Chapter I

Introduction

1.1 Background of Study

Floods from heavy rains can create flood waves that can damage or even destroy river dikes in the form of sediments. The propagation of flood waves that pass through such erosion-like areas are greatly influenced by water flow and sediment. The interaction of flood with the sediments causes damage to the surrounding environment, even can threaten human life. Therefore, a simulation is needed to find out more about the influence of water waves on the sediment such that the possible impacts can be detected and prevented earlier.

Experimental activities to find out more about the impact of water flow on sediments have been discussed and conducted at the LIA Lab (Laboratory of Water Engineering), University of Cassino and Southern Lazio, 2016 [2, 5]. The configurations of this experiment is shown in Figure 1.1.

In the paper of Di Cristo et al [2], numerical solutions using mixed cell-centered finite-volume (CCFV) and node-centred finite-volume (NCFV) discretization methods have been proposed. The results show that the model allows for a logical simulation of free surface elevation experimental trends independently of the geofailure operator. In this paper, the another model will be used to simulate this experiment. This model is known as the SWE-Exner model which has been applied in many applications such as erodible dam-break, subcritical steady and transcritical flow over a bump, etc.

Moreover, in order to approximate the solution of SWE-Exner model, a robust semi-implicit staggered grid scheme will be used (this scheme is introduced in [6] in detail). This scheme is a very appropriate method for estimating the Exner-shallow water equation for bedload sediment modeling. Several numerical tests in [6] are shown in good convergence properties to analytical solutions and match well-designed data experiments in dam-break on an erodible embankment.

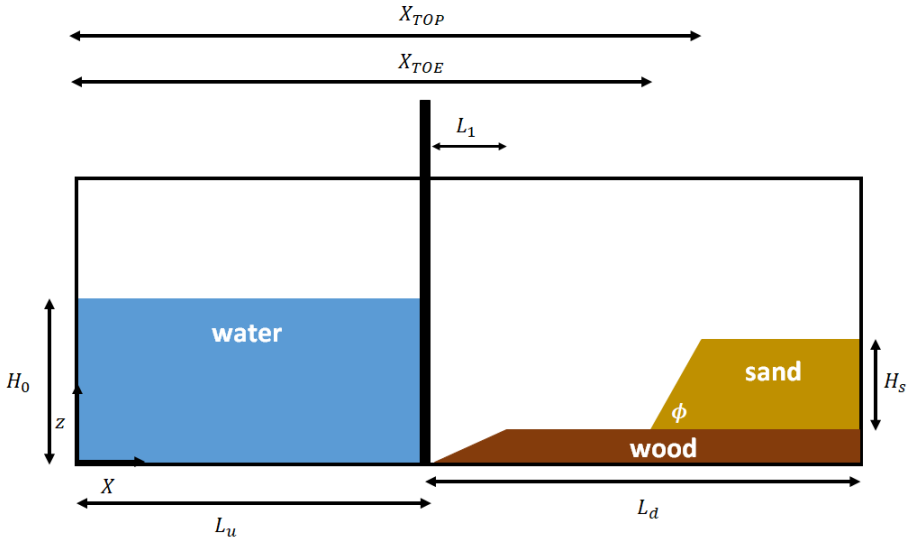

Figure 1.1: The lateral view of the experiment with the parameters $H_0 = 0.20$ m, $H_S = 0.10$ m $L_u = 3.00$ m, $L_d = 3.03$ m and $L_1 = 1.00$ m. The value of Φ are depend on X_{TOP} and X_{TOE}.

1.2 Problem Formulation

There are several problem formulations raised in this final project, i.e.:

1. How to elaborate SWE-Exner model with semi-implicit staggered scheme for simulating dam-break over an erodible embankment?
2. How is the simulation comparison to the experimental data?

1.3 Object of Study

Based on the problem formulations, here are several objects of the study for this final project.

1. to elaborate SWE-Exner model with semi-implicit staggered scheme for simulating dam-break over an erodible embankment.
2. to get the simulation comparison to the experimental data.

1.4 Problem Limitation

Here are some problem limits for Simulating Dam-break Over An Erodible Embankment Using SWE-Exner Model and Semi-implicit Staggered Scheme

1. Shallow water equations for wave water simulations are only valid if the wavelength of the water is much greater than its depth.
2. Friction force is ignored in this simulation.