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Experimental Investigation on the cavitation erosion properties of concrete with different damage degrees under ultrasonic cavitation

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Cavitation erosion, widely existing in many flood discharge structures of concrete dams, has a direct impact on the performance of concrete. Understanding the cavitation erosion properties of concrete with different damage degrees is vital to the long-term operation safety of concrete dams. In this study, the cavitation erosion properties of concrete with different damage degrees under ultrasonic cavitation are systematically investigated in the laboratory, including three damage degrees and three ultrasonic cavitation intensities. Based on the stress-strain curve of concrete under uniaxial compression, the damage variable is defined and the corresponding concrete specimens are pre-treated. The experimental results reveal the influence of the damage degrees on the cavitation erosion properties of concrete, regarding the mass erosion characteristics, the predominant failure behaviour, and the coupling effect mechanism. Image analysis of the specimens shows some level of deterioration at the surface and inside the specimens. Under higher damage degree or cavitation intensity, the concrete is characterized by higher mass erosion rate, higher cumulative cavitation damage and worse surface smoothness. Furthermore, the micro-cracks caused by concrete damage aggravate the aggregate liberation of concrete under ultrasonic cavitation, and the crack propagation under coupling effect of damage and cavitation is most likely driven by the combination of fatigue-like crack growth and deformation, thereby reducing the service life of concrete.