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Revolutionizing Maritime Engineering and Navigation through Advanced Data Intelligence and Artificial Intelligence Applications

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EMPLOYEES
70 engineers, naval architects, oceanographers, software engineers, IT personnel and master mariners.

PROUDLY AUSTRALIAN
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DUKC®
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MARINE WEATHER
Research, development and delivery of critical marine weather intelligence for port and shipping operations.

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35 Years

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0 Incidents

Over 175,000 DUKC® transits without incident.

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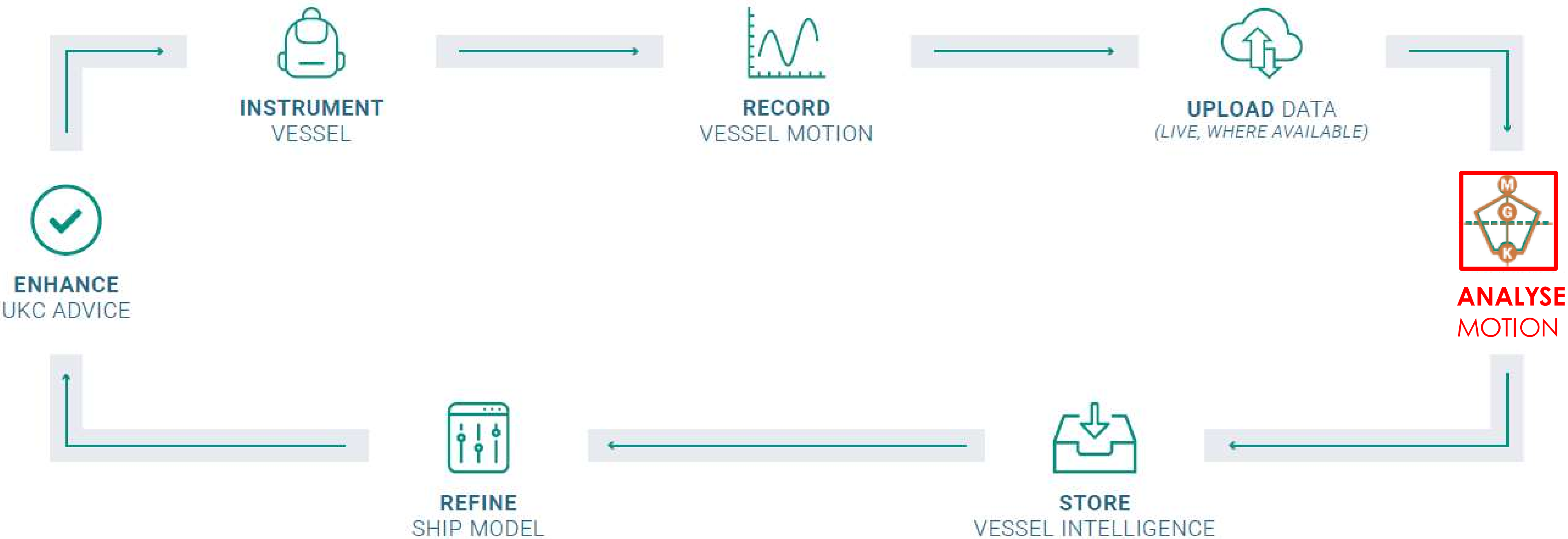
Recall: PIANC APAC 2022

“Data science has become a fourth approach to scientific discovery,

in addition to experimentation, modeling, and computation”
- - Provost Martha Pollack (2015)

Live UKC Enhancement



Advances in Hydrodynamic Prediction through Data Intelligence and AI

5th MASHCON Proceedings *19 – 23 May 2019, Ostend, Belgium*

APPLICATION OF NOVEL SYSTEM IDENTIFICATION METHODOLOGY FOR FINDING ROLL DAMPING AND RESTORING PARAMETERS BY USING THE MEASURED RESPONSE AT SEA

Mohammadreza Javanmardi, Chris Hens, Jack Bucher and **Gregory Hibbert,** OMC International, Australia

SUMMARY

This paper introduces a technique for identifying the parameters in the equation describing the rolling motion of a ship using only its measured response at sea. The parameters being identified are the linear and nonlinear damping and restoring coefficients. These are identified using a reinforcement learning technique. The proposed method would be particularly useful in identifying the nonlinear damping and restoring parameters for a ship rolling under the action of unknown excitations caused by a realistic sea state. The rolling motion of a 1.5 m model and the recorded data for two ships' rolling motion in random seas are used to test the accuracy and the validity of the method. It was shown that the method is reliable in the identification of the parameters of the equation of the rolling motion using only the measured response at sea.

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Application of Reinforcement Learning Technique for Parameter Identification of Coupled Heave-Pitch Motion Equations Using Measured Response at Sea

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ABSTRACT

This study introduces a technique for identifying the parameters in the equation describing the heave/pitch motion of a ship by using only its measured response at sea. The parameters being identified are the direct and cross coupling damping and restoring parameters. These values are identified using a reinforcement learning technique. The proposed method would be suitable in identifying the direct and cross coupling

hydrodynamic forces is not considered. While CFD simulations do not require the same simplifications, the computational cost is too great for many use cases. Recently, work on modelling the non-linear aspects of seakeeping using time-domain methods has become more common (He & Kashiwagi, 2014a) (Jiang, et al., 2015).
For a considerable time, model tests have been (and arguably still are) the most reliable method for determining ship reactions in waves. However, the effect of scaling should not be ignored. There is a growing

