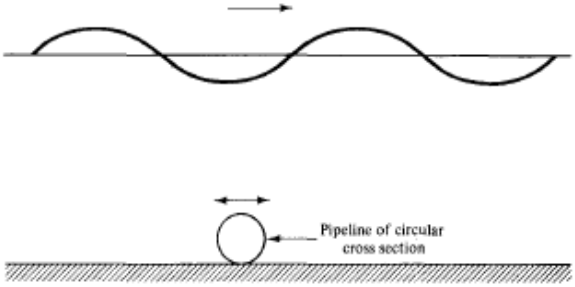
Underwater Technology – MM570
Sheet
Wave Theory

1- A submarine oil pipeline with outside diameter of 1m, wall thickness 20 mm is resting at the seabed at water depth of 30 meters. The significant wave height at the site is estimated to be 4 meters with a corresponding wave period of 5 sec. At a water depth of 29.5 m Calculate the following using linear Airy wave theory:



- The maximum horizontal wave particle velocity (m/sec)
- The maximum horizontal wave particle acceleration (m/sec^2)
- The wave phase velocity (m/sec), wave frequency (rad/sec) , wave length and wave number.
- Hydrostatic and maximum dynamic pressure.
- The particle trajectory type and amplitudes.
- The maximum drag force (N/m) at this water depth if C_D= 1.0
- The maximum inertia force (N/m) at this water depth if C_M = 1.0
- For a time frame of 10 sec plot the drag force, inertia force, and total hydrodynamic force. Determine the maximum value of the total force.

Morison Equation

Total Force $F_T = 0.5\ \rho C_D\ A\ u|u| + \rho C_M V \frac{du}{dt}$

Where C_D = drag coefficient
C_M= inertia coefficient
ρ= salt water density
u = horizontal particle velocity
$\frac{du}{dt}$ = horizontal particle acceleration
A= cross sectional area
V= volume.