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Using CFD and VR to Model and Visualize Fire in the Ship Engine Room

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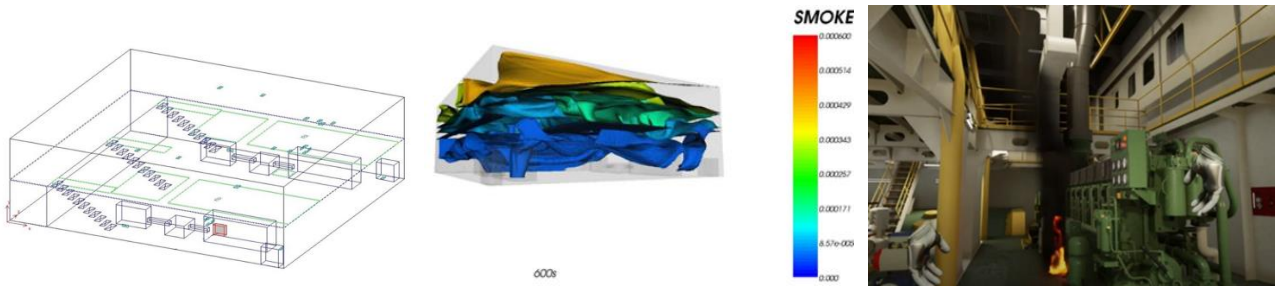
ABSTRACT

The design of the ship, evacuation procedures and firefighting training can be significantly improved using computational fluid dynamics (CFD) to model the fire dynamics on board a ship, Vukelic et al. (2023). However, CFD has a shortfall in that it is not able to adequately visualize the fire dynamics in the 3D environment. This is where virtual reality (VR) excels, offering an immersive environment for a user.

This paper presents a CFD analysis of a fire spread inside a two-storey ship engine room, Fig. 1 a), and a visualization of that fire in VR. A scenario of a fire originating in the ship engine was developed. The results of the CFD analysis, Fig. 1 b), for this specific scenario are then transferred to the VR environment of the same engine room, Fig. 1 c), using a specifically developed interface ensuring the complex data from the CFD model is accurately transferred into the VR. Using wearable headsets, users can be totally immersed in the VR environment of a ship engine room under fire. This allows for more advanced maritime firefighting training and adjusting the design of the ship engine room, making it safer for the crew. The advanced CFD-VR fire application has been tested by experienced seafarers who have noted that the VR fire dynamics based on the CFD analysis are more realistic than the one developed solely using the VR game engine, Glujic et al. (2024).



a) b) c)

Figure 1: a) Layout of the engine room at the lower deck. b) CFD analysis results in the form of smoke isosurfaces. c) Fire and smoke on the lower deck of the VR engine room.

References

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