UNIVERSITY COLLEGE LONDON POST GRADUATE PROJECTS 1992–1993

MARINE ENGINEERING AND NAVAL ARCHITECTURE

Summaries of the projects on the 1992–93 MSc courses at the University College London are:

NAVAL ARCHITECTURE

A finite element study into Turret Mooring Vessel bearing loads
by D. BLACK, U.K. MoD

This report describes work done using the ABAQUS finite element package. Two finite element meshes were developed to represent the portion of the ship's structure that surrounds the turret shaft of a proposed turret mooring vessel design. The mesh used for the analysis was a coarse mesh; there was insufficient time to run the refined mesh. Nodes representing the bearing locations were loaded appropriately and the responses studied to determine the load conditions under which the turret will become detached from any of its bearings.

Mathematical curve fitting to resistance data
by A. MERCHANT, Private Student-Singapore

In preliminary ship design studies it is frequently necessary to estimate the calm water resistance characteristics of various hull forms, prior to carrying out model test. For such estimations, use is generally made of results of well known methodical model experiments such as TAYLOR's Standard Series, Series 60 and others to determine the effect of specific hull form parameters on resistance. These methods present the results of resistance tests with models based on various ratios and coefficients. The aim of this study was to find a mathematical representation of this type of data.

An investigation of the structural efficiency of the Trimaran hull form
by M.W ASH, U.K. MoD

The findings of an investigation into the structural efficiency of the box and side hulls of a trimaran hull form are presented. The work begins by examining the way in which the primary loading on the hull girder may be derived in the early stages of the design and hence how this may be used to estimate initial scantlings. Subsequently the structural arrangements of recent trimaran designs are reviewed prior to presenting the geometry of a representative simplified finite element model. The finite element model is then subjected to a parametric study, the results of which are reduced to a small number of design algorithms, which may be utilized in the early stages of the structural design process prior to conducting a more rigorous analysis at a later date.

An assessment of the critical variables in overlaminate Tee-Joints
by P. SOULIS, Private Student-Greece

Work by SHENOIR and others has examined the problems of forming efficient joints between the major structural components of fibre reinforced plastic ships and has shown that simple composite overlaps may be used, in conjunction with preformed stiffeners, to form tee and top hat joint configurations. This report is concerned primarily with tee joints between watertight bulkheads and shell plating; it summarises the applications and properties of such engineering components, attempts to identify critical design parameters and hence optimise joint configurations capable of achieving higher performance at reduced weight and cost. The objectives of this project were approached using a numerical analysis based on the I-DEAS integrated design package.

Forces on the rudder, in the wake of a submarine
by LIEUTENANT M. SAEED, Pakistan Navy

In this project, a submarine was modelled by using source and sink of equal strength to analyse the force generated by a rudder in the wake of a submarine. The radius of the submarine was changed by increasing the strength of the source and sink, to analyse the effect on the force generated by the rudder at different radii of the submarine. The positions of the rudder were also varied to find the most effective position for the rudder. In parallel to this, force was calculated for varying rudder angles, to compare the effectiveness in different cases. The flow for the analysis was assumed inviscid.

Validation of Chaos Theory predictions of ship capsize
by LIEUTENANT (N) M. RUSSEL, Canadian Navy

No specific model testing, has been carried out to date, to validate the ship capsize predictions from Chaos Theory. Therefore, the primary goal of this project was to design and carry out a model test experiment which would test this hypothesis and serve as a basis for continuing research and testing.

Longitudinal Strength Analysis by Coarse Finite Element
by P. O'BRIEN, U.K. MoD

This project sets out to demonstrate that it is possible to model a ship, with as few as 700 elements using a PC based finite element analysis package. The resolution of the model is vital, as is the loading, both of which will require further work before the system is totally viable. Several load scenarios have been examined and all have inherent problems. It is envisaged that a PC based system will eventually become viable when these problems have been overcome.

