PRESSURE BEHAVIORS CORRESPONDING TO LEAST AIR CONCENTRATION TO PREVENT CAVITATION EROSION *

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A lot of high dams which are greater than 100m in height have been so far completed in China. And many super high dams over 200m high such as the Ertan and Longtan Hydropower Stations were completed or are under construction. Some of them even attain the order of 300m high such as the Xiaowan and Xiluodu Hydropower Stations. According to incomplete statistics, nearly 30 super high dams that are greater than 200m in height have been so far completed in the world. Because of head increase, flow velocity in these high dams can reach several-dozen meters per second, and even up to or over 50m/s. This experimental investigation was systematically conducted with the aid of a non-circulating water tunnel in the Hydraulics Laboratory at Zhejiang University of Technology in China. The experimental setup principally consists of aeration, contraction, observation and diffusion sections made of alloy-steel with square cross-section as shown in Fig.1.

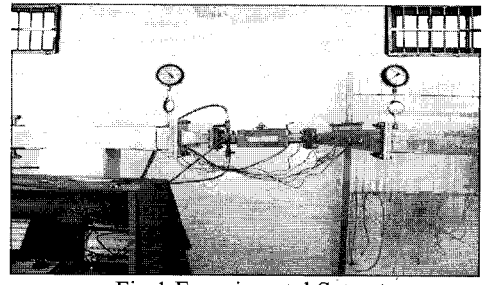

Fig.1 Experimental Setup

Pressure waveform with and without aeration is stepped; the waveform ahead of the stepped denotes aerated pressure, and one behind the stepped non-aerated pressure.

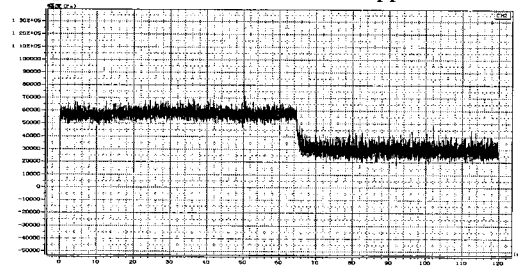

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Fig. 2 Pressure waveform with and without aeration at x=7cm, C=2.8% and V=28.1m/s

Comparison of time-averaged pressure distribution with and without aeration within cavitation region at C=3.1%, V=32.7m/s is shown in Fig.3. It follows from Fig.3 that aeration can remarkably increase pressure within cavitation region, thus enhancing cavitation number of high velocity flow.

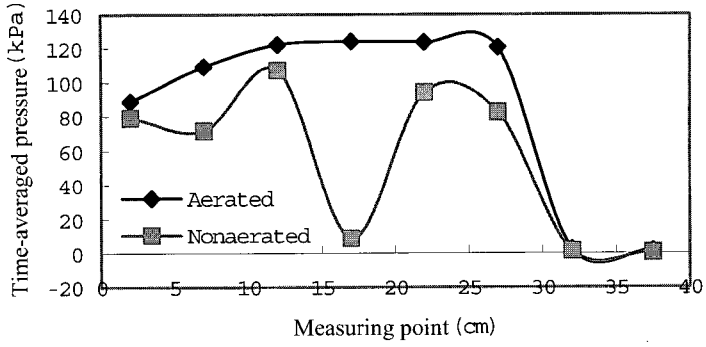

Fig. 3 Comparison of time-averaged pressure within cavitation region

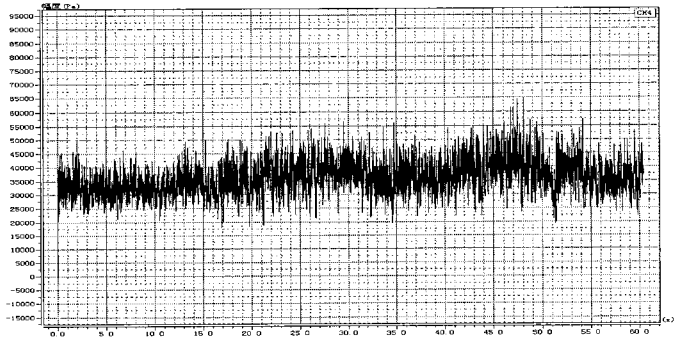

Fig. 4 shows pressure waveform at x=20cm for the least air concentration C=4.5% corresponding to preventing cavitation erosion and for flow velocity V=37.9m/s.

Time-averaged pressure profiles for the different velocity and for the different air concentration within cavitation region are shown in Fig.5.

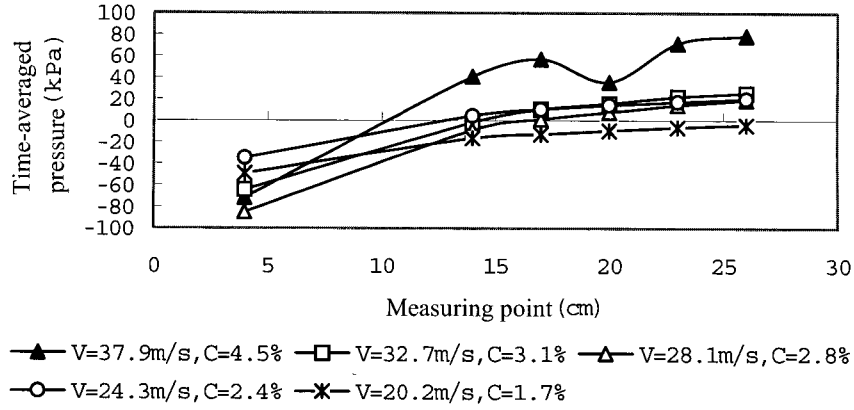

Fig. 5 Time-averaged pressure profiles at different velocity and air concentration

Keywords: Cavitation; Cavitation control by aeration; Air concentration; Pressure