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Numerical Analysis for Hydrodynamic Interaction Effects between Vessel and Semi-Circle Bank Wall

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요 약 : The hydrodynamic interaction forces and moments induced by the vicinity of bank on a passing vessel are known as bank effects. In this research, the characteristic features of interaction acting on a passing vessel in the proximity of a semi-circle bank wall are described and illustrated, and the effects of ship velocity, water depth and the lateral distance between ship and semi-circle bank wall are summarized and discussed.

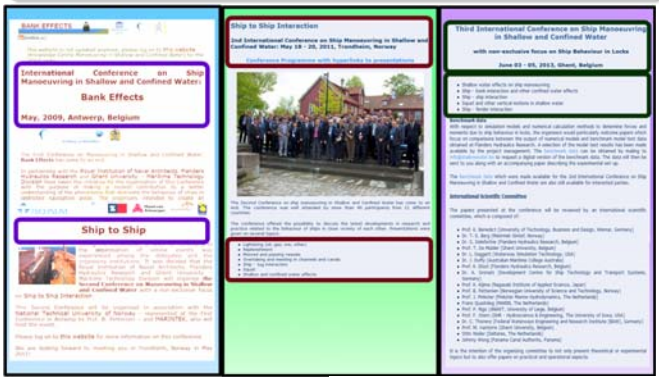
핵심용어 : Hydrodynamic Force, Bank Effect, Spacing between Ship and Semi-Circle Bank Wall

배경 및 목적

❖ When a large vessel maneuvers in restricted waters:

Ship maneuvering motion

- The problem due to the shallow water effect ?
- Bank effect / Ship-Ship interaction effect in congested water areas due to the increasing size and number of large vessel ?
- The Difference of maneuvering characteristics in deep and shallow water ?



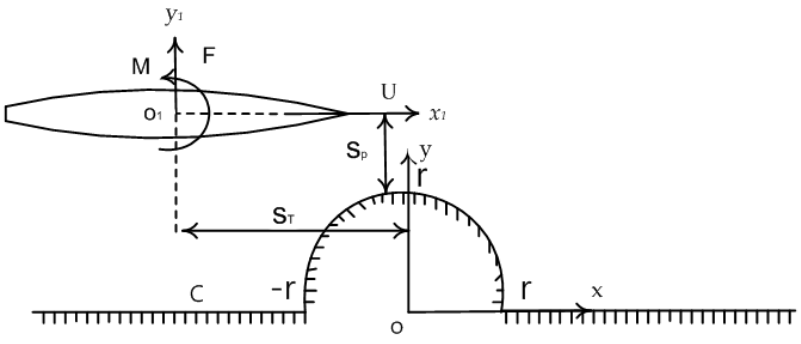
Principle particulars

L (m)	325
B (m)	53
d (m)	22.05
C_B	0.831

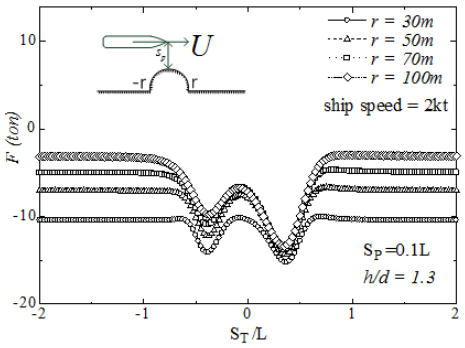
Main Parameters

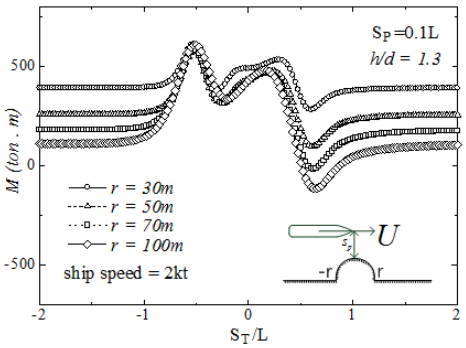
- Ship's velocity (U)
- Lateral distance (S_P)
- Longitudinal distance (S_T)
- Depth to draft ratio (H/d)
- Length of semi-circle (r)
- Shape of bank

Coordinate Systems



Hydrodynamic force and moment





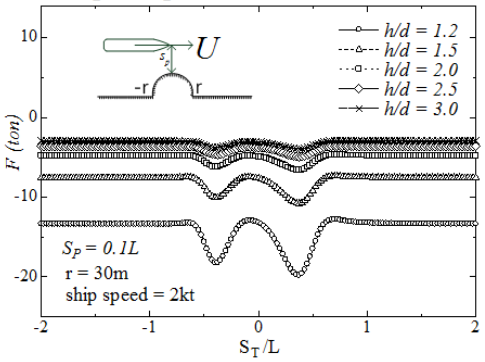
Parameters

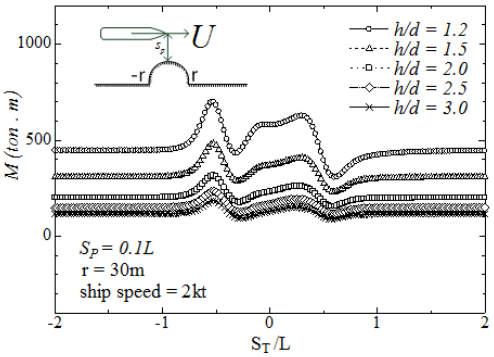
- Ship's velocity ($U = 2kt$)
- Lateral distance (S_P = 0.1L)
- Length of semi-circle (r=30m~100m)
- Depth to draft ratio (H / d = 1.3)

Non-dimensional Hydrodynamic Force & Moment

$$C_F = \frac{F}{\frac{1}{2}\rho L d U^2}, \qquad C_M = \frac{M}{\frac{1}{2}\rho L^2 d U^2}$$

Hydrodynamic force and moment





Parameters

- Ship's velocity ($U = 2kt$)
- Lateral distance (S_P = 0.1L)
- Length of semi-circle (r=30m)
- Depth to draft ratio (H / d = 1.2~3.0)

Non-dimensional Hydrodynamic Force & Moment

$$C_F = \frac{F}{\frac{1}{2}\rho L d U^2}, \qquad C_M = \frac{M}{\frac{1}{2}\rho L^2 d U^2}$$

Conclusions

- In case of bank effect between ship and semi-circle bank wall,
  - Significant changes arose at the leading part of radius of semi-circle bank wall
  - As the radius increases the semi-circle bank wall generates the largest disturbance
- When moving at low speed of 2kt near the semi-circle bank wall,
  - Bank effect sharply increases as the lateral distance decreases
    (S_P is less than about 0.2L)
  - Bank effect largely decreases as the lateral distance increases
    (S_P is more than about 0.3L)