

3-D potential theory including wave diffraction

DIFFRAC

DIFFRAC is a wave diffraction program capable of calculating the wave loads and motion responses of free floating or moored structures in regular waves, including their hydrodynamic interaction. The program is applicable to both shallow and deep water and has been validated against many physical model test results.

Computational approach

DIFFRAC is based on a three-dimensional source distribution technique for the solution of the linearised velocity potential problem. For this approach the fluid is assumed to be inviscid, homogeneous, irrotational and incompressible. DIFFRAC computes fluid pressures and wave loads on the basis of the velocity potential around the vessel(s), given as a scalar function in space and time.

For the computations, the mean wetted part of the hull of the vessel(s) is approximated by a number of plane elements. Each element represents a distribution of source singularities, each of which contributes to the velocity potential describing the fluid flow.

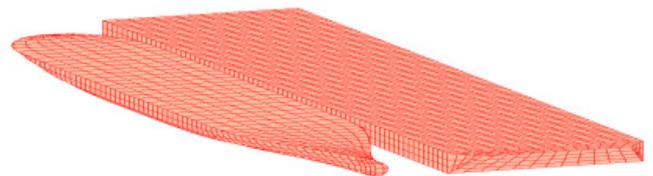
The rigid lid method is used to suppress the effect of irregular frequencies. A damping lid may be used to damp resonant water motions, for example in the gap between side-by-side moored vessels.

Input

- Structure's geometry (body plan)
- Position of centre of gravity
- Radii of inertia about the three axes
- Water depth

Output

- Hydrodynamic reaction forces and moments, expressed as added mass and damping coefficients due to the structure-fluid interaction
- First order wave exciting forces and moments including the diffraction effects of the waves on the structure(s)
- Response amplitude and phase operators can be obtained from the linearised set of equations of motion, where the first-order wave exciting forces and moments together with the added mass and damping coefficients are used
- Total pressure distribution, including motion and wave effects, needed for the strength analysis (DYNFORC)
- Water velocities needed for drift force analysis (DRIFTP/DBDRIFT)



Panel distribution of an LNG carrier side-by-side to an FSRU

References

- Buchner, Van Dijk and De Wilde; "Numerical Multiple-Body Simulations of Side-by-Side Mooring to an FPSO", Proc. of IOPEC2001.
- Buchner; "The Motions of a Ship on a Sloped Seabed", Proc. of OMAE2006.
- Pauw, Huijsmans and Voogt; "Advances in the Hydrodynamics of Side-by-side Moored Vessels", Proc. of OMAE2007.

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