Chapter 9

Conclusions and Suggestions

9.1 Conclusions

The goal of this work was to explore the problem formulation for multidisciplinary design optimization of containerships. This has been accomplished by developing a model that behaves well when coupled with a geometry manipulation scheme and an optimization tool.

A procedure to account for the discrete container stowage issue by expressing the number of containers as a function of the principal dimensions and the geometry of the hull form has been implemented.

Various problem formulation issues involving practical considerations such as port conditions and trade routes, and optimization details such as objective function scaling that have significant effects on the optimum design have been discussed.

The optimum ship tends to be the largest ship in terms of length and beam. An optimum speed has been identified as a trade-off between higher revenue implied by higher speeds and lower fuel costs implied by lower speeds. The objective function has been found to be insensitive to the blending coefficient and the optimum ship tends to favor neither a fuller nor a finer hull form but an intermediate one.

The three techniques provided in DOT give fairly consistent results, but once a good optimum point is identified in the design space using the technique mentioned in section 7.2, SLP proves to be the most consistent method to converge to a local optimum as shown in section 7.2 and discussed in section 7.3.

The fact that the objective function is flat in the vicinity of the optimum, as explained in section 7.3, indicates that the designer is not confined to a severely restricted design space and has some freedom in designing the optimum ship.

9.2 Suggestions for Future Work

- The coefficients in the equations for steel hull, outfit, hull engineering and machinery costs need to be recalculated by regression analysis based on recent data.

- The stowage factor for the TEUs above deck needs to be expressed as a function of the waterplane coefficient. This has not been done presently because of the lack of data on the waterplane coefficient.

- The current propulsion module could be made more efficient by optimizing the propeller diameter towards obtaining an overall propulsive efficiency rather than assuming a constant overall propulsive efficiency.

- Features of the hull form need to be identified which would allow the designer to gain control over the shape of the hull form, thereby making the objective function sensitive to the blending coefficient, for the combination of basis hull forms used in this work. For example, if we could show that changing the bulbous bow area caused further reduction in the objective function, we could use this parameter to modify our basis hull forms, thereby gaining control over the shape of the hull form and hence on the blending coefficient. This would make the objective function sensitive to the blending coefficient.