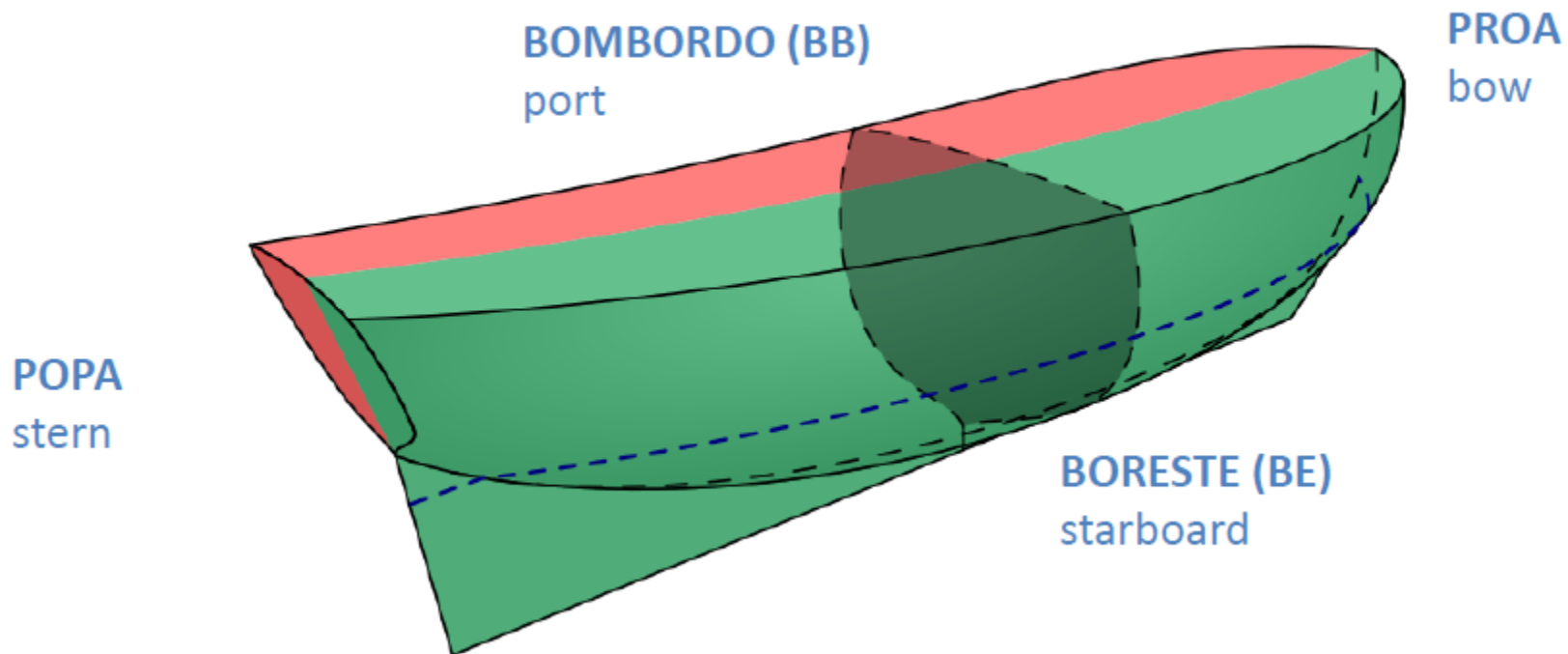


# Fundamentos de Engenharia Naval – Aulas 1 e 2

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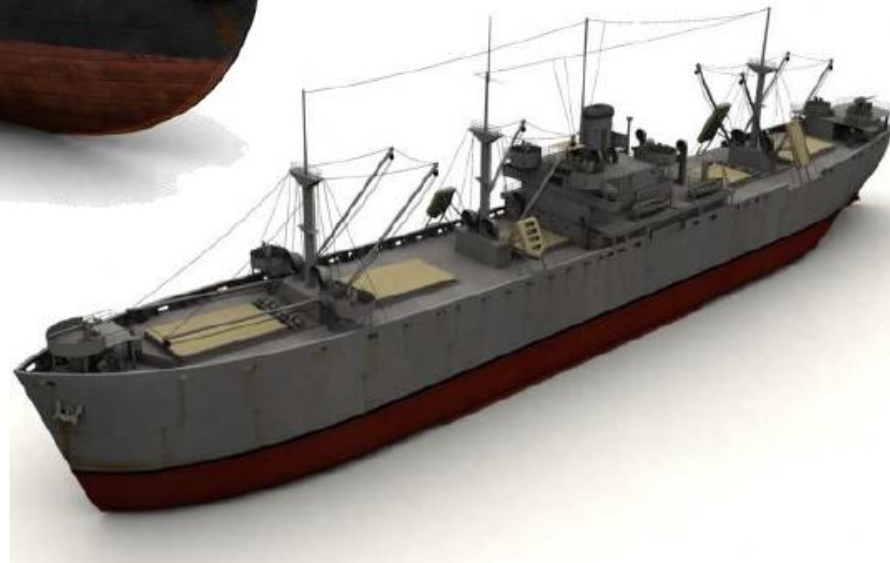
Nomenclatura e Geometria do Navio

