ABSTRACT

This thesis deals with tsunami wave propagation models. The aim of this work is to develop algorithmic-based tools for computing the tsunami wavespread under different conditions. The models in this work establish the methods of computing the rate of propagation of tsunami waves and Estimated Arrival Time (EAT). Moreover, cellular automata models are useful for both homogeneous and non-homogeneous ocean environments and Huygens’ Principle model is implemented for homogeneous ocean environment. The algorithms are developed using mathematical and soft computing techniques. The objectives of the thesis are two-fold: (a) To simulate various scenarios of tsunami wavespread and (b) to study the performance and effectiveness of cellular automata and the geometric models in tsunami wave propagation.

The first study discusses two-dimensional cellular automata model to correlate the sensitivity of the computational results to tsunami wavespread. In the second study a new hexagonal cellular automata model based on the transfer of fractional traversed area and thereby, graphical representation of rate of wavespread has been found successfully. The performance enhancement of hexagonal cellular automata over two-dimensional cellular automata is also studied.

According to Huygens’ wavelet principle, each point on the curve can be regarded as point source, which expands as small ellipse. The envelope of these ellipses describes the new perimeter with discontinuous wave front. An algorithm that defines this envelope has been developed.

The algorithms are efficient and can be easily implemented with less computational time and cost. Experimental results of our models mimic the value of real propagation. Together with these working models of a tsunami wave and historical data, Visual representations using the Java programming language for our models are also presented.