Ship Stability

Ch. 6 Free Surface Effect

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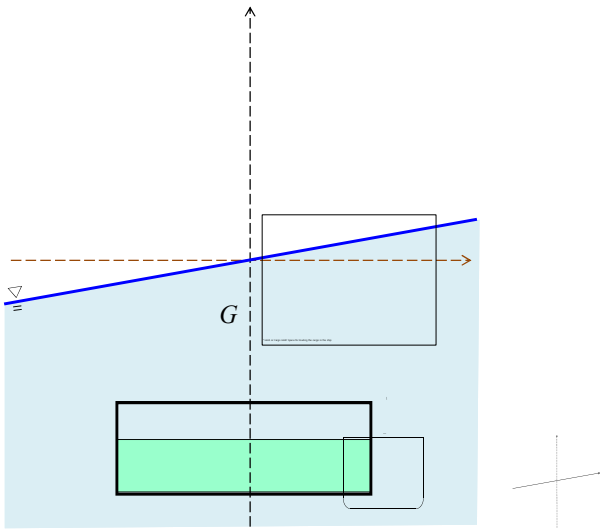
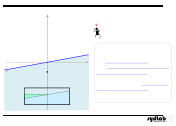
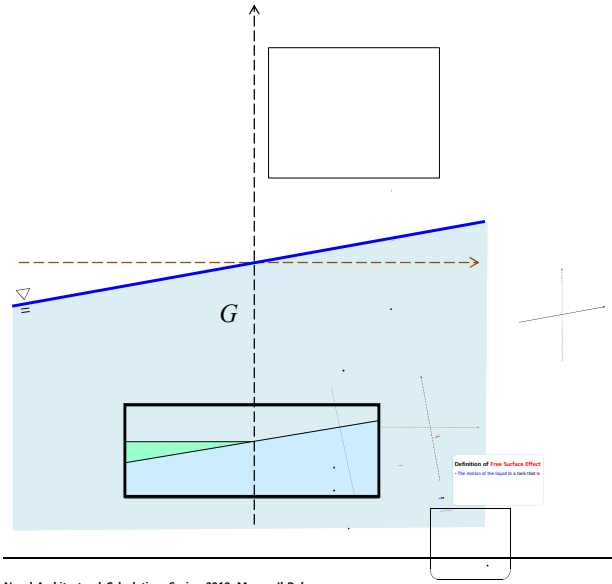
Free Surface Effect

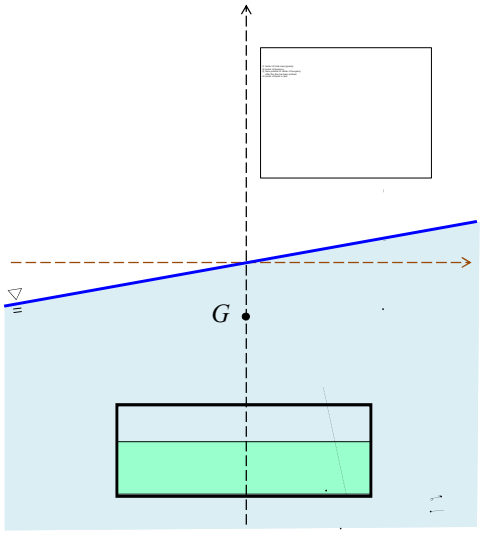




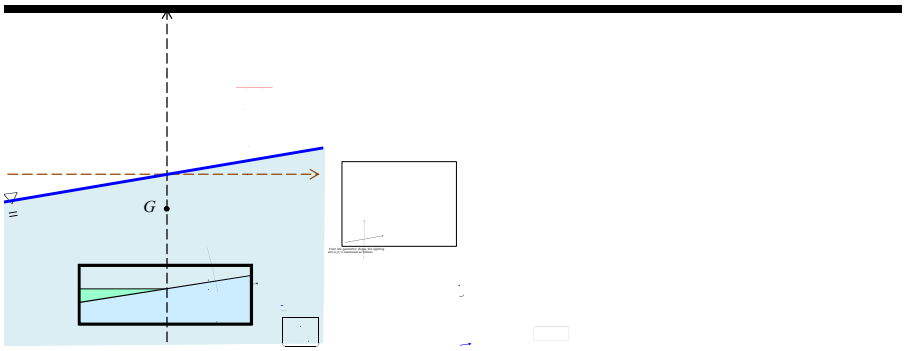
Definition of Free Surface Effect

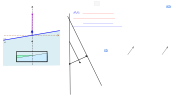


Transverse Righting Moment
When there is no Effect of Free Surface



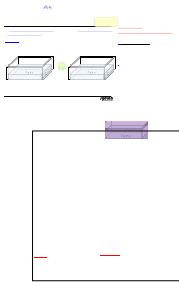
- **Transverse Righting Moment**


G



✓ Evaluation of effect of free surface on righting arm

$$GG_1 // bb_1,$$

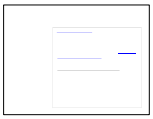


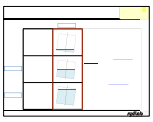
The Effects of Free Surface

G: Center of total mass (gravity)
G_f: New position of center of total mass (gravity)
w: Weight of liquid in tank
i_f: Moment of inertia of liquid plane area in tank about x' axis

- **Free Surface Effect**

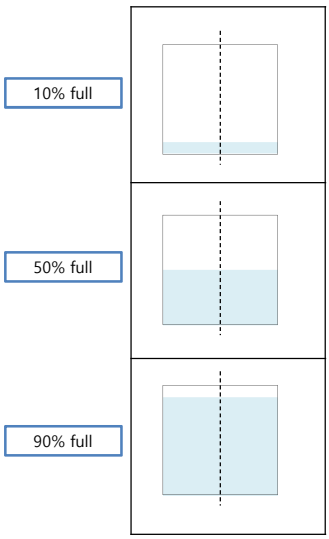
$$GM = KB + BM - KG_0,$$

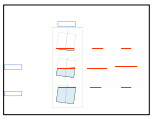


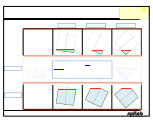


The Influence of Free Surface at Large Angles of Heel (1/5)

$$GG_0 = \frac{w}{W}\frac{i_T}{v} = \frac{\rho_F}{\rho_{SW}}\frac{i_T}{\nabla}$$

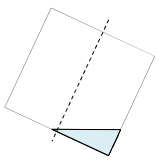
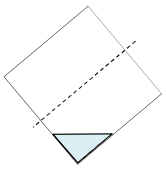
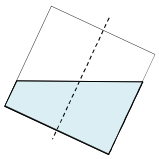
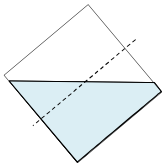
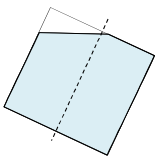
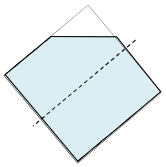






$$GG_0 = \frac{w}{W}\frac{i_T}{v} = \frac{\rho_F}{\rho_{SW}}\frac{i_T}{\nabla}$$

: free surface correction

		25° Inclination	50° Inclination
			
			
			

$$GG_0 = \frac{w}{W}\frac{i_T}{v} = \frac{\rho_F}{\rho_{SW}}\frac{i_T}{\nabla}$$

: free surface correction

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