CHAPTER IV

EXPERIMENTS AND RESULTS

4.1 Experimental Set Up

To verify the orbital flow theory experimentally in the laboratory, waves were generated in a rectangular rotating tank of 1.20 x 2.0 x 0.50 m^3 (width x lenght x height) filled with water 0.38 m deep (Fig. 5 and Fig. 6). The tank was mounted on a rotating platform which can be rotated up to the speed of 0.39 radians per second (Fig. 7). The wave generator (Fig. 8) can generate waves of frequencies and amplitudes in the range of 1.76 to 2.27 cycles per second and 0.25 to 0.49 centimeters respectively. The top of the rotating tank was covered with a glass plate in the middle to be used as a window for observation, the rest of the tank was covered with a plastic sheet to prevent the relative movement between rotating water and the air above the tank.

The observations of wave-induced current according to the orbital flow theory were carried out by tracing the movement of specially designed drifters as shown in Fig. 9. The movements of the drifters were recorded by using a set of video camera and recorder. Both the camera and the recorder were mounted on the rotating wave tank. A photographic camera was used to take pictures of the undulating water surface. The pictures (Fig. 10) were used for determining the wavelengths and the wave amplitudes.

The measurements of the induced current velocity were carried out later on a T.V. screen.

4.2 Experimentations

Thirteen experiments were carried out in the study, but only nine experiments wer properly recorded. In the first and eighth experiments, the tank was fixed. In the second, the forth, the sixth and the ninth experiments, the tank was rotated counter-clockwise at angular frequencies of 0.189, 0.249, 0.388, and 0.385 radians per second respectively. In the third, the fifth and the seventh experiments, the tank was rotated clockwise at angular frequencies of 0.189, 0.248, and 0.388 radians per second respectively. Table 1 summarizes the angular frequencies used in the experiments.

Since the rotating axis in the experiments was perpendicular to the direction of the flow, Coriolis parameter $f = 2\Omega \sin\varphi$, was reduced to $f = 2\Omega$, the calculated values of Coriolis parameters for each experiment are also shown in Table 1.

Wave amplitudes, wavelenghts and frequencies for each experiments are shown in Table 2.

4.3 Experimental Results

The experimental results are as shown in Tables 3.1 to 3.9. The velocity components shown in the tables are the mean values of velocity components of a number of drifters used in each level of water. An example of the calculation method is shown in APPENDIX A.

The results in Tables 3.1 to 3.9 are plotted in Figs. 11.1 to 11.9.