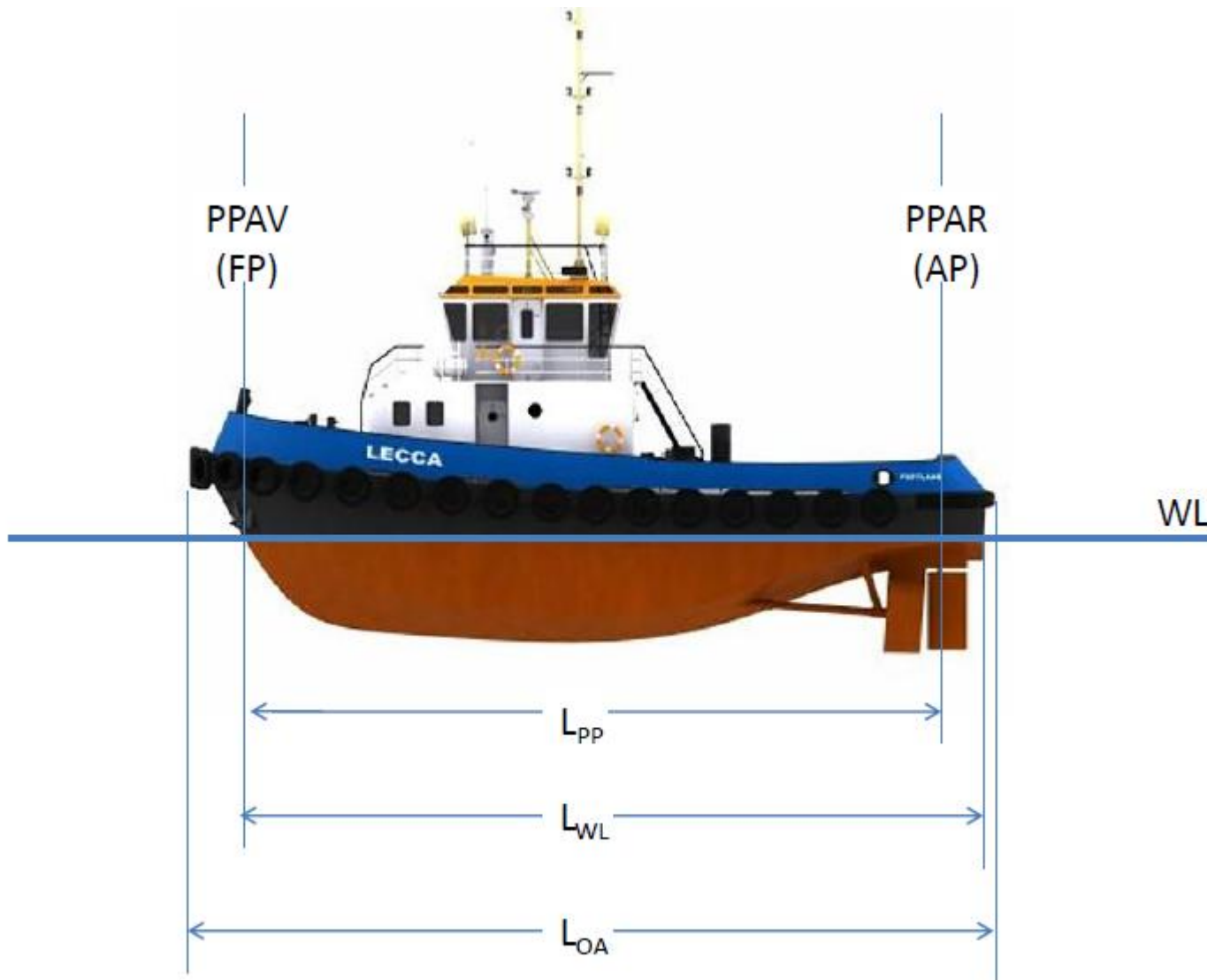


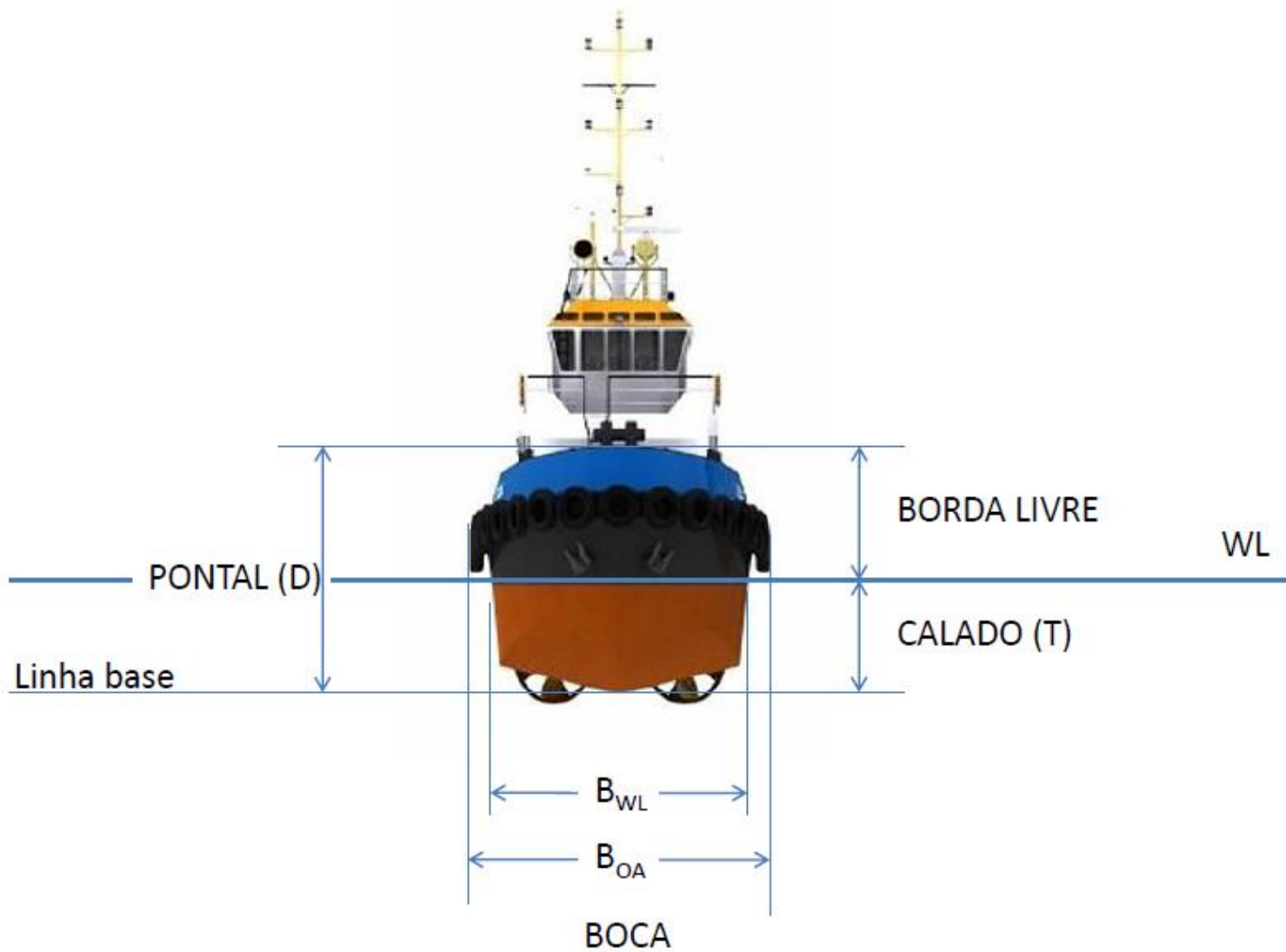


- Costado
- Obras vivas / obras mortas
- Borda
- Quilha
- Bojo
- Bolina
- Leme, Hélice
- Bulbo

- Casco
- Superestrutura
- Convés
- Proa / Popa
- Meia-nau
- Bombordo / Boreste
- Barlavento / Sotavento







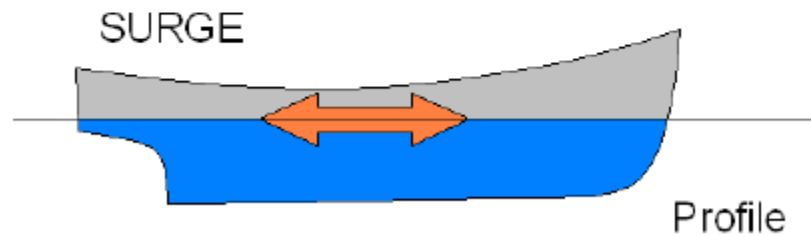
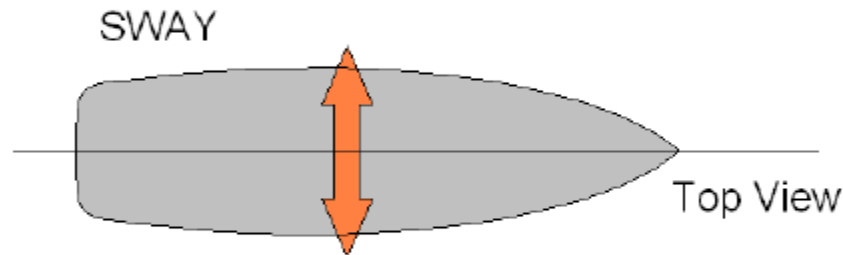
## Partes