Roll prediction accuracy dependencies:

- Metacentric height
- Radius of gyration
- Roll damping
- Added mass

Image Source: https://www.hullwiper.co/

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Estimating Longitudinal and Vertical Centre of Gravity from Vessel Response in Random Waves

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ABSTRACT

Autonomous shipping is a high impact development topic in the maritime navigation industry which is predicated on the development of accurate decision support systems. The accurate prediction of a vessel's centre of gravity is a critical component of ship stability and would tremendously aid real time navigational adjustments to avoid dangerous situations the vessel can encounter. This study was undertaken to estimate the position of the centre of gravity from the full-scale vessel wave induced motions recorded from inertial measurement units. Results showed that the adopted technique can accurately estimate the centre of

which is a standard assumption (Lewis, 1989). In the following section, mathematical equations based on the angular velocities and tangential accelerations for estimating CoG position are presented.

THEORETICAL BACKGROUND

When the structure is not restrained, it is free to move. All points of a rigid body will experience the same angular velocities and accelerations; however, the experienced tangential velocities and accelerations of any arbitrary point can be different. Inertial measurement units (IMUs) can measure the rotational and tangential velocities/ accelerations.

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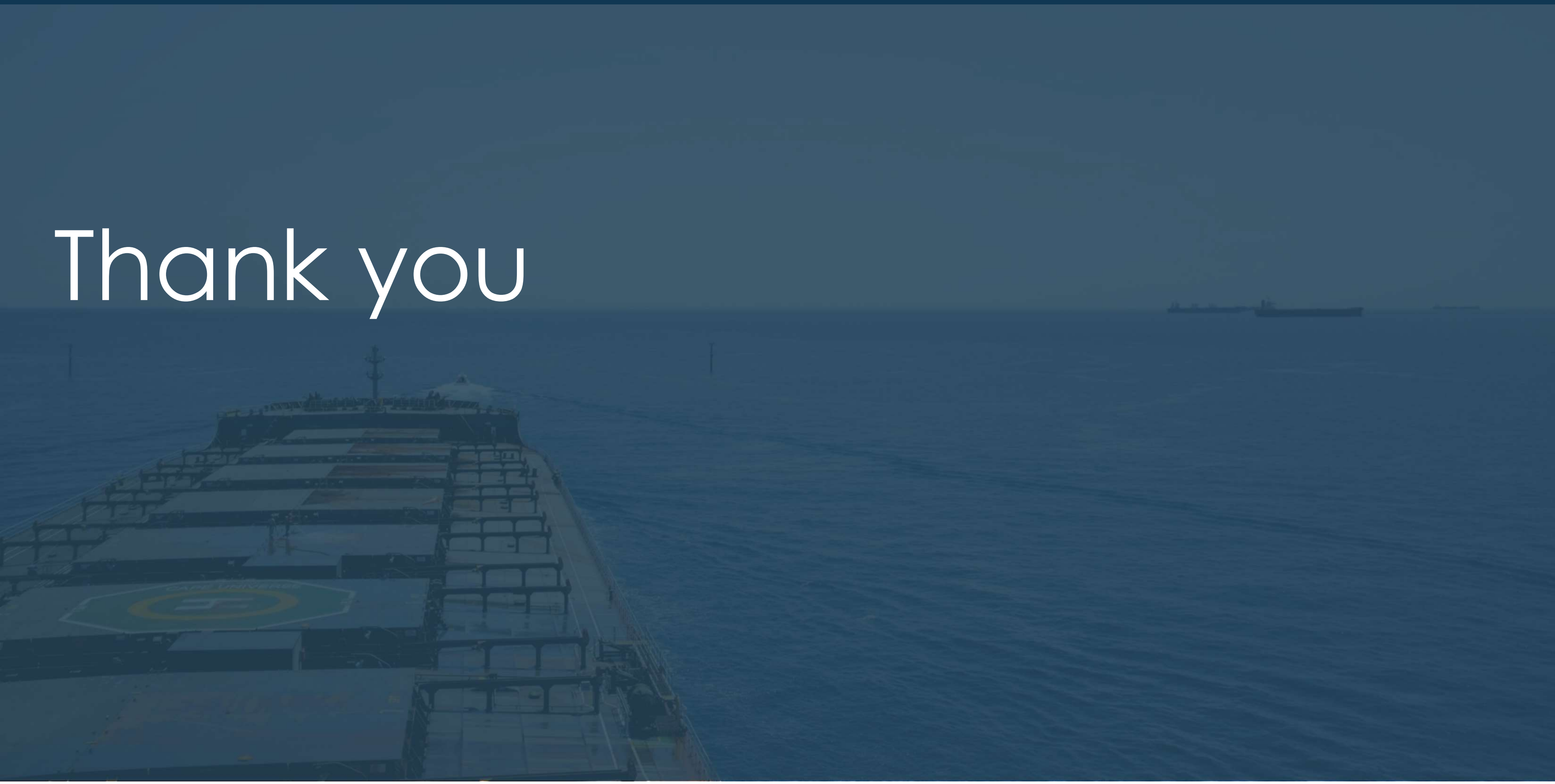
The ONE Apus arrives in Kobe, Japan on December 8, 2020, after losing an estimated 1,816 containers overboard approximately 1,600 nautical miles northwest of Hawaii, USA. Photo courtesy W K Webster and Co.

Photo: © W K Webster & Co Ltd

Future of Navigation



Thank you