An Enhanced Propeller Design Program Based on
Propeller Vortex Lattice Lifting Line Theory

by

Hsin-Lung Chung

Submitted to the Department of Mechanical Engineering on May 11, 2007
in Partial Fulfillment of the Requirements for the Degrees of
Master of Science in Naval Architecture and Marine Engineering
and
Master of Science in Mechanical Engineering

Abstract

A suite of propeller numerical design tools was developed in MATLAB®, a high-level technical computing language. The tools were based on the FORTRAN programs developed by Professor Justin Kerwin at MIT in 2001 and include enhanced parametric design capability, Graphical User Interfaces (GUIs) and enhanced graphics capability. The MIT Propeller Vortex Lattice Lifting Line Program (PVL) is an executable file written in FORTRAN language and serves as a preliminary propeller design tool. In this thesis, PVL was rewritten in MATLAB® and presented with the GUIs. The enhancements were incorporated in a revised propeller design program designated MPVL to distinguish it from PVL. Several new features such as the user-friendly GUIs and colorful graphs were included in MPVL in addition to the full functions of PVL. Moreover, MPVL was validated by comparing its outputs with PVL and MIT Propeller Lifting Line Program (PLL) and proved to be consistent with PVL. The advantages of MPVL were revealed in this thesis and enabled MPVL to replace PVL. MPVL was developed to serve as an open source code for propeller design. It is also a base program which can be extended to perform more sophisticated propeller design applications such as ducted propellers and contra-rotating propellers. A description of the development efforts for this revised propeller design program forms the basis of this thesis.

Thesis Supervisor: Patrick J. Keenan

Title: Professor of Naval Architecture