- Casco [hull]
- Superestrutura
- Convés [deck]
- Proa [bow] / Popa [stern]
- Bombordo [port] / Boreste [starboard]
- Barlavento / Sotavento
- Meia-nau [midship]
- Costado
- Obras vivas / mortas
- Borda [board]
- Quilha [keel]
- Bolina [bilge keel]
- Leme [rudder]
- Hélice [propeller]
- Bulbo [bulbous bow]
- Bojo

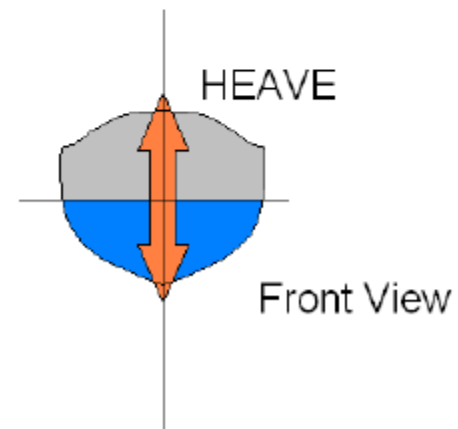
## Dimensões e referências

- Linha base (BL) [base line]
- Linha d'água (WL) [water line]
- Linha d'água de projeto (DWL) [design WL]
- Perpendiculares (PPAV, PPAR)
- Comprimentos (LPP, LOA, LWL)
- Boca (BOA, BWL) [beam]
- Calado (T) [draft/draught]
- Pontal (D) [depth]
- Borda livre [freeboard]
- Deslocamento (W,  $\Delta$ ) [displacement]
- Superfície molhada [wet surface]
- Plano diametral
- Plano de meia-nau

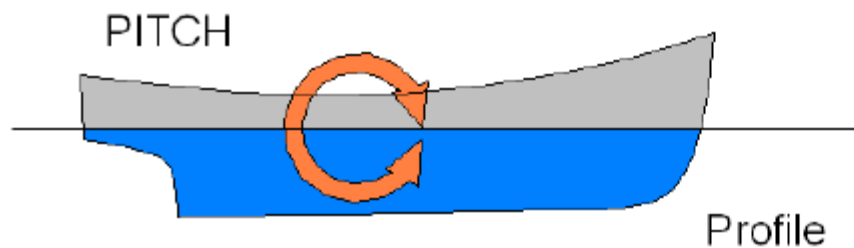
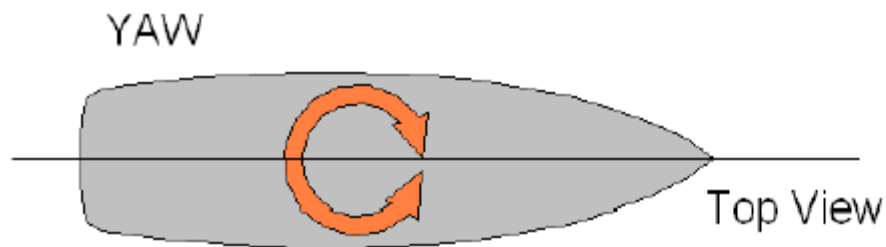
# Movimentos da embarcação



