A numerical Study on the Design of a Rotor System

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Abstract

This paper presents the numerical calculation results for the design of a rotor system which is composed of two cylinders, where the inner cylinder is rotating while the outer cylinder is fixed.

Ships travel faster through seawater and consume less fuel when their hull surfaces are clean and smooth. For the purpose, ship surfaces are usually conserved using organic coatings like a self-polishing paint. The leaching rate of these paints is controlled because the biocide is released when seawater reacts with the surface layer of the paint. Once the surface layer is worn off, the reaction to release the biocide begins again with the next layer. In this way, the leaching rate is the same throughout the life of the paint – and it becomes possible for ships to go up 60 months without repainting.

Thus, paint makers have to guarantee the life of the paint. A rotor system is usually used to undertake extensive testing of coating parameters including erosion, leaching and accelerated ageing. The rotor system must be designed to simulate the ship surface condition at a sea in order to predict the leaching rate exactly. The important design parameters will be Reynolds number of the inner cylinder surface and the gap between two cylinders. Numerical calculations are carried out at several Reynolds numbers and gaps.

The Reynolds-Averaged Navier-Stokes equations combined by the finite volume method are used for the numerical calculation. The realizable k-ε model is employed for the turbulence closure.

The computational results are shown as the frictional resistance coefficients according to the variation of the Reynolds number and gaps at each.

Keyword: *Rotor system, cylinder, self-polishing paint, leaching rate, frictional resistance*