On the development of a series of empirical predictor equations for seakeeping
by LIEUTENANT (N) D. HAWKINS, Canadian Navy

This paper discusses the development of a series of eight empirical predictor equations that will enable a ship designer to quantitatively assess the heave and acceleration amidships with knowledge of only four basic hullform parameters. It briefly describes the mathematical series of models produced and tested by the National Research Council of Canada Institute for Marine Dynamics in the late 1970's and their subsequent data analysis. The regression techniques used and tried are discussed and two appendices are given containing sample plots of the predicted curves and associated NRC data curves. The range of applicability for the equations are discussed, and in general, covers the range required for modern frigates, destroyers and fast patrol boats.

The probabilistic damage stability of warships
by C.J.R. HILL, Private Student-U.K.

The purpose of this paper is to examine the application of the probabilistic method of damage stability assessment to warships and to explore the extension of the methodology to the damage risks that are specific to these vessels.

MARINE ENGINEERING (MECHANICAL)

Propulsion and fuel consumption analysis for a coastal tanker
by S. ADAMOPOULOS, Private Student-Greece

A particular type of small coastal tanker has shown a relatively high fuel consumption compared to other vessels of a similar size. This report consists of a propulsion analysis of the vessels, in an attempt to reduce their fuel consumption. The ships are about 4200 tonnes displacement and were British built in 1980. They are fitted with medium speed Mirlees-Blackstone diesel engines and controllable pitch propellers. The object of the report is to find ways of reducing the fuel consumption, through optimization of the rpm of the corresponding pitch of the propeller. The analysis was based on both theoretical and actual measured parameters.

Vibration response analysis of ship piping systems under excitation from ship plant and propulsion systems
by T.R. BEDO, Private Student-Ethiopia

The purpose of this dissertation is to examine the effect of propulsion system torsional vibration on ship piping systems. Shipboard vibration can be categorised into two main groups, hull and propulsion. The propulsion system vibrations are lateral, longitudinal and torsional. Since torsional vibration presents the most significant of all three types, the scope of this dissertation is restricted to its study and to suggest means of minimizing its effect on ship piping systems.

Vibration analysis of steering gear
by LIEUTENANT M.J. BROWNE, South African Navy

Recent steering gear failures on Bulk Carriers and VLCCs have highlighted the need for detailed analysis of the forces applied on such equipment. The objectives of the dissertation were:

(*a*) To obtain data on the vibration experienced by the steering gear during normal running.
(*b*) To analyse the vibration experienced and its source and effect.
(*c*) To find if this vibration has any effect on the fatigue life of the equipment.

The repowering of the FF-1052 KNOX class frigate
by M.T. GIOURGAS, Private Student-Greece

This dissertation outlines the preliminary design work carried out from the marine mechanical engineering standpoint, for the repowering of the KNOX class frigates that were recently acquired for the Hellenic Navy from the U.S. Navy. This involved replacing the existing steam turbines with modern CODOG propulsion plants. The report also includes a financial analysis in order to demonstrate the economic benefits of this project.

Application of system identification to ship motion prediction
by COMMANDER H. HANSEN, South African Navy

The subject of this thesis is the application of system identification to the prediction of ship motions. The data obtained for a Type 22 frigate was analysed. Based on this analysis, and an understanding of the requirements for effective model parameter estimation, various pre-treatments are proposed. An auto regressive moving average and algorithm are developed and the resulting model is applied to the 10 seconds ahead prediction of ships roll motion.

Fumigation of a LISTER LT1 diesel engine with methyl alcohol
by M. OMIDVAR, Private Student-Iran

Exhaust gas emissions from internal combustion engines, in particular diesels, have become a major source of air pollution. In order to reduce these harmful emissions and to increase performance, one of many methods tried is fumigation. In this dissertation a single cylinder LISTER LT1 diesel engine is fumigated by small amounts of methyl alcohol (methanol). The results of performance and exhaust emissions are compared with those of a standard engine. In order to investigate the combustion characteristics, a heat release program was used to analyse the cylinder pressure characteristics.

The full reports are held at the University and further information may be obtained from:

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