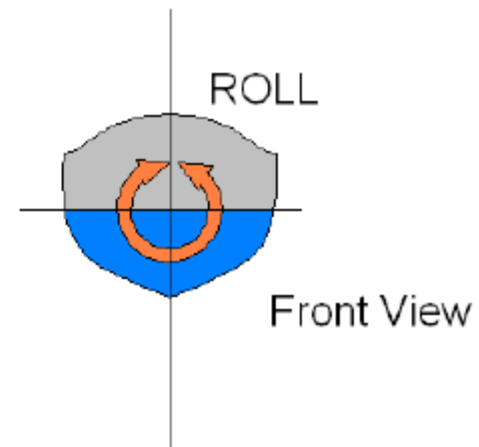
## Translations



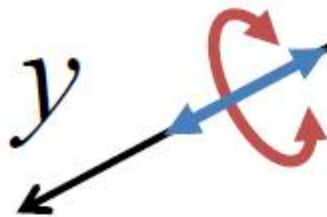
# Movimentos da embarcação



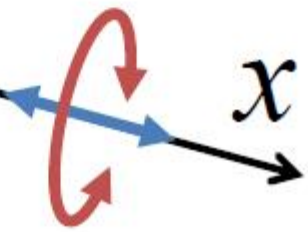
## Rotation







SWAY, deriva  
PITCH, arfagem, caturro  
TRIM

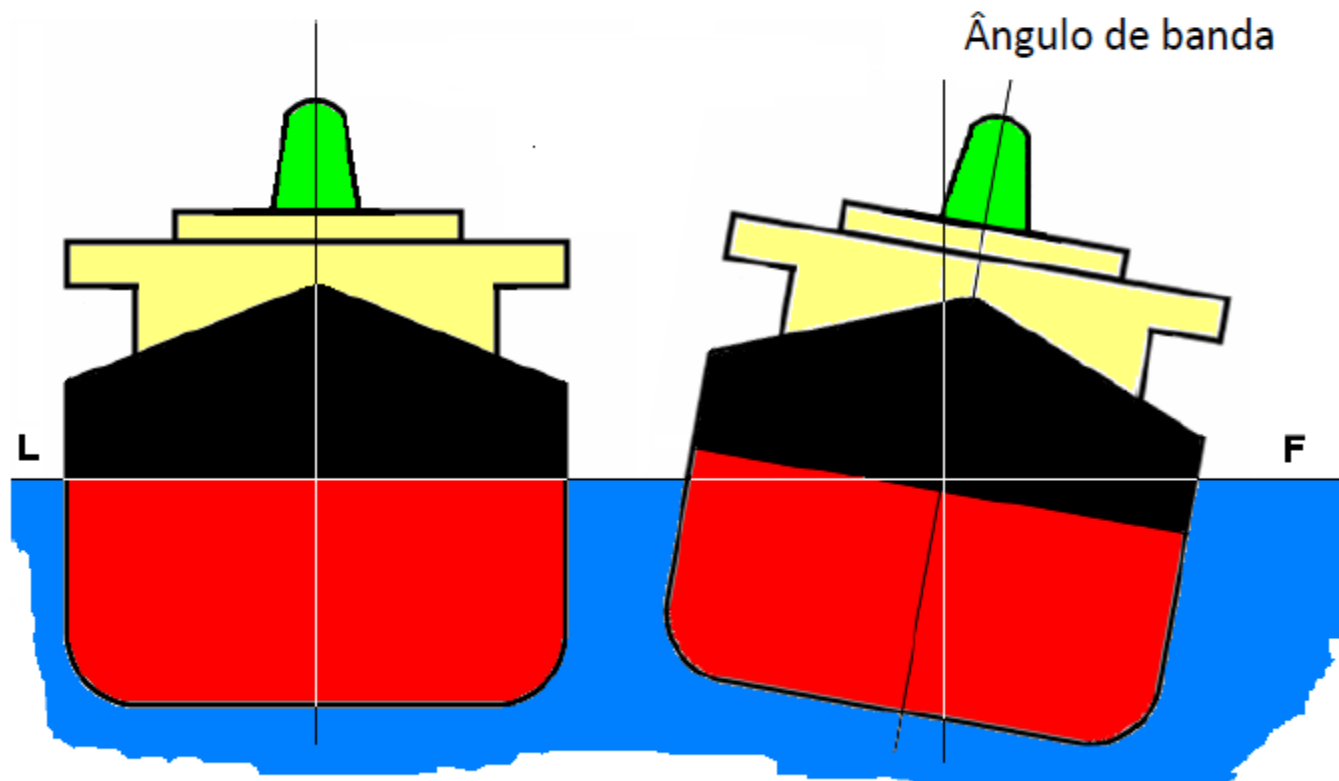


SURGE, avanço  
ROLL, balanço, jogo  
HEEL, banda, adernamento

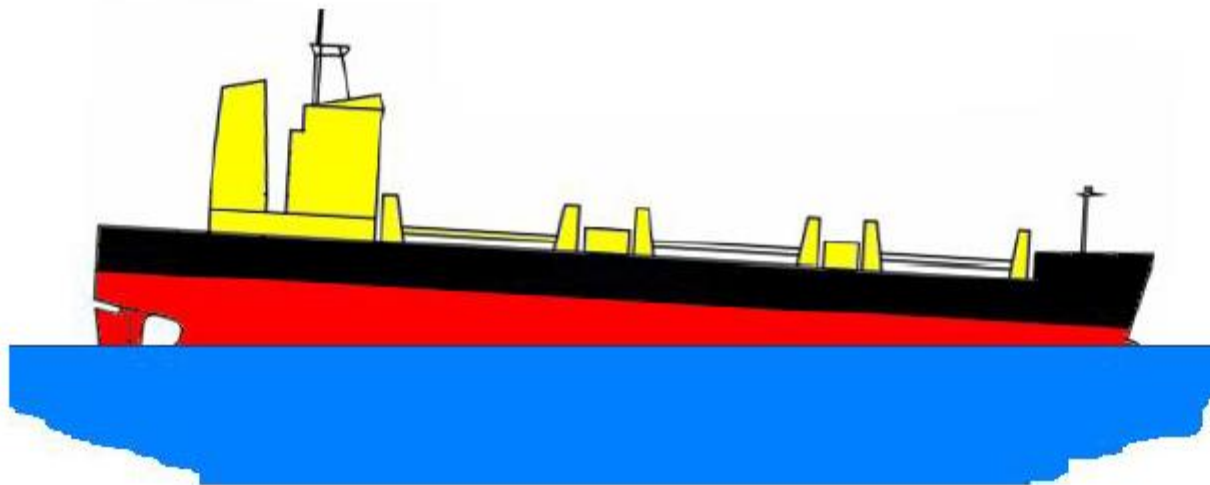
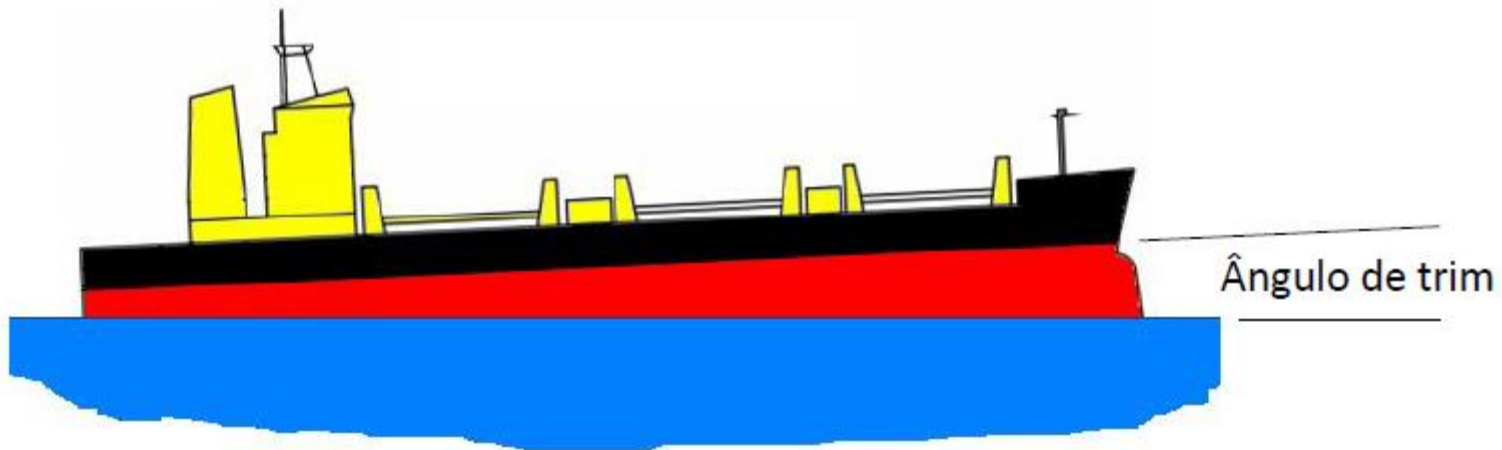


