SEMINAR
Tuesday, June 4th h 11, room A2

" CFD , UQ , AI "

" Sex , Lies and Videotapes " déjà vu
in Ocean Engineering

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i-Ship, Innovative Ship design Laboratory

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Abstract

Computational Fluid Dynamics (**CFD**) is causing a revolution in ship design, taking over traditional methods based on experimental tests in model scale and facilitating innovation by cheaper and faster simulations on virtual prototypes. **CFD** is **sexy**: its attraction derives from the ability to simulate very complex physics and to provide virtually unlimited amount of data.

Uncertainty Quantification (**UQ**) studies should closely follow the rapid expansion of CFD based design, but unfortunately this is not often the case: few studies are published and often the methodology used is incomplete or flawed. Standard **UQ** studies often lead to *false conclusions* (i.e. **lies**). Artificial intelligence, (**AI**), first invented to process **digital image** content, offers unique capabilities of complex data analysis and reduction. Specialized AI algorithms applied to the interpretation of scientific data have merely started to unveil their enormous potentials, when used in conjunction with numerical models or computer aided multi-disciplinary, multi-objective design frameworks.

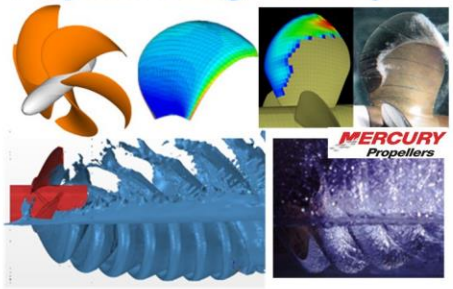
Following the dynamic of the Cannes Palm d'Or movie winner, "Sex, Lies and Videotapes" the talk will discuss the intimate relationships between CFD (sex), UQ (lies) and AI (videotapes) in ocean engineering. Examples of new CFD methods, recently developed at i-Ship lab, will be presented in conjunction with problematics found in the application of different UQ methodologies for their verification and validation. Finally, we will show potentials and interesting synergies offered by new AI-based techniques, specifically developed to enable simulation based design or to improve numerical models in CFD solvers.

Bio

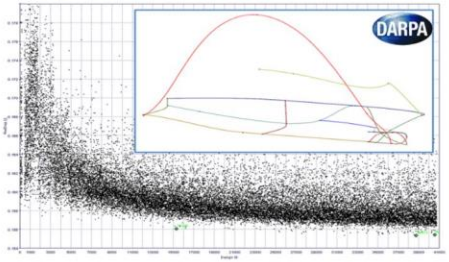
Stefano Brizzolara is Associate Professor in the Kevin T. Crofton Department of Aerospace and Ocean Engineering at Virginia Tech. Master in Naval Architecture and Marine Engineering and PhD in Numerical Hydrodynamic for Ship Design from the University of Genova. He acquired a solid ship design background in Fincantieri, hydrodynamic design office. His academic career starts in the Department of Naval Architecture of the University of Genova where, in 2003, he created the new course in Numerical Hydrodynamics for Ship Design and founded the Marine CFD Group, a research team devoted to the development, validation and application of different Computational Fluid Dynamics Methods to ship design. In 2011 he joined the Massachusetts Institute of Technology (MIT) as Peabody Visiting Associate Professor (MechE) and since 2013 he has been Assistant Director for Research at the MIT Sea Grant, where he founded the Innovative Ship Design Lab, iShip. The research group, now at Virginia Tech, focuses on the development of innovative designs and design tools for advanced ocean vehicles and offshore technologies. Hydrodynamic methods developed range from unconventional high performance hull forms, like high speed SWATHs, semi-displacement multi-hull vessels, stepped cambered planing hulls, to super-cavitating surface-piercing hydrofoils, high efficiency low-noise propulsors and wave energy harvesting devices. The research portfolio is sponsored by the Office of Naval Research (ONR) of the US Navy, the Defence Advanced Research Projects Agency (DARPA) and high-tech ocean engineering companies.

Author of more than 200 scientific papers, inventor of six patents for new concept designs of marine vehicles/devices and co-founder of a spin-off, based in Cambridge (MA) that designs and develops underwater autonomous vehicles for affordable, persistent ocean monitoring and exploration.

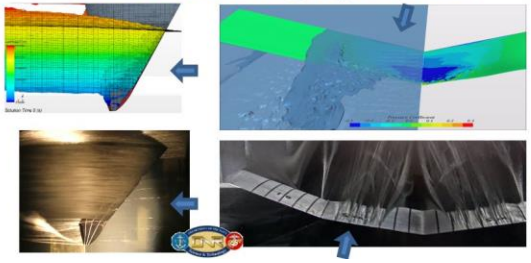
High Speed high Efficiency Propeller Design & Analysis



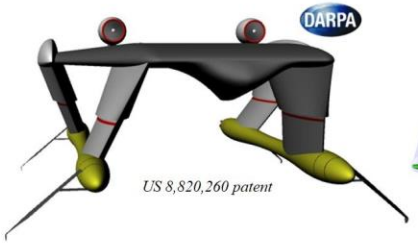
A.I. for Design Under Uncertainty by Multi-Fidelity CFD Optim.



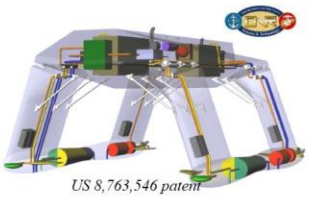
Super-Cavitating Surface-Piercing Hydrofoils



2nd Generation Autonomous Surface Vessels



US 8,820,260 patent



US 8,763,546 patent

VIRGINIA TECH **i-SHIP**

Innovative Ship Design Lab

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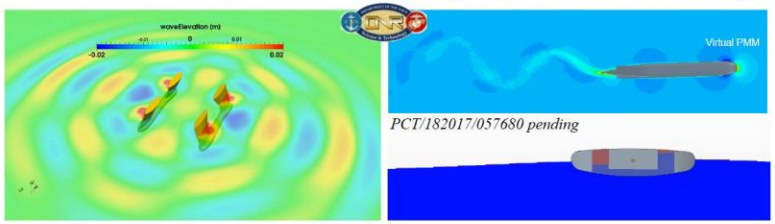
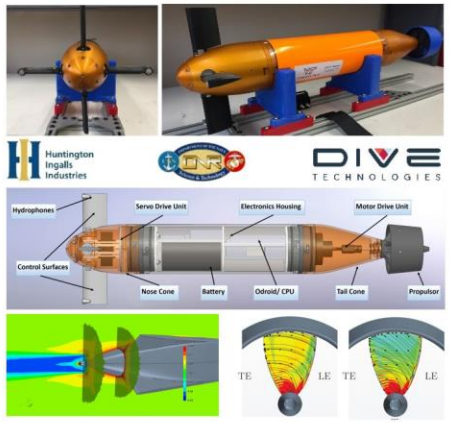
US 8,763,546 patent

Viscous Non-linear Seakeeping & Maneuvering

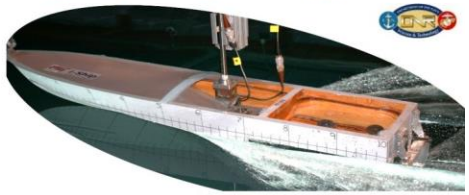


PCT/182017/057680 pending

Underwater Autonomous Vehicles Hydrodynamics



High Performance High Speed (Planing) Crafts



US 10,189,544 patent