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Characteristic correlation study of UV disinfection performance for ballast water treatment TE BA, HONGYING LI, Institute of High Performance Computing, ASTAR, HAFIIZ OSMAN, Research Development, Sembcorp Marine Ltd, CHANG-WEI KANG, Institute of High Performance Computing, ASTAR — Characteristic correlation between ultraviolet disinfection performance and operating parameters, including ultraviolet transmittance (UVT), lamp power and water flow rate, was studied by numerical and experimental methods. A three-stage model was developed to simulate the fluid flow, UV radiation and the trajectories of microorganisms. Navier-Stokes equation with k-epsilon turbulence was solved to model the fluid flow, while discrete ordinates (DO) radiation model and discrete phase model (DPM) were used to introduce UV radiation and microorganisms trajectories into the model, respectively. The UV dose statistical distribution for the microorganisms was found to move to higher value with the increase of UVT and lamp power, but moves to lower value when the water flow rate increases. Further investigation shows that the fluence rate increases exponentially with UVT but linearly with the lamp power. The average and minimum resident time decreases linearly with the water flow rate while the maximum resident time decrease rapidly in a certain range. The current study can be used as a digital design and performance evaluation tool of the UV reactor for ballast water treatment.

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