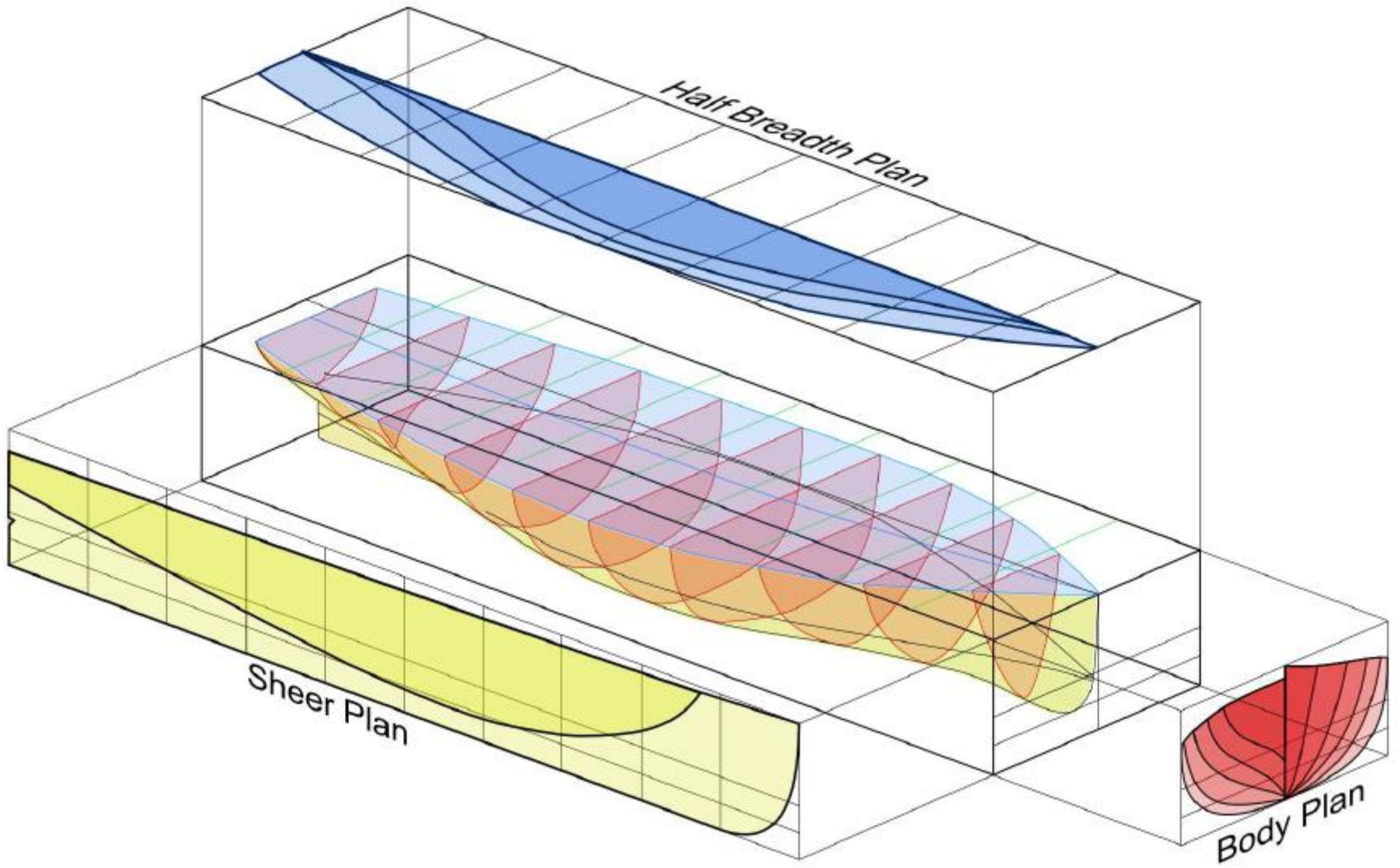
HEAVE  
YAW, guinada

# Banda



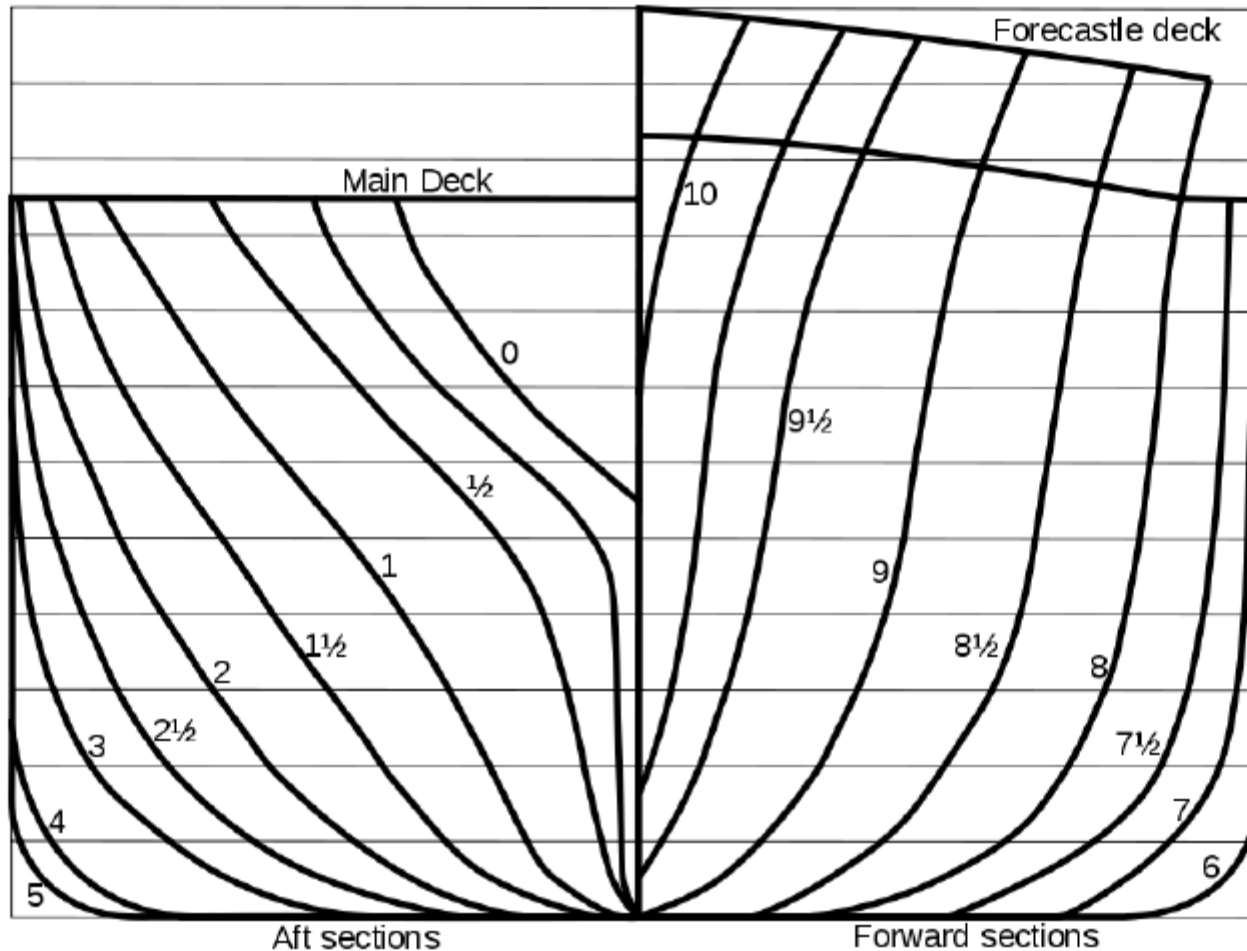
# Trim

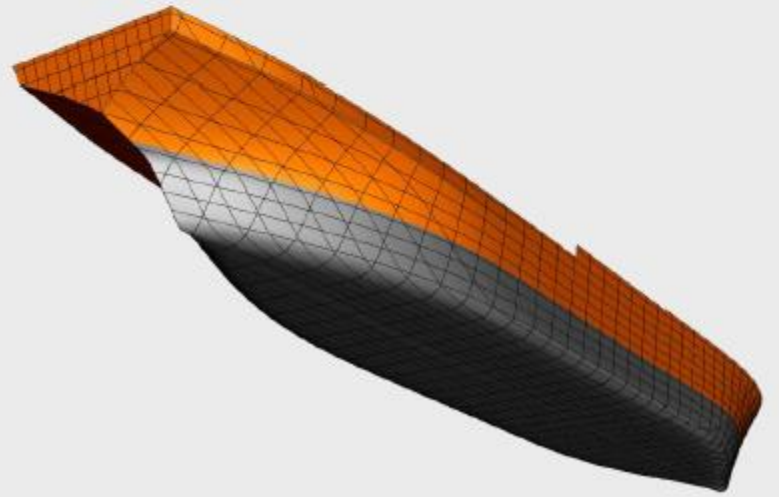
