Water Hammer and
Water- Structure- Soil Interaction

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Abstract

The subject of Water Hammer and Fluid-Structure-Soil Interaction is under research and experimenting, and finds its issues in the interference of three civil engineering branches, so, one has to work with classic water hammer equations (characteristic method), dynamic structure equations, soil mechanic (geotechnique) equations. Building up this extended system of equations, including the three groups of equations, aim to study water hammer problems and to design projects to give results approaching field measurements, where characteristic method of water hammer (classic method) gives differences. There is no analytic method to solve this system of partial nonlinear differential equations, so researchers have been working on developing numerical methods such as, Extended Characteristic Method, Characteristic-Finite Element Method, which are used to solve hydraulic-structural system of equations, and Finite Difference Method, used to solve structural–soil system of equations.

This research depends upon combining the Characteristic-Finite Element Method and Finite Difference Method, and applying to an example, to demonstrate the importance of accrediting the extended system of equations rather than classic water hammer equations, and make use of the positives of each methods. It is clear depending on results that extended system of equations carries out results closer to field measurements than classic water hammer. Moreover, the present numeric method is more interactive and give more stable results than does each.

Key Words: water hammer; pipe wall—water interaction; pipe wall—soil interaction; extended characteristic method; finite element method; finite difference method.