I.7. Discussion on the Report of the 23rd ITTC Specialist Committee on Waves: Deterministic seakeeping tests

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Congratulations for this excellent report. I appreciate very much that the committee supports the application of deterministic seakeeping tests. We are developing this technique as a tool for the investigation of wave/structure interactions, using tailored wave packets embedded in irregular seas (Clauss, 2002a). Wave elevation, pressure distribution as well as acceleration and velocity fields in space and time can be determined at the position of the structure, even if the vessel is moving at an arbitrary speed and course. Thus physical mechanism of vessel dynamics can be evaluated as a cause-effect chain. Composing response based wave sequences special phenomena such as capsizing of ships can be analysed in detail. Based on such seakeeping tests non-linear numerical models are developed and verified to design safer ships and optimize ship operation and navigation (Clauss et al., 2002a).

The technique also allows the generation of registered wave sequences like the extremely high New Year Wave which has been recorded on January 1, 1995 at the Draupner field in the North Sea (Figure I.7.1). Using our dedicated generation technique the non-linear genesis of these wave groups can be studied. Also, the seakeeping behaviour of any structure can be evaluated in such extreme environment. As shown in Figure I.7.2 the semisubmersible GVA 4000 has been tested in these extreme waves investigating heave, pitch and airgap (Clauss et al., 2002b). Selected wave groups can be tuned arbitrarily and integrated in regular or irregular seas, e.g. by stretching or compressing the peak wave to adjust a critical wave length and steepness for response based evaluations. Also phase relations between incident wave and (moving) structure can be varied, and any test can be repeated identically if a specific effect is analysed.

As a consequence, with this technique the mechanism of non-linear behaviour of ships and offshore structures in tailored waves can be evaluated which helps to reveal the mechanism of arbitrary wave/structure interactions including slamming, green water and capsizing as well as other survivability design aspects (Clauss, 2002b). It is also indispensable for the development and validation of (non-linear) numerical programs which are necessary tools for systematic investigations of seakeeping characteristics of marine systems in harsh environment.

References


Figure I.7.1  Comparison of model wave and registered New Year Wave, presented as full scale data.

Figure I.7.2  Results of numerical simulation and experimental tests for semisubmersible GVA4000: Heave, pitch and airgap (measured at scale 1:81, presented as full scale data).