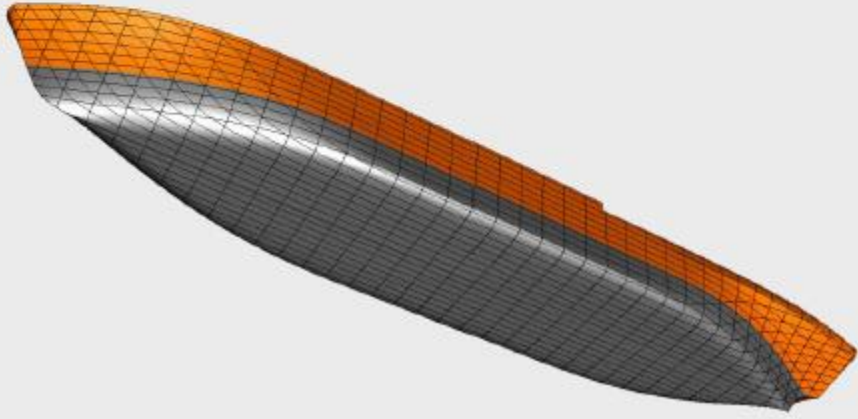
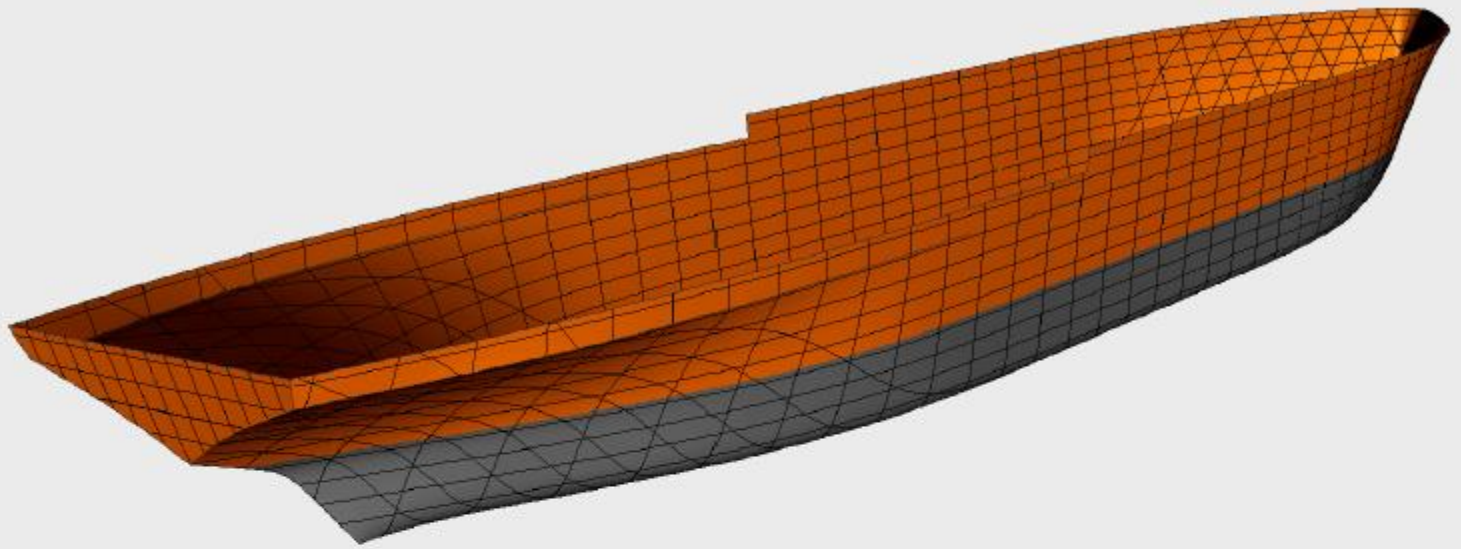


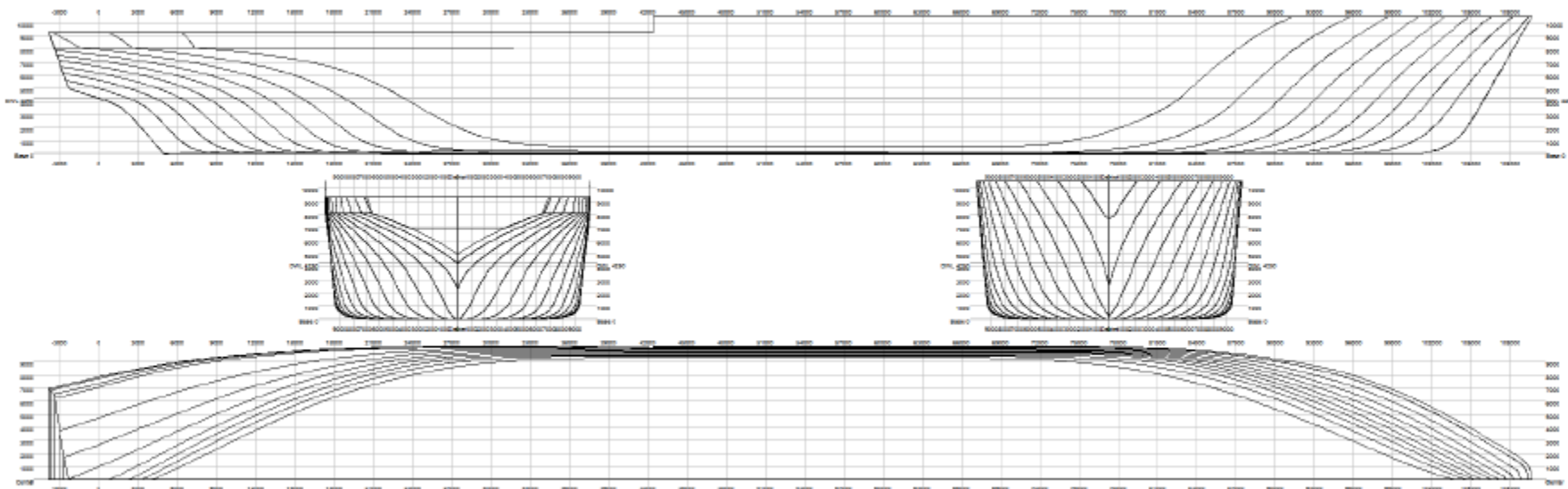
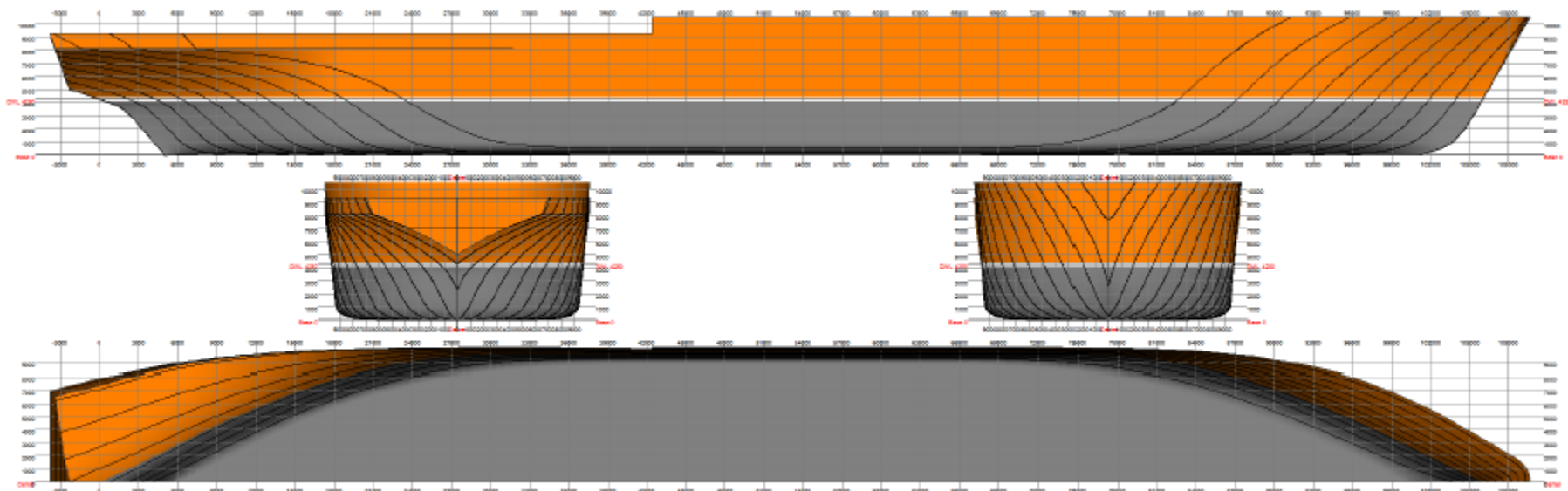


