Sloshing assessment of the LNG floating units with membrane type containment system where we are?∗
Sime Malenica a,∗, Louis Diebold a, Sun Hong Kwon b, Dae-Seung Cho b

a Bureau Veritas, Neuilly sur Seine, France
b Pusan National University, Busan, South Korea

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A B S T R A C T
The paper gives an overview of the current status of the methods and methodologies which are in use for the evaluation of the structural response induced by sloshing impacts. First the overall problem (seakeeping, sloshing, impacts, statistics…) is discussed and then the accent is put on the modeling of hydro-structure interactions which occur during the severe sloshing impacts in the tanks of the Liquefied Natural Gas (LNG) Carriers of membrane type. The main conclusion is that the sloshing assessment procedures are still under investigations and there are still no fully satisfactory methods and methodologies available to solve the problem fully consistently within the so called direct calculation approach. That is why, for the time being, a relatively simplified procedures are used in practice.

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1. Introduction
Sloshing became a very important practical issue in the last decades due to the increased activities in the LNG transport. Large numbers of LNG ships were built or are under construction with the capacities which almost doubled as compared to the classical LNG ships (from 138 000 m³ to 260 000 m³). At the same time the projects of several LNG FPSO (Liquefied Natural Gas – Floating Production Storage Offloading) units, were built or are in the design process, among which the Prelude LNG FPSO operated by Shell is probably the most well-known. This FPSO represents the biggest floating unit in the world and its length is close to 500 m for breadth of 74 m and the total capacity is around 220 000 m³ of LNG together with 90 000 m³ of LPG and 120 000 m³ of condensate. The most common LNG units belong to the so called membrane type which is of main concern here. Within the membrane type concept, the LNG is kept liquid at very low temperature (−165 °C) by complex cargo containment system (CCS) which is attached to the ship structure. There exist today two main types of CCS (NO96 and MKIII) and they are shown in Fig. 1. Both systems are owned by Gaztransport and Technigaz (GTT), and both systems are structurally very complex and involve different types of materials (plywood, perlite, invar, stainless steel, foam, glue…) which are connected together and attached to the hull structure. For reference, the CCS which was used for Prelude LNG FPSO is the MKIII CCS.

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∗ Corresponding author.
E-mail addresses: sime.malenica@bureauveritas.com (S. Malenica), louis.diebold@bureauveritas.com (L. Diebold), shkwon@pusan.ac.kr (S.H. Kwon), daecho@pusan.ac.kr (D.-S. Cho).

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