Technische Universiteit Delft

Flexible floating island

Nowadays, fears over rising sea levels due to global warming have prompted many countries with lands below sea level to find solutions to ensure the safety of nation and citizen. Furthermore, the development and utilization of marine resources have always been a topic of interest. Due to these necessities, the concept of flexible floating islands that can be used for fish farm, energy islands and residence has emerged. The flexible floating island consists of many smaller identical triangles connected by springs. This design is convenient for installation, disassembly, and diversification of functions.

The main objective of this thesis is to investigate and analyze the forces acting on and motions of the flexible floating islands due to the interaction with regular waves; a numerical model is an excellent way to complete that mission.

The floating islands in waves that are constrained with mooring lines have translational and rotational motions under the combined effect of hydrodynamic, hydrostatic, gravitational and mooring forces. The approach for solving the forces starts with linear potential theory, which means that uncompressed inviscid flow is assumed. After marking out the identical smaller panels on the wetted surfaces of each small triangle, the interface conditions between the triangle and the fluid are satisfied, thereby obtaining the source strength for each panel. With the expressions for the potentials, all the hydrodynamic coefficients including added mass, damping and wave exciting forces can be evaluated.

Finally, the response of islands can be evaluated by using the equations of motions of the island in the time domain and converting them to the frequency domain. Two models are created in this thesis, a single island model and a two-island model, the former focuses on learning the methods for solving the hydromechanics coefficients, and the latter focuses on the hydrodynamic interaction between the two islands.

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