Detailed Response to Reviewer 4

General Comment

Please see the original pdf file for details. Below are presented only general remarks.

First, I must admit the paper is excellent, written very concisely and clearly. I would like to add that I greatly appreciate the Author's contribution to the field of cavitation analysis. The way of description of cavitating jet phenomenon, carried out laboratory tests, and number of citations are really impressive, including the number of self-citations. It was a great pleasure to review it.

Comment 1

Line50. 'A typical cavitating jet in the air is shown in Fig. 1 (b).' Fig.1b presents two cavitating jets, so why is it a typical jet? This is a combination of jets. I think the sentence should be revised.

Answer

Thank you for reviewing my manuscript, and thank you for your comment.

Fig. 1 (b) presents a cavitating jet in air by injecting two "water jets", i.e., a high-speed water jet and a low-speed water jet. Although it was described as "Soyama developed a cavitating jet in air by injecting a high-speed water jet into a low-speed water jet, which was injected into air without the water-filled chamber using a concentric nozzle [33-36].", the sentences marked in red was added in the text as follows.

"A typical cavitating jet" means "Cavitation clouds are observed in the water column of low-speed water jet" and "the wavy pattern of the low-speed water jet was observed". These sentences were already in the text.

A typical cavitating jet in air by injecting a high-speed water jet into a low-speed water jet is shown in Fig. 1 (b).

Comment 2

L153. The description is not clear. Is cavitating jet shed from the nozzle continuously or stopped at 4.25s and then a new one is released? Please explain/revise the text.

Answer

Thank for your question. In the case of the cavitating jet, the water jet was injected continuously. As shown in Fig. 5 (a), the vortex cavitations near nozzle shed downstream coalescing each other as same as Karman vortex. Thus, the following sentences were added.

Although the water jet is injected continuously into water, the vortex cavitations near nozzle shed downstream coalescing each other and they become a large cloud cavitation, thus the bubble density between clouds is reduced.

Comment 3

L201. The Author should extend the text and explain how to understand the term 'pressure hysteresis' in case of cavitating jet? This is not obvious.

Answer

For example, if the cavitation in swirl directly hit the impinging surface, the pressure around cavitation would be the pressure in the shear layer around the jet, and it gradually increases with the shedding of cavitation, as the jet speed decreases from the distance from the nozzle. On the other hand, the pressure of the cloud cavitation, which impinges the surface, increases at the impinging jet center suddenly and decreases in the ring vortex cavitation, then increases again.

Comment 4

L218. Missing a verb. "The detail of the pressure distribution on the impinging surface in references."

Answer

Thank you for your comment. The word "was" marked in red was added as follows.

"The detail of the pressure distribution on the impinging surface was in references."

Comment 5

L240. What is the meaning for researchers of this statement for a good understanding of cavitation cloud shedding (CCS)? I.e., does CCS start at this number or finish? In other words, shouldn't it be inequality that CCS can be observed when St is below or above this limit (0.18)? Please explain in the text.

Answer

Thank you for your comment.

The aggressive intensity and of the cavitating jet were affected by the nozzle outlet geometry [39, 74, **]. Details are described in *4.6. Nozzle Geometry and Diameter*. For example, when the guide pipe was installed, the aggressive intensity of the jet with the guide pipe with the cavitator was four times larger, and *St* became nearly a quarter of that of the jet without the guide pipe and the cavitator [**]. The *St* of our aggressive cavitating jet was lower than 0.18. But the data is not enough. In order to enhance and/or control the aggressive intensity of the cavitating jet, the investigation of *St* for various nozzles would be a future work.

Thus, the sentences marked in red were added in the text as follows.

This result suggests that the cavitation cloud shedding is a phenomenon governed by a constant Strouhal number. On the other hand, the nozzle outlet geometry affects the aggressive intensity of the cavitating jet [39, 74]. Details are described in *4.6. Nozzle Geometry and Diameter*. The ~~As~~ f_{sedd} is also affected by the nozzle outlet geometry. For example, when the guide pipe with the cavitator was installed, the aggressive intensity of the jet was four times larger than that of without the guide pipe and the cavitator [39], and *St* became nearly a quarter of that of the jet without the guide pipe and the cavitator [75], as f_{sedd} was decreased. Namely, the constant value of *St* should be unique to the nozzle outlet geometry. The investigation of *St* for various nozzles would be a future work, to enhance and/or control the aggressive intensity of the cavitating jet.

[39] Soyama, H. Enhancing the aggressive intensity of a cavitating jet by introducing a cavitator and a guide pipe. Journal of Fluid Science and Technology 2014, 9, paper No. 13-00238, 1-12.

