

# Department of Ocean and Resources Engineering

## *Seminar*

### MULTI-OBJECTIVE OPTIMISATION OF A FLOATING LNG TERMINAL

By

**Prof. Apostolos Papanikolaou**

Professor, National Technical University of Athens, Greece &

Director of the Ship Design Laboratory (NTUA-SDL) <http://www.naval.ntua.gr/sdl>

Wednesday, May 21, 2008, Holmes Hall 243

3:00-3:30 pm Coffee Hour

3:30-4:30 pm Seminar

**Please join us for the coffee hour near the seminar venue a half hour before the seminar, 3:00 – 3:30 pm**

#### **Abstract**

With the still growing demand for hydrocarbons worldwide and the proven economic and environmental advantages of natural gas over coal and oil, the demand for new LNG terminals has significantly increased in recent years. Safety and security aspects in view of the risk of possible terrorist attacks and relatively short lead time between conception and deployment is driving many decision makers to look after floating offshore LNG terminal solutions. Offshore LNG terminals are typically few miles away from the coast and offer relatively little threat to the people and marine environment, and easy access for incoming LNG carriers. When considering offshore LNG terminals, weather and marine environmental conditions are major factors greatly affecting the terminal design for optimal operational efficiency and reliability. Wind, waves and currents in many locations of interest can be severe. This complicates the terminal design and its operation, considering that the LNG carrying ships have to moor and offload to a moving floating structure in the middle of the sea. The maximization of the utilization of the facility for ensuring acceptable economy of the concept requires an operability of the terminal even in appreciably adverse environmental conditions.

This paper presents a comprehensive multi-objective hydrodynamic optimisation procedure and its application to the early design of a Floating LNG Terminal for improved seakeeping and wave attenuation characteristics on its lee side. Genetic Algorithms are used to find the Pareto optima designs followed by Multi-Objective Decision Making procedures to select the optimum design among them. The paper addresses the definition of the relevant optimisation problem and the setup and interface of relevant software tools, presents results of systematic studies with respect to the minimization of the motion responses and the wave elevation on the leeward side of the free-floating terminal and concludes with the analysis and critical review of the obtained results and their impact on the terminal design.

The presented work is based on research conducted in the framework of the European Union funded research project GIFT [1]. Besides NTUA, the partners in this project were DORIS Engineering (France, coordinator), Aker Yards SA (France), London Marine Consultants Ltd (UK) and Det Norske Veritas (DNV, Norway).

#### **References**

[1]. GIFT Project (2005-2007), Project funded by the European Commission, DG Research, Contract Number FP6-TST4-CT-2004-12404.