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A NEW METHODOLOGY FOR ESTIMATING CAVITATION EROSION: APPLICATION ON A HIGH SPEED CAVITATION TEST RIG

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Cavitation is defined as the formation of vapour/gas pockets inside the bulk volume of the liquid, due to the local static pressure drop near or below the saturation pressure. Cavitation occurrence is possible in all hydraulic related systems and machinery, such as piping, valves, pumps, turbines, propellers and more, leading often to lower operating efficiency, reduced flow rates, flow choking, vibration and damage of mechanical components. Thus, in the recent years, there has been increased effort for studying cavitation effects, either experimentally or with CFD simulations, aiming to understand the physics of cavitation itself and find a correlation between cavitation occurrence and erosion damage.

Cavitation erosion is not yet well understood and is a subject of ongoing research. According to Franc et al.[1], erosion due to cavitation may be attributed to the microjet effect, collective bubble collapse and the collapse of cavitating vortices. T.G. Leighton [2] considers the microjet effect dominant when the cavitation intensity is low, whereas in cases of intense cavitation, erosion is predominantly attributed to the shock wave from the collective bubble collapse. In any case, the main mechanism that is believed to be the cause of erosion is the localized and focused release of accumulated potential energy in vapour structures, during their collapse.

In the present work, a novel methodology for correlating cavitation with erosion is proposed. The proposed methodology is based on the tracking of the vapour volume fraction and determining when its value is reduced near the wall. A reduction of the vapour fraction represents the collapse of macroscopic vapour structures, which, as mentioned before, is linked to the production of potentially erosive shock waves or microjets. This procedure is general and may be applied in any methodology for representing cavitation, either in Eulerian or Lagrangian framework.

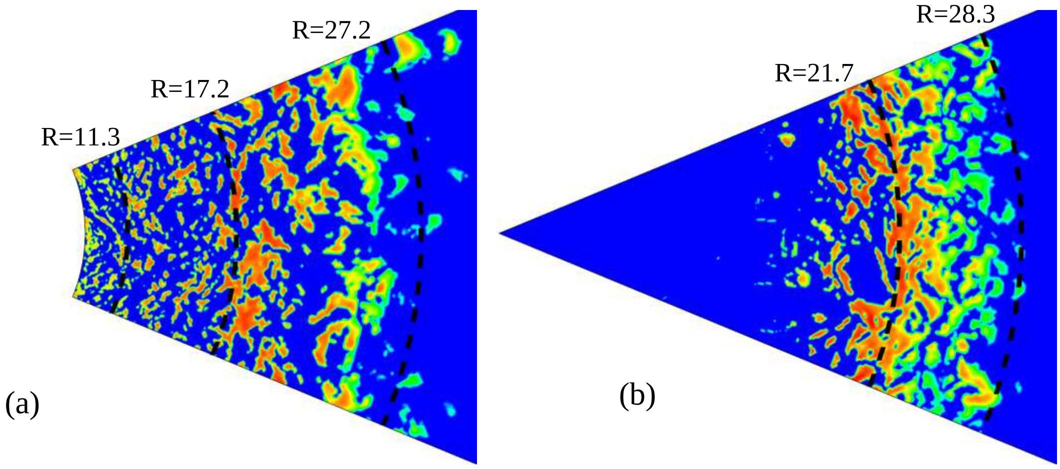

Fig. 1. Indicative erosion pattern at the upper (a) and lower (b) surfaces of the test section simulated. Dashed lines mark the actual erosion sites. Red corresponds to high damage and blue to zero.

REFERENCES

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[2] T. G. Leighton, *The acoustic bubble*: Academic Press 1994.