

## SESSION: Innovation and development

### MARS Themes:

Innovation and development

### Title:

The Development of a Structural Digital Twin for the SA Agulhas II

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### Abstract:

In shipping, the evolution of cyber-physical connectivity enables benefits to inform decision-making towards increased vessel safety, enhanced passenger comfort and sustainable operations. The SA Agulhas II (SAAII), a South African polar supply and research vessel, suffers accelerated fatigue as a result of wave slamming which leads to resonant excitation of the structure. Current ship design practice does not account for fatigue related to resonant wave-induced vibration. As ships evolve it has become evident that digital twin solutions are necessary to monitor and model hull loads to enable informed (close to real time) operational and strategic decision-making with respect to the remaining useful life of the structure.

Measurement of the hull response is limited to a finite number of locations. The limited number of data points is not sufficient to estimate the stress distribution of the hull during operation. As such, a virtual sensor is proposed to estimate the global stress distribution of the hull for the low frequency bending and whipping responses. The virtual sensor is built on a physics-based global finite element model (FEM) of the SAAII. This work discusses the virtual measurement architecture and the evolution of the hull structure of the SAAII into a digital asset.

### Format:

Oral presentation

### Keywords: (add ; between keywords)

Ship vibration, Hull fatigue, Virtual measurement, Digital twin