

Abstract Submitted
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A data assimilation method for analysis of cavitation bubble dynamics.¹ JAVAD ESHRAGHI, AREZOO ARDEKANI, PAVLOS VLACHOS, Purdue University — The original or modified Rayleigh-Plesset equation (RPE) is often used for the analysis of cavitation bubble dynamics. The accuracy of the bubble's characteristics predictions by these equations is governed by initial values of the physical parameters. Currently, this initialization is predominantly user-defined, where through trial and error, the initial values are determined. Here, we present a novel state observer-based data-assimilation technique, designed for the assimilation of measured cavitation bubble diameter with Rayleigh-Plesset-type models to enhance the spatio-temporal predictions by these models. This fully autonomous method places an observer in the original/modified RPE and uses a proportional-integral-derivative (PID) control law on the difference between the predicted and measured cavitation bubble diameter. The data-assimilated modeling using an observer in the RP-type equations most accurately estimates the bubble diameter and far-field pressure at the probed locations and is not sensitive to the initial values of the physical parameters.

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