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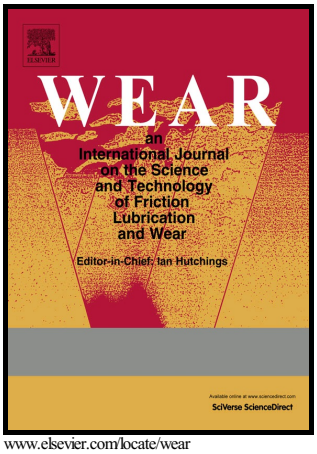

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PII: S0043-1648(17)31451-5
DOI: https://doi.org/10.1016/j.wear.2017.11.006
Reference: WEA102288

To appear in: *Wear*

Received date: 13 October 2017
Revised date: 9 November 2017
Accepted date: 14 November 2017

Cite this article as: Kewen Peng, Shouceng Tian, Gensheng Li and Habib Alehossein, Mapping Cavitation Impact Field in a Submerged Cavitating Jet, *Wear,* https://doi.org/10.1016/j.wear.2017.11.006

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Mapping Cavitation Impact Field in a Submerged Cavitating Jet

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Abstract: A full assessment of the cavitation erosion potential of a cavitating jet necessitates the determination of the cavitation impact field. However, a detailed description of the impact intensity and spatial distribution of the large numbers of cavitation impacts has not been fully established. Here, we report such a map of cavitation impact field constructed with an inverse finite element method based on pitting analysis. The map presents the distribution of each impact on the impingement surface with its peak impact pressure, impact size, impact force, and impact energy. From this map, it is seen that cavitation impacts are preferentially localized in a ring region and a circular region at relatively small and large standoff distances, respectively. A statistical analysis of the impact data reveals those dominating impacts which contribute most to the overall intensity of the cavitating jet. To elucidate the underlying mechanism for the different impacts distribution patterns appearing on the impingement surface, the flow structures of the impinging jet are investigated by conducting a flow field simulation. The results show that the stagnation region and the recirculation zone above the impingement wall are the two key factors to the formation and variation of impact distribution patterns. Compared with the conventional measurement with pressure transducers, the present investigation is assumed as a further step towards depicting and interpreting the erosive intensity of a cavitating jet.

Keywords: Cavitation impact, Cavitating jet, Distribution pattern, Flow field

1. Introduction

Cavitating jets have been used substantially in various applications such as material cutting and cleaning [1], surface modification for metallic materials [2], and rock breaking in underground drilling [3-5]. The superior treatment efficiency is attributed to the destructive

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