

Industry 4.0 in Ship Design, Production & Maintenance

Friday, 17 June 2022 09:00 (20 minutes)

Industry 4.0 has favoured the expansion of many technologies where application boundaries are very diffuse. Although some technologies may have very specific applications, they must be implemented as a whole when applied to Computer Aided Design, Manufacturing & Engineering (CAD/CAM/CAE) System (from now on referred just as CAD). The CAD tool stands at the beginning of the design, but it manages many data that must be considered in advance for the further stages of the product lifecycle.

Augmented Reality, Virtual Reality and Mixed Reality are closely related to the Digital Twin and interlaced with Big Data, which are generated by CAD tools and all surrounding solutions, which applies some cloud/edge/fog computing to these data in a merged technology between finite-state machines and Artificial Intelligence (AI) cognitive processes. To perform all these integrations in an agile manner requires a network which support different connections to add specific devices, i.e. Internet of Things (IoT), which can access to the data, creating and modifying them, in a different layer which affects to the basic information layer created by the CAD System in the shipyard. This network should be secure, but also open to allow distributed work, which must be tracked such that all design or process modifications are recorded an open, transparent, trusted and non-modifiable working method for all stakeholders, like: shipyard, engineering offices, classification society and ship owner.

Results of the design should be easily integrated with future manufacturing methods like 3D printing, generating printing orders directly from the CAD model. Shipbuilding phases involve design and manufacturing, but an integrated Industry 4.0 CAD System should also be involved in operation and maintenance phases, i.e. it must cover all the vessel lifecycle end to end, from design to decommission.

This paper briefly summarizes how Industry 4.0 technologies may be applied to the shipbuilding, whether through direct integration or in connected periphery applications.

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Session Classification: 5C

Track Classification: Unmanned vehicles