A COMPARISON BETWEEN STANDING WAVE PATTERN IN FRONT OF VETICAL BREAKWATER WITH HORIZONTAL AND SLOPED-BED

Fatemeh Hajivalie **Abbas Yeganeh-Bakhtiary** **Hitoshi Gotoh**

f_hajivalie@iust.ac.ir *yeganeh@iust.ac.ir* *gotoh@mbox.kudpc.kyoto-u.ac.jp*

ABSTRACT

A two-dimensional numerical model is developed to study the formation of standing waves in front of a vertical breakwater positioned on both flat and sloped-bed. The main components of the model are the Reynolds Averaged Navier-Stokes (RANS) equations, which define the average motion of a turbulent flow, a k-ε turbulence closure model and a Volume Of Fluid (VOF) technique for tracking the free surface motion. By imposing the generating-absorbing boundary condition at the inlet boundaries, waves can be generated while the reflected waves can be absorbed. First, we compared the model results with the experimental results of Shaosong et al. (2001) for model validation. The results indicated that the steady streaming feature is more regular in case of flat bed while in case of the sloped-bed the distance of recirculating cells varies with the water depth. It is also evident that the turbulence intensity is higher in case of sloped-bed compare to flat bed one.

Keyword: standing waves, vertical breakwater, steady streaming, RANS, k-ε turbulence model, and VOF.

1. INTRODUTION

Formation of standing waves in front of a vertical breakwater is a very common hydrodynamic feature in coastal zone. The standing waves characteristics depend on several parameters including the incident wave characteristics, breakwater shape and reflection coefficient and the bottom slope. Carter et al. (1973) were the first who noticed the effect of standing waves on formation of parallel pattern of scour/deposition in sand bars near the shorelines. They pointed out that the standing waves develops a field of steady streaming system of recirculating cells in front of vertical breakwater (figure 1) which directly affects the local scouring of seabed in the vicinity of breakwater.

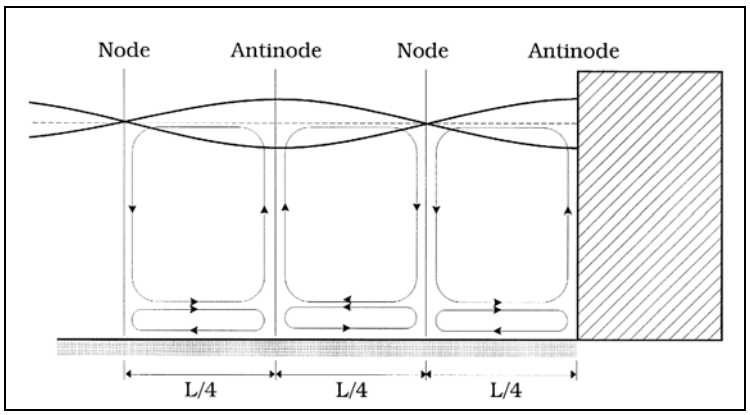

Fig. 1 Steady streaming pattern in front of vertical breakwater under standing waves, Sumer & Fredsøe (2000)

Xie (1981) measured the maximum horizontal orbital velocity in front of a vertical breakwater while he was studying local scour pattern in front of vertical breakwater under action of nonbreaking waves. Later Shaosong et al. (2001) experimentally studied the kinematic and dynamic characteristics of full and partial standing waves. They studied the effect of partial standing waves on kinematic characteristics of water particle including the maximum horizontal velocity of water particles near the nodes.