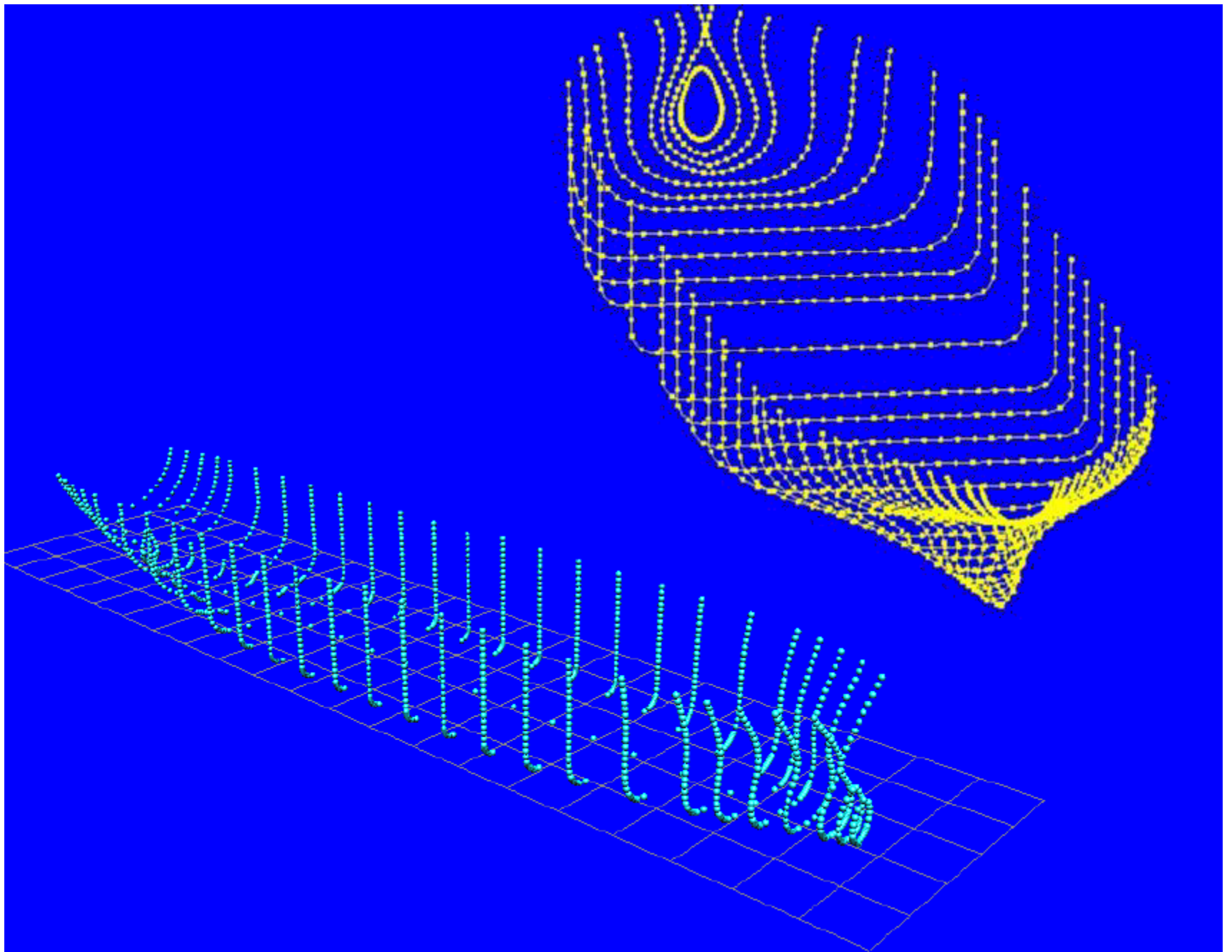
# Vista frontal

## Seções transversais: BALIZAS (stations)











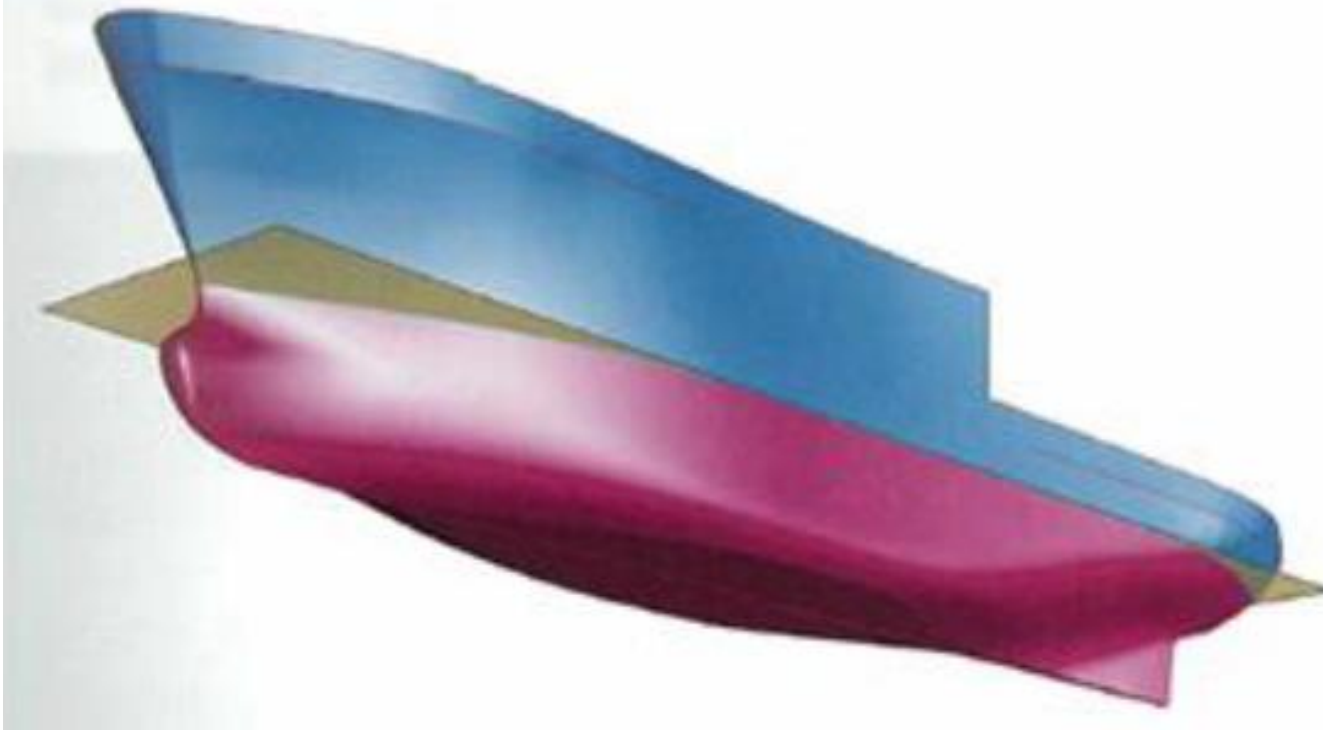
# Adimensionais (Coeficientes de Forma)

