A MODEL FOR MULTIDISCIPLINARY DESIGN OPTIMIZATION OF CONTAINERSHIPS

by

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Thesis submitted to the Faculty of

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

Master of Science

in

Ocean Engineering

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July, 1999
Blacksburg, Virginia

Keywords: Multidisciplinary, Optimization, Containerships

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(ABSTRACT)

This thesis describes a multidisciplinary design optimization approach to containership design. The method employs widely accepted regression equations for computing resistance, weights, building costs and operating costs. The current regulations governing freeboard and the Coast Guard wind heel criterion are included.

The measures of merit used are the required freight rate and the return on investment. The system is flexible enough to allow changes in trade routes, shipyard and port parameters, and fuel costs.

The weight-displacement balance is maintained by including draft as a design variable and imposing an equality constraint on weight and displacement rather than introducing an internal loop to calculate draft at each iteration. This speeds up the optimization process.

The process takes into account the discrete container stowage issue. The carrying capacity (number of containers) is expressed as a continuous function of the principal dimensions by using a linear response surface fit that in turn makes the objective function continuous.

Speed is a design variable. The optimum speed takes into account the compromise required between higher speeds that imply higher revenue and lower speeds that imply lower fuel costs.

The optimizer used is the Design Optimization Tools (DOT) program from Vanderplaats Research and Development, Inc. Results employing the three different techniques provided in DOT have been obtained and compared.

The optimum ship tends to be the largest ship in terms of length and beam. An optimum speed is identified. The three techniques provided in DOT give fairly consistent results, but once a good optimum point is identified in the design space, the sequential linear programming algorithm is found to be the most consistent method to converge to a local optimum.

The objective function is found to be flat in the vicinity of the optimum that indicates that the designer is not confined to a severely restricted design space and has some freedom in designing the optimum ship.

Acknowledgements

During the past two years I had the good opportunity to work with the FIRST team, comprising three faculty and five graduate students at the Aerospace and Ocean engineering department at Virginia Tech. The multidisciplinary optimization approach to design enabled me to look at design aspects that were traditionally treated one at a time, in a multidisciplinary perspective.

I would like to express my deep gratitude to my advisor and committee chair, Dr. Owen Hughes who was a constant source of guidance and support throughout this work. I am also extremely grateful to members of my committee, Dr. Wayne Neu and Dr. William Mason for their guidance and support. Our weekly meetings where we discussed problems and sought solutions provided a constant source of direction and encouragement to me. Special thanks are due to Dr. Neu and Dr. Mason for making valuable suggestions for improvement to this work.

I am also very thankful to Dr. Paul Ni, Ying Chen, Frank Lin and Sivaramakrishna Tumma, graduate students in the department, for their numerous contributions without which this work could not have been completed in its present form.

I would like to extend my gratitude to the team members of the DARPA/ Maritech sponsored FIRST project: Intergraph Corporation, Proteus Engineering, SPAR Associates, Inc., Newport News Shipbuilding and American Bureau of Shipping.

Last but not the least, my sincere gratitude to the department of Aerospace and Ocean engineering at Virginia Tech, a unique blend of two disciplines, for having given me the opportunity to participate in their graduate program comprising research and course-work.