REAL-TIME SIMULATION OF MULTI-OBJECTIVE SHIP NAVIGATION AND CONTROL

Stephane Bressan   CS Chang*   Gopala Krishnan
O'Dhaniel Mullette-Gillman   Tan Woei Wan

*Department of Electrical & Computer Engineering
Leader, Proposed Green Energy Track, Centre of Maritime Studies
National University of Singapore
Email: eleccs@nus.edu.sg
Tel: (645)65166543

Multi-objective Features of Real-time Ship Simulation

Comprehensive computational tool for advising Ship Master to optimize ship navigation and control with the following multi-objective features :

fuel efficiency   air emission
collision risk   cargo safety
reliability of electric/ non-electric propulsion

Modeling Requirements of Real-time Ship Simulation

1.   Accurate Ship Movement and Plant Models **(will not work on their own)**

2.   Accurate **Human-factor** Model of Ship Master to steer the ship:
- Through extreme weather at open sea & narrow waters
- Under tight time schedule, fatigue & stress

Objectives of Multi-objective Real-time Ship Simulation

Objectives: (1) To develop accurate ship-dynamics and human-factor models for simulating multi-objective ship navigation & control
(2) To verify and adjust these models using ship-movement trajectories captured from Singapore waters and the Full Mission Ship-handling Simulators (FMSS) of Singapore Maritime Academy

The Simulator will have two interactive modules with model verification/adjustment algorithms using real-time trajectories extracted from AIS/ VTS & FMSS data

Modules of Multi-objective Real-time Ship Simulation

The simulation will have two interactive modules:

* ❖ *#1 Knowledge Discovery from Ship-movement Trajectories*
* ❖ *#2 Simulator Models*

Module #2 will perform 3 functions:
  * ○ *#2-1 Ship-master Model*
  * ○ *#2-2 Multi-objective Ship-dynamics Model*
  * ○ *#3-2 Model Verification & Adjustment*

CONCLUSIONS

1. *A smart and adaptive ship-dynamics and ship-master simulator is being developed.*

2. *The simulator provides real-time computational support to ship master for multi-objective ship navigation & control*

3. *The simulator will have many applications for strategizing options on energy, emission, navigation & control, open-sea & narrow waters*

4. *We would like to thank contributions from all parties, industrial & academic; and invite your participation*

THANK YOU
Q&A