

Ship Motion Simulation Platform (SMSP)

Technology Requirement

ORNL's previously developed Ship Motion Compensation for Force Control Systems (SMCFCS) controls algorithm had been tested for the U.S. Navy using simulation models only. A means of verifying these simulation results was needed and testing aboard ship did not offer the requisite experimental control. No operational system was available in the United States that could meet the required high payload, low frequency, and large displacement specifications. Industry bids to meet the demanding specifications were excessively expensive.

Approach

- Two parallel hydraulic actuators loaded in tension provide heave (common mode) and pitch (differential mode).
- Utilization in tension instead of the more conventional compression arrangement resulted in dramatic size reduction in the heave/pitch actuators.
- Prudent use of accumulators and exploitation of motion profiles resulted in significant power and energy optimization.

Results

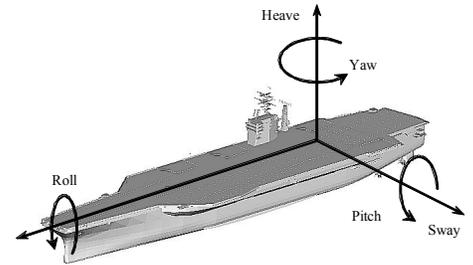
- High payload, high fidelity simulation of ship motion (frequency range ≈ 0.1 – 1 Hz) in five degrees of freedom
 - Payload – 5,000-lbs
 - Heave – ± 4 -ft
 - Surge – ± 9 -in
 - Sway – ± 19 -in
 - Roll – $\pm 10^\circ$
 - Pitch – $\pm 3^\circ$
- Motion profiles can be specified for various sea states (up to sea state 5), ship hull designs, ship heading with respect to waves, and locations aboard the selected ship.
- Designed and constructed by ORNL for approximately 25% of lowest industry bid.
- Following testing and validation of the SMCFCS algorithm, the SMSP was transferred to the U.S. Navy testing unit in Philadelphia, Pennsylvania where it is currently located.

Point of Contact:

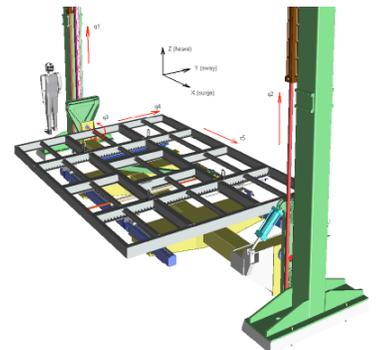
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SMSP displacements.



SMSP model.



SMSP with system under test mounted.

