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Analysis of Impact Load Induced by Ultrasonic Cavitation Bubble Collapse Using Thin Film Pressure Sensors

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Abstract : The understanding of generation and collapse of acoustic cavitation bubbles are prerequisites for application of cavitation erosion. Microbubbles generated due to rapid fluctuation of pressure induced by propagation of ultrasonic wave lead to formation of high velocity microjets and or shock waves upon collapse. Due to vast application of ultrasonic, it is important to characterize and understand cavitation collapse pressure under the radiating surface at different conditions. A comparative investigation is carried out to determine impact load and dynamic pressure distribution exerted upon bubble collapse using thin film pressure sensors. Measurements were recorded at different input conditions such as amplitude, stand-off distance, insertion depth of the horn inside the liquid and pulse on-off time of acoustic vibrations. Impact force of 2.97 N is recorded at amplitude of 108 μm and stand-off distance of 1 mm from the sensor film, whereas impulsive force as low as 0.4 N is recorded at amplitude of 12 μm and stand-off distance of 5 mm from the sensor film. The results drawn from the investigation indicated that variety of impact loads can be achieved by controlling generation and collapse of bubbles, making it suitable to use for numerous application.

Keywords : ultrasonic cavitation, bubble collapse, pressure mapping sensor, impact load
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