

Coastal and Ocean Wave Hydrodynamics
K.N.T. University of Technology
Assignment 2

2-1.

A wave of period 8 s, height $H=1$ m, is recorded by a bottom pressure type wave gage in 20 m depth in water. Assume the wave to be sinusoidal and that the linear wave theory applies.

- (1) What is the length of this wave?
- (2) What is the wave celerity of this wave?
- (3) What is the pressure variation measured by the pressure gage?

2-2.

Given the two velocity potentials

$$\phi_1 = ac \frac{\cosh k(h+z)}{\sinh kh} \sin k(x-ct)$$

$$\phi_2 = -ac \frac{\cosh k(h+z)}{\sinh kh} \sin k(x+ct)$$

Assume linear wave theory to be valid.

- (1) Describe physical meaning what ϕ_1 and ϕ_2 represent.
- (2) Define a velocity potential

$$\phi = \phi_1 + \phi_2$$

and show that $\frac{\partial \phi}{\partial x} = 0$ at $x=0$. Would the motion described by ϕ be changed if a vertical impermeable wall was introduced at $x=0$?

- (3) Assuming the linear theory to be valid, determine the surface profile corresponding to ϕ and sketch it in the interval $-L \geq x \geq 0$ at times corresponding to

$$\sigma t = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}.$$

2-3.

Two sets of waves are interfering in deep water. If the phase velocity is represented by c ,

show that group velocity c_g is $c_g = \frac{c_1 c_2}{c_1 + c_2}$.

2-4.

A wave maker generates two groups of waves. The first group has a wave period of 1 s, the second group has a period of 1.5 s. The water depth in the flume is 1.5 m. After

generation of the 1 s waves, the generator is stopped for 20 s before the 1.5 s waves are generated.

How far down the flume will the front of the 1.5 s waves catch up with the 1 s waves?