Structural Analysis and Design of Floating Wind Turbine Systems

LT Joshua Di Pietro, USCG

Prof. Paul D. Sclavounos	**Prof. Trent R. Gooding**
Thesis Supervisor	Thesis Reader

As oil supply rates approach potential maximums and the global detrimental affects of carbon emitting energy technology are becoming more comprehensively understood, the world is searching for environmentally benign energy technology which can be reliably and economically harvested. Deep water offshore wind is a vast, reliable and potentially economical energy sources which remains globally untapped. In order to harvest this resource, potential floating turbine systems must be analyzed and designed for; economic production and deployment, reliable operation, and adequate service life.

The Laboratory of Ship and Platform Flow (LSPF) has created trusted hydrodynamic modeling software used to perform a Pareto Optimization which resulted in an optimized Floating Wind Turbine (FWT) design; hereto called MIT TLP1. This thesis details the structural design aspects of Floating Wind Turbines (FWT) in a rationally based optimization approach for incorporation into existing LSPF hydrodynamic optimizations. A steel structural design is created based on the geometry and loading of the MIT TLP1 for a 10m significant wave height. The design is based on similar system analysis, classic linear structural theory, American Bureau of Shipping rules and American Petroleum Institute recommended practices. The design is verified using Finite Element Analysis (FEA). The results of this work show that the MIT TLP1 design is technically feasible from a structural integrity, performance and produce-ability standpoint.

Master of Science in Naval Architecture and Marine Engineering, Master of Science in Mechanical Engineering