

Department of Ocean and Resources Engineering

Seminar

Development and Simulation of A 3-D Flapping Foil Motion Control System for Advanced Marine Vehicles

by

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Abstract

There is currently a great commercial and military demand for stable ship platforms that can operate safely in large sea states. For high-speed applications, stable novel vehicle concepts can be used to quickly ferry materiel and passengers over significant distances with reduced motions over conventional ship types. For low speed applications, stable platforms are required for landing helicopter, launching and retrieving RHIB or UUV, and transferring cargo.

High-speed ships, SWATH vessels and other advanced vessels currently use flaps, fins and other forms of dynamic lift producing stabilizers to improve seakeeping and stability. Researches in the past decade demonstrated that a mechanized 2-D flapping foil or 3-D flap simulating the motion of a penguin wing could product large unsteady lifting forces in a very short period of time that cannot be obtained by conventional motion stabilizers. In addition, flapping wings are capable of producing large lifting forces in low ship forward speed cases.

In a recent study, flapping foil technology was demonstrated in a simulation environment to provide motion control on an advanced hull form. This is intended to be a groundbreaking study of an enabling technology that may revolutionize vehicle motion control and maneuvering mechanism that is equally effective across all ship operating speed and environment conditions. In this presentation, we will discuss the dynamics and hydrodynamics of flapping foils, the overall nonlinear simulation environment for marine vehicles, and the results of the recent vehicle motion stability study.