

## **Recitation 10: Forces on cylinder, Labs and Linear Water Waves**

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### 1. Horizontal forces on fully submerged cylinder in oscillatory flow

Scope

Approach

- 1.1. Estimate  $K_c$  to determine viscous and/or potential forces dominate
- 1.2. Inertial force  $F_x$  from potential flow theory, with 3 *equivalent* ways
- 1.3. Estimate ratio of form drag  $D_x$  over inertial force  $F_x$  ( $D_x/F_x$ )
- 1.4. Estimate ratio of skin friction drag  $D_{fx}$  over inertial force  $F_x$  ( $D_{fx}/F_x$ )

Anticipate: forces on objects in the presence of wave field

### 3. Labs: Discussion and hints on Labs A and B

### 4. Behavior of $\sinh(x)$ , $\cosh(x)$ , $\tanh(x)$ for small and large $x$

### 5. Linear Water waves

- a. Solutions for deep, intermediate and shallow water depths
  - b. Wave parameters: wavenumber/wavelength, period/frequency
  - c. Phase velocity
  - d. Dispersion relation
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