[74] Soyama, H. Enhancing the aggressive intensity of a cavitating jet by means of the nozzle outlet geometry. Journal of Fluids Engineering 2011, 133, paper No. 101301, 1-11.

[75] Kamisaka, H.; Soyama, H. Enhancement of an aggressive intensity of a cavitating jet by water flow holes near nozzle outlet Transactions of the JSME 2019, 85, Paper No. 19-00280, 1-12.

Comment 6

L269. Concerns fig.12. 'When the maximum values of the 1st peak and 2nd peak are compared, the value of the 2nd peak is 1.5 times larger than that of the 1st peak'. In Fig. 12 such a situation can be observed only for P2 = 2.4 bar. For the others, the 1st peak is even larger. This sentence suggests such a conclusion for all three pressures shown in Fig. This should be explained.

Answer

Thank you for your comment. The sentences marked in red were added in the text as follows.

At p_2 = 2.4 bar (0.24 MPa), the weight losses at 1st peak and 2nd peak are 250 mg and 450 mg, respectively. They are 250 mg and 220 mg for p_2 = 3.0 bar (0.3 MPa) and 300 mg and 110 mg for p_2 = 3.6 bar (0.36 MPa). When the maximum values of the 1st peak and 2nd peak are compared, the value of the 2nd peak at p_2 = 0.24 MPa is 1.5 times larger than that of the 1st peak at p_2 = 0.36 MPa. Namely, at optimum cavitating condition, the aggressive intensity due to cavitation impact, i.e., the 2nd peak, is larger than that of water column impact, i.e., 1st peak. Note that water jet peening and cavitation peening use the 1st peak and 2nd peak, respectively.

Comment 7

L295. The Author should explain more clearly what it is 'the processing capability β' for the readers' convenience. This is important for a better understanding Fig.14.

Answer

Thank you for your comment. The following explanation was added.

The processing capability β is defined by the arc height h of band steel made of the same material as Almen strip, considering the width of the steel w_s and the peening width w_p, as follows [92].

$$\alpha = \left|1 - \frac{w_p}{w_s}\right| \tag{9}$$

$$\frac{1}{\rho} = \frac{8h}{L^2} \tag{10}$$

$$\beta = \frac{1}{\rho}(1 + \alpha) \tag{11}$$

Here, L is the length to measure h.

Comment 8

L308, Fig. 14. "constan" "constant"

Answer

Thank you for pointing out the mistake. I have corrected as "constant".

Comment 9

L325, Fig. 15. I think, the quality of Figs. Should be improved (if possible).

Answer

Thank you for your comment. I replaced the figures.

Comment 10

L335. raio, "ratio"

Answer

Thank you for pointing out the mistake. I have corrected as "ratio".

Comment 11

L397. 'four times' "larger?"

Answer

Thank you for pointing out the mistake. I have put "larger" in the text.

Comment 12

L439. 'Here, v is the threshold level of the velocity…'. I think the Author meant sound velocity. I suggest adding the word sound'.

Answer

Thank you for pointing out the mistake. I have put "sound" in the text.

Comment 13

L440. 'In the present review, n = 3 is chosen.' Please explain why n = 3. This is not obvious what value should be used, so it should be clarified.

Answer

Thank you for the comment.

If it was assumed that I_{cav} was proportional to the flow energy, which was defined by the product of the pressure and the flow rate, the flow energy is proportional to $p_1 - p_2$ and $\sqrt{p_1 - p_2}$, as $\sqrt{p_1 - p_2}$ was proportional to the flow velocity. Namely, the flow energy is proportional to cube of $\sqrt{p_1 - p_2}$.

Thus, the above mentioned sentences were added in the text.

Comment 14

L444. "open squares" "empty squares?"

Answer

Thank you for your comment. I have changed from "open squares" to "empty squares".

Comment 15

L508. '… a constant Strouhal number, which is defined by the shedding frequency, the flow velocity, and the cavitating region.' I think the last statement is not precise. Strouhal number contains the characteristic length. The Author should point directly what it is (width of jet, generally size of…, etc.).

Answer

Thank you for your comment. As Strouhal number in the difference was defined by the width of the jet, the sentence marked in red was added in the text as follows.

(2) Cloud shedding is a phenomenon governed by a constant Strouhal number, which is defined by the shedding frequency, the flow velocity and the width of the cavitating region.

Comment 16

L511. "imping" "impinging?"

Answer

Thank you for pointing out the mistake. I have corrected as "impinging".