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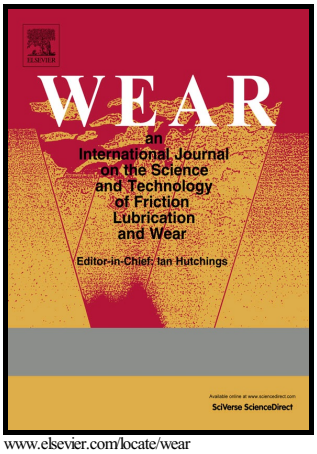

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Abstract

Computational fluid dynamics (CFD) is a useful tool to predict the erosion behaviour over geometries exposed to conditions of severe erosion wear. This work shows how CFD can be used to virtually characterize the wear behaviour of materials used in several hydraulic components, including turbomachinery systems, in which it is important to consider the effect of particle size. In addition, this work develops a methodology for determination and validation of the constants involved in the well-known Tabakoff-Grant model for erosion prediction using the erosion wear obtained via erosion testing in a jet tribometer reported in the literature as a reference. From the experimental data, an optimization algorithm was performed to determine the optimal values of Tabakoff-Grant model constants for ASTM A743 grade CA6NM martensitic stainless steel. The simulated erosion rate agrees with the experimental data for the material analysed in jet erosion simulations with impact angles ranging from 15° to 90°. The change of the angle of maximum erosion rate for small particles, which has been reported in the literature via experimentation, was explained satisfactorily. The results showed that the erosion rate with smaller particles is affected by fluid flow, since small particles tend to follow the flow streamlines, while larger particles move according to the conditions imposed by the jet at its outlet. The effective impingement angle against the surface for small particles is lower than the impingement angle for large particles; therefore, the angle of maximum erosion rate, measured between the jet and the sample's surface, for small particles increases.

Keywords: computational fluid dynamics; erosion by hard particle; particle size; jet erosion device.

1. Introduction

Erosive wear due to sand particles is one of the most important problems that must be taken into account at the design stage for hydraulic turbines, particularly for run-of-the-river facilities. Wear conditions are influenced by the river's water conditions and local hydrological conditions during the operation period. This is the case for several plants located at Los Andes and the Himalayas that, have been affected by erosive wear via sand particles [1-5] with severe damage to the