

The Trajectories of Deep-Water Wave Motion with the Stokes Drift

National Central University

Yu-Lin Tsai

The surface elevation can be specified as the harmonic cos function, which depends on the wave number, the angular frequency, and the wave amplitude.

$$\eta = A \cos(kx - \omega t) \quad (1)$$

The trajectories of the parcels' center are influenced by the Stokes Drift, and the moving distance in the x direction of the parcels will decay exponentially with the water depth that we are located in.

$$x_o = x_o + kA^2 \omega t e^{2kz_o} \quad (2)$$

$$z_o = z_o \quad (3)$$

The displacements in the x and z directions are shown below. In the movement of the x direction, there exists two terms: the first term is from the orbital motion of the parcels, and the second term is from the Stokes Drift.

$$\Delta x = -A e^{kz_o} \sin(kx_o - \omega t) + kA^2 \omega t e^{2kz_o} \quad (4)$$

$$\Delta z = A e^{kz_o} \cos(kx_o - \omega t) \quad (5)$$

where,

A is the wave amplitude,

k is the wave number,

ω is the angular frequency,

x_o , z_o are parcels trajectory's center,

Δx , Δz are the displacement from the center x_o and z_o