

Vertical Response of Offshore Structures Affected by Sea Severities

Cheung Hun Kim and Suresh Rajendran

Texas A & M University, Coastal and Ocean Engineering Division, Zachry Department of Civil Engineering
 College Station, TX, USA

Sun Hong Kwon

Pusan National University, Department of Naval Architecture and Ocean Engineering, Busan, Korea

ABSTRACT

Dalzell (1962) determined experimental LTFs of pitching motion of a fast running destroyer affected by sea severity. The experimental LTFs decreased with increase of sea severity. Such nonlinear behavior has been investigated again here by analyzing the motion of an ITTC standard container ship moored in head seas. The current study has found the experimental QTFs behaved similar to the experimental LTFs increasing with sea severity.

KEY WORDS: sea severity, linear frequency response function (LTF), quadratic frequency response function (QTF), Volterra linear and quadratic model, theoretical LTF, experimental LTF and experimental QTF.

INTRODUCTION

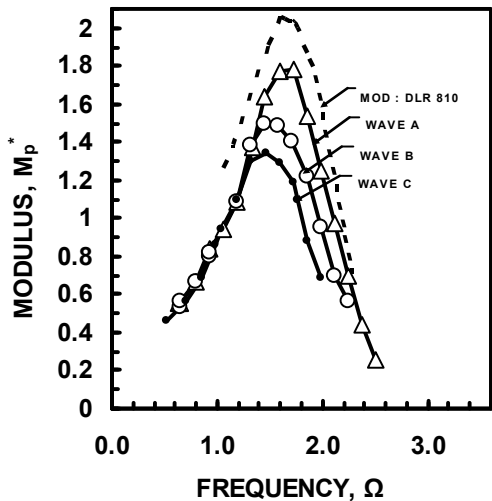


Fig. 1 Experimental LTFs of pitching of a destroyer Dalzell (1962): in non-dimensional form of encounter frequency and LTFs.

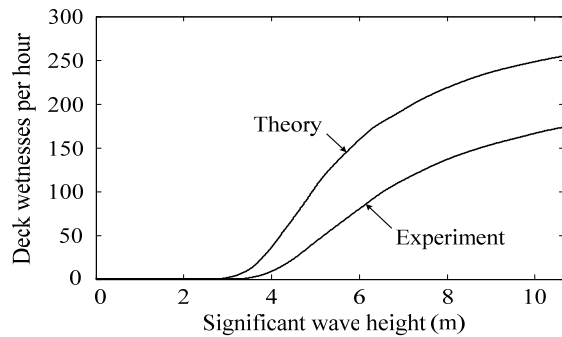


Fig. 2 Deck wetness per hour of a destroyer (Cummins, 1973).

Dalzell (1962) in Fig. 1 was copied from Cummins (1973). It gave experimental LTFs for the pitching motion of a high speed destroyer of 150 m long in head seas A, B, C, and D ($H_s = 6$ m, 9m, 11m). The experimental LTFs decreased with increase of the sea severity and the linear theory in dotted line gives the highest LTFs.

Cummins (1973) compared the linear theory with experiment of a destroyer for the deck-wetting as function of sea severity as shown in Fig. 2, where the linear theory much overestimates the peak values.

Our main interest is to study the foregoing behaviors again with a S175 container ship moored in head seas of varying sea severity of $H_s = 4.5$ m, 6.5 m, 10.0 m and 12.2 m.

These waves belong to the seas of very rough, high and very high and are coded with # 6, 7, and 8 as indicated in Table 1.

The vertical motions: heave, pitch and vertical relative motions were measured simultaneously with the incoming waves at the longitudinal center of the structure for 30minutes.

We have found that the experimental LTFs and QTFs both decrease