a dock, requires kinetic energy dissipation which is a product of distance. Some of the applied force that brings a berthing vessel to a stop may be provided by the own ship engine or berthing/maneuvering aids such as thrusters or tugboats.

Hydrodyn-Navsoft calculates the 6 degrees of freedom of the ship subjected to environmental conditions.

GRAPHICAL USER INTERFACE FEATURES

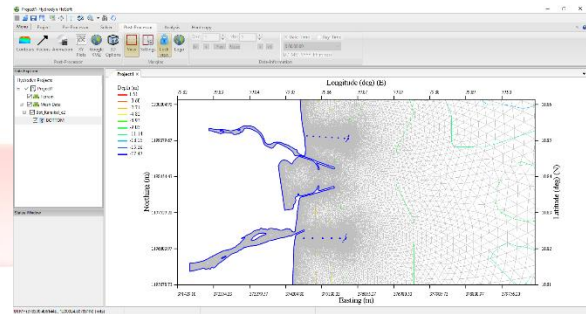
Hydrodyn-NAVSOFT provides interactive Graphical User Interface (GUI) which guides the user for defining topographical features, specifying boundary locations, defining meteorological data options, selecting options for grid generation, specifying model parameters, selecting physical models, properties, boundary conditions and solvers, initialising the solver parameters, setting up solution controls, running the solvers, on-line animation facilities, hard copy utilities and extensive on-line help facilities.

Post Processor assists the user for the display of solver output results graphically in various formats. GUI options are available for plotting of contour maps and color maps of model properties, simulation results such as water elevations, plotting of flow velocity vectors, computational grid, residual velocities, ship motion tracks, animation facilities, setting background colors of pre and post processor screens etc. GUI's Hard copy utilities helps the user to save the image pictures in standard formats and to export software results to ASCII text files supported by virtually any 3D visualization software. Online Help facility is also available in the GUI. This

guides the user to help out in various stages in the preparation of input data and setting up the software.

GEOMETRY AND MESH SYSTEM

Hydrodyn-NAVSOFT interface is built on Triangular grid generation module based on Advanced Front Technique which contains a logical menu interface that guides the user to generate the grid for complex domain shapes. The user can control the grid spacing in selected regions of the domain of study. Constant grid spacing and spatially varying grid spacing options are also available while generating mesh.



SOLVER FEATURES

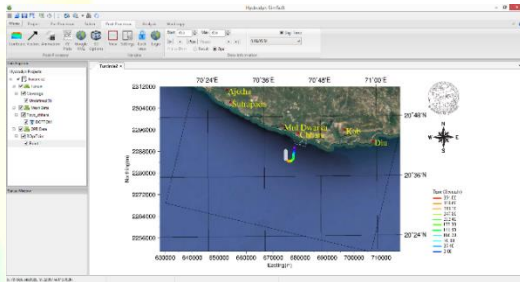
Hydrodyn-NAVSOFT uses Finite Element Method to solve the Hydrodynamics and ship stability equations on Triangular grid system for the prediction of Forces and moments of the ship.

- Uses the Finite Element approach, which allows modeling up to three dimensions
- Solves equations for conservation of mass, momentum and energy for flow
- Has its own Grid Generator based on the Advanced Front Technique
- Uses 3D triangular (horizontally) and sigma-stretched (vertically) grid so that the simulation can be done for any arbitrary shaped topography of flow domains
- The user can select any type of boundary conditions at any location i.e. steady or transient
- A graphical interface i.e. pre-processor is integrated to the model to define the required model inputs graphically
- Various objects, i.e. bathymetric depth contours, islands, dykes, coastlines, etc. are represented by different colors to identify the objects easily
- Interactive GIS data management system



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- The observation points can be applied at any location of the computational domain to visualise the Hydrodynamic outputs graphically



- Input winds time series
- The GIS utility is highly interactive and allows the user to import from external GIS sources, a variety of geographic data such as response resources, environmental sensitive areas, and key coastal features.
- It has animation facility for output results of various file formats i.e. Bitmap, JPG, PNG
- Dispersant effectiveness and over-flight update tools

SOFTWARE CAPABILITIES

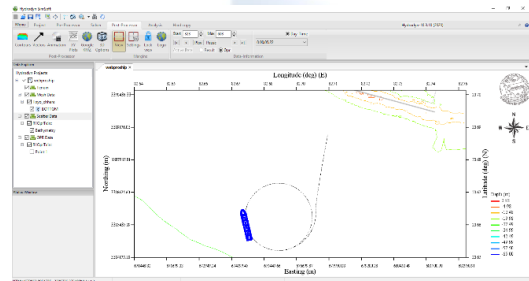
This software is flexible and can be used for any geographical locations in the world.

