Openchannel flow - lab report example

Engineering

OpenChannel Flow

DISCUSSION PART OF OPEN CHANNEL FLOW As previously explained, an open channel consists of adiversion in which a pure fluid streams with a free surface that gets directly exposed to the atmospheric conditions. For the fluid to flow, a difference in potential energy has to between two points along the duct channel (Mousa and Alasta, 2014). Equal values of average velocities of fluid in subsequent cross-sections imply a uniform flow in the channel. An alteration of channel depths and velocities affects the steadiness of the fluid flow. Beta (2006) states that a surface parallel to the channel bottom induces a uniform fluid flow. A minimum specific energy indicates a steady flow with parallel streamlines especially in channels characterized with very small slopes. Hydraulic jump, a phenomenon that depends on initial fluid velocity, occurs when the transition velocity increases abruptly. As a result, the transition front breaks and curls back upon itself in conjunction with violent turbulence and eddy currents.

The introduction of a weir along the channel of fluid flow results to an increase in the fluid level. An increased fluid head or level is determined by measuring the upstream of the hydraulic structure. According to ToolBox (2014), the rate of fluid flow over the weir relates with the level of the weir. To determine the discharge constant for the weir, individuals should conduct some fluid analysis and calibration tests. In most cases, the discharge coefficient remains constant for a given set of head ranges. A specific energy diagram determines the possible heights and depths of weirs. A low level that supports critical flow results to a decrease in the fluid level without affecting the upstream (Kay, 2015). After achieving the critical flow, an

increase in the weir level leads directly affects the upstream fluid level. Typically, a subcritical flow produces a low vitality state while a supercritical state creates a faster and shallow flow. During a supercritical condition, waves produced by downstream eddies cannot travel upstream. On the other hand, subcritical conditions initiate upstream travel of waves produced at the downstream due to the slower flow of fluids. The diagram below demonstrates the water profile along the flow channel with various regions where subcritical and supercritical flows occur.

φxx + φyy = 0 where φy equals FD` (x) and y equals −1

The three fluid profiles demonstrate critical, subcritical, and supercritical respectively.

Reference

Beta. (2006). Open Channel Flow. Retrieved on 2nd June, 2015, from http://www. fsl. orst. edu/geowater/FX3/help/8_Hydraulic_Reference/Open_Channel_Flow. htm

Kay, M. (2015). Broad-Crested Weirs. Retrieved on 2nd May, 2015, from http://www. jfccivilengineer. com/broad_crested_weirs_2. htm

Mousa, M & Alasta, K. (2014). Experiment (13): Flow channel. Retrieved on 1st June, 2015, from http://site. iugaza. edu. ps/mymousa/files/Experiment-13-4-hydraulics-lab-2. pdf

ToolBox. (2014). Weirs - Flow Rate Measure. Retrieved on 1st May, 2015, from http://www. engineeringtoolbox. com/weirs-flow-rate-d_592. html