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# A practical empirical formula for the calculation of ship added friction-resistance due to (bio)fouling

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## Abstract

An accurate prediction of the ship added friction-resistance due to (bio)fouling is important in the maritime sector in view of environmental sustainability. For industrial needs, the prediction method must not only be accurate but also be practical. An empirical formula is proposed in this study for the calculation of ship added friction-resistance due to (bio)fouling. An optimization method was applied, in which the objective function is defined as the least mean square error between the predicted results and data derived from Demirel et al.'s diagrams. The mathematical model to be fitted with the data involves power functions whose form resembles the functional relationship between the added friction-resistance coefficient and Reynolds number, and between the added friction-resistance coefficient and roughness ratio. The coefficients, powers and constant in the mathematical model were

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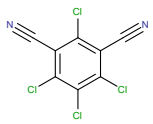

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