Segmented ferry model in breaking wave from the bow-quarter.

23227

# New tests seek solutions to slamming problems

**Impulsive loads experienced by ships in waves degrade directly and indirectly, performance and safety.**

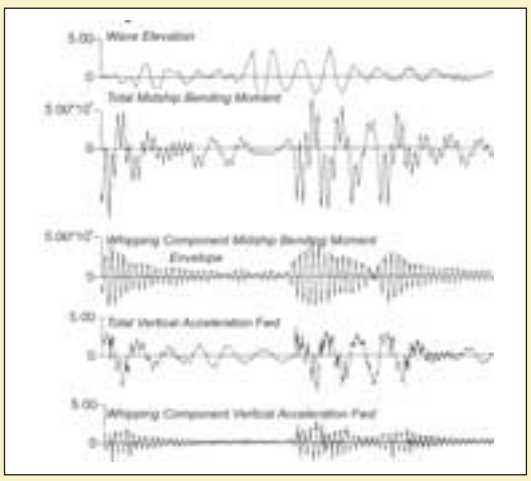
Mirek Kaminski &
Reint Dallinga
M.Kaminski@marin.nl

A direct effect of slamming is a transient response of the global and local structure. Direct safety issues are local damage, such as cracks and because of the vibrations, lashing and stowage problems. Passenger discomfort becomes an issue in other cases. An important indirect effect is reduced operational reliability related to the "voluntary" speed reductions of prudent masters.

Pressure gauge set-up to measure aft-body excitation.

## Model test techniques

Traditionally, slamming impulse is measured by means of a limited number of pressure gauges at relevant locations. Recent work in the areas of bow-flare and aft-body slamming has found that part of the impulsive load originates in a very local, high pressure, area that travels across the shell at high speed. The limited spatial extent and short duration seem the reason why the traditional model test techniques are not always sufficiently reliable to identify operational problems.




Contribution of whipping to bending moments and vertical accelerations at the bow.

A very straightforward new model test technique to obtain information on the whipping bending moments and accelerations is based on tests with a segmented model. Here, the stiffness of the connection between the two or more, model segments mimics the first global vertical bending vibration mode of the ship. An alternative, which gives explicit insight in the temporal and spatial extent of the pressures, is to perform detailed measurements on the impulsive loads experienced by a rigid model and to use a dynamic Finite Element Analysis to solve the transient flexural response. An advantage of this procedure is that all relevant mode shapes are covered. It disregards however a possible hydro-elastic interaction.

## Numerical tools

Tools for the numerical prediction of the hull girder whipping on a given impulsive load are under development in the working group, Cooperative Research Ships. Although the quantification of the impulsive loads seems feasible in a two-dimensional analysis, it proves hard to relate these results to the loads experienced in irregular waves from ahead, and also from the bow-quarter. This problem will be an important area of research in the near future.

## Spin-off to springing

Large ships have relatively long periods of natural hull vibrations of about three seconds. This means that at certain ship/sea conditions these modes can be excited when the encounter period of waves matches the natural vibration period. The result will be springing (bending mode) or twisting (torsional mode). Both phenomena need to be properly addressed during design and operation as they may significantly reduce fatigue lifetime and increase discomfort. Tests with segmented models having properly modelled damping can define the operational envelop or support a decision for an active damping device.

MARIN