- It uses a 3D triangular grid to map the physical domain features to be modeled exactly and with generalized flow boundary conditions
- It includes many specialized features of graphics and menu driven pre/postprocessor for setting up the input, running the calculation, and selecting and obtaining graphical output from the analysis
- It allows fast, flexible creation and modification of computational models, while greatly reducing the possibility of errors in the input
- It is capable of calculating force produced by the ship with operative/inoperative engine conditions
- It predicts the moments encountered by the ship subjected various environmental conditions Including the Ship engine ON/OFF conditions
- Tugs and their bollard/mooring force can be calculated
- It also performs Drift calculations
- It also establishes Turning circle manoeuvre calculations

- It calculates, pitch, roll, yaw angles and moments along with the force encountered by the ship on sea

Some of the core features are mentioned below

- Digitization of the raster images using .dxf files and .xyz files
- Drawing the coastal boundaries, triangular mesh generation with mesh refinement in selective region
- Applying the bathy using scatter points
- Saving the domain in binary format which reduces the size of memory compared to ascii format files



- Defining the boundary conditions and applying the tides and wind for boundary condition
- Finite Element Method solving technics which involves fast computation and produces more accurate results
- Displays the contours, vectors while simulation goes on
- Saving the flow result in binary format
- Loading of huge result files takes less time compared to loading of ASCII files
- Plotting, extracting and saving of Time dependent results at selected observation points
- Capable of producing results in PNG format and saving
- Producing animation of velocity contours, vectors and ship navigation path

SOFTWARE APPLICATIONS

Hydrodyn-NAVSOFT covers the following model applications

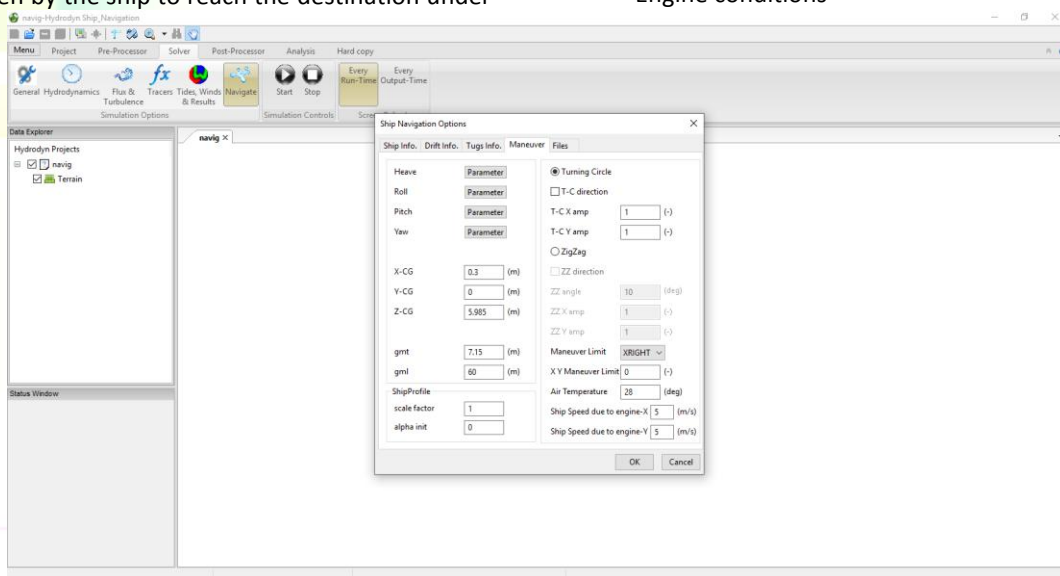
- Predicts the navigation of ship
- Calculates the force encountered by the ship based on those sizes



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• Capable of finding the time taken by the ship to reach the destination under

the influences of meteorological conditions and Engine conditions



OUR SCIENTIFIC SOFTWARE PRODUCTS

- | | |
|--------------------|---|
| Airsoft | : Simulation of pollutants spread in atmosphere. |
| Flosoft | : Simulation of Hydrodynamic flow |
| Stmsoft | : Simulation of Solute transport, Biodegradation, Transport chemical Reaction processes in Ground Water flow system |
| Nspsoft | : Simulation of Noise Pollution Management Practice |
| Oilsoft | : Simulation of fate and trajectory of oil spills |
| Polsoft | : Simulation of Conservative and Non- Conservative Pollutant Transport |
| Surgsoft | : Simulation of surges due to cyclones |
| Sedsoft | : Simulation of Cohesive and non- Cohesive Sediment |
| Ahdsoft | : Analysis of Hydrographic Data For Tidal |
| Libsoft | : Library Management System |
| Wavesoft | : Simulation of water elevation due to wave |
| e-Institute | : institutional Management System Software |
| e-Breeze | : Office Automation Software |

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