- A *relação comprimento-pontal*,  $L/D$ , útil para o dimensionamento estrutural;
- A *relação comprimento-boca*,  $L/B$ , relacionada com a esbeltez e que impacta sobre a manobrabilidade da embarcação;
- A *relação comprimento-calado*,  $L/T$ , indicativo importante para os estudos acerca do “slamming” durante condições severas de mar;
- A *relação boca-calado*,  $B/T$ , com implicações sobre a estabilidade transversal e de geração de ondas.

# Coeficiente de Linha d'água

## 2.1 Water-plane coefficient. $C_w (\alpha)$

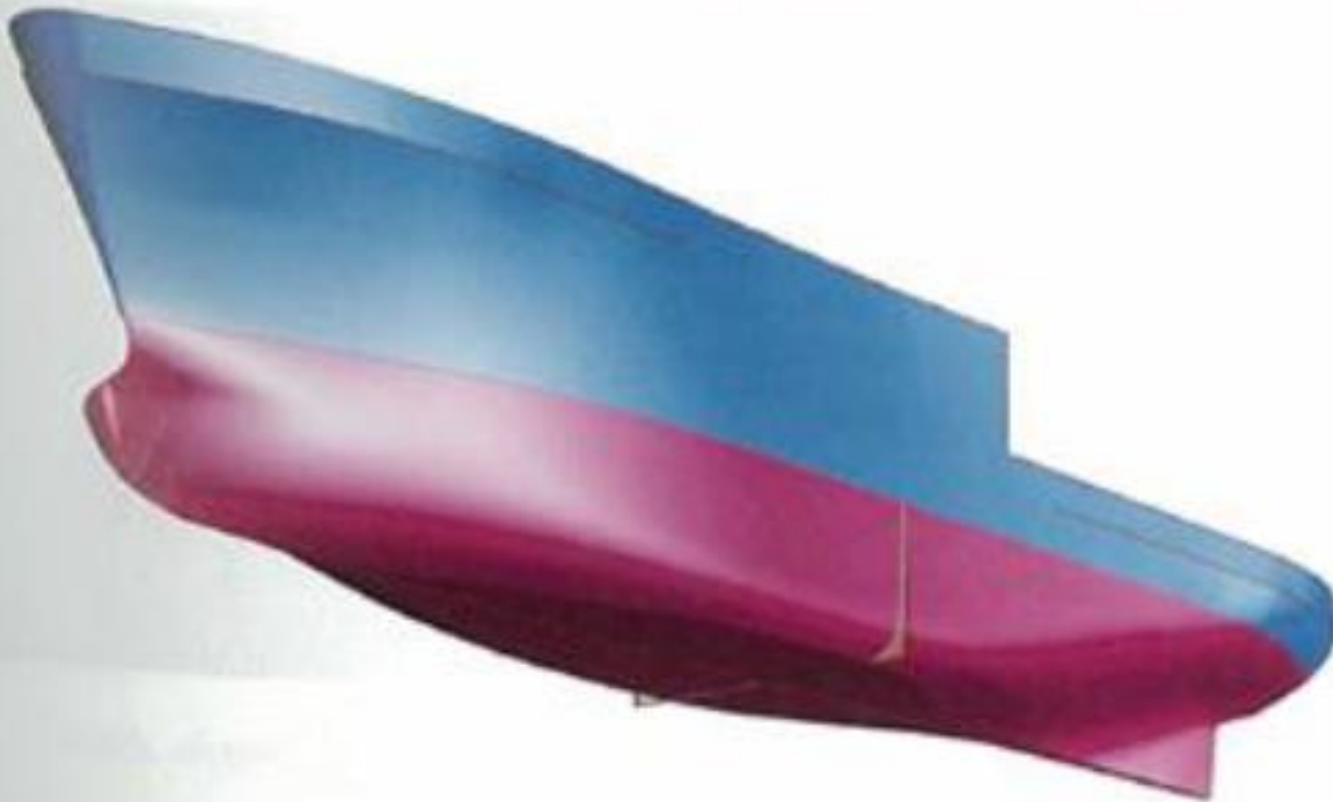
$$\text{Waterplane-coefficient } (C_w) = \frac{A_w}{L_{pp} \times B_{mid}}$$



# Coeficiente de Seção Mestra

## 2.2 Midship Section coefficient, $C_m$ ( $\beta$ )

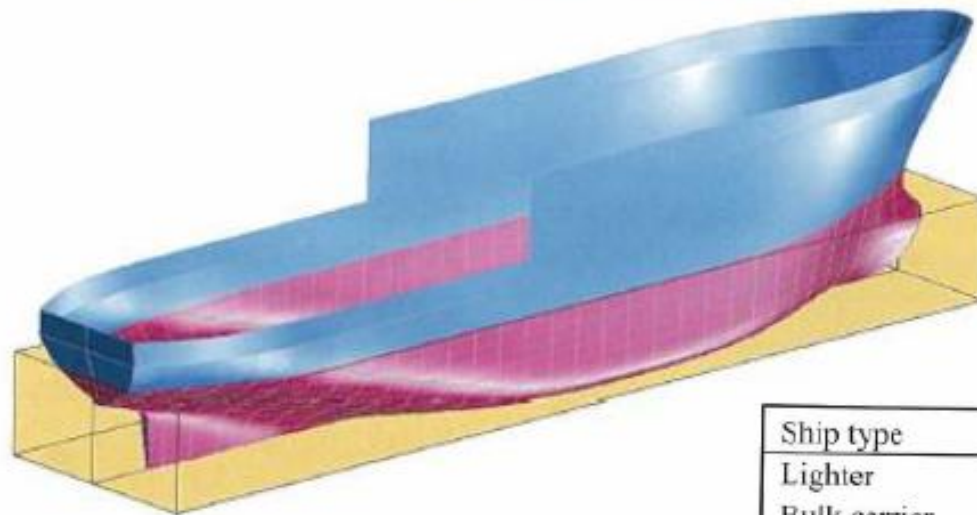
$$\text{Midship-coefficient } (C_m) = \frac{A_m}{B_{mld} \times T}$$



# Coeficiente de Bloco

## 2.3 Block coefficient, coefficient of fineness, $C_b$ . ( $\delta$ )

$$\text{Block coefficient } (C_b) = \frac{\text{Volume}}{L_{pp} \times B_{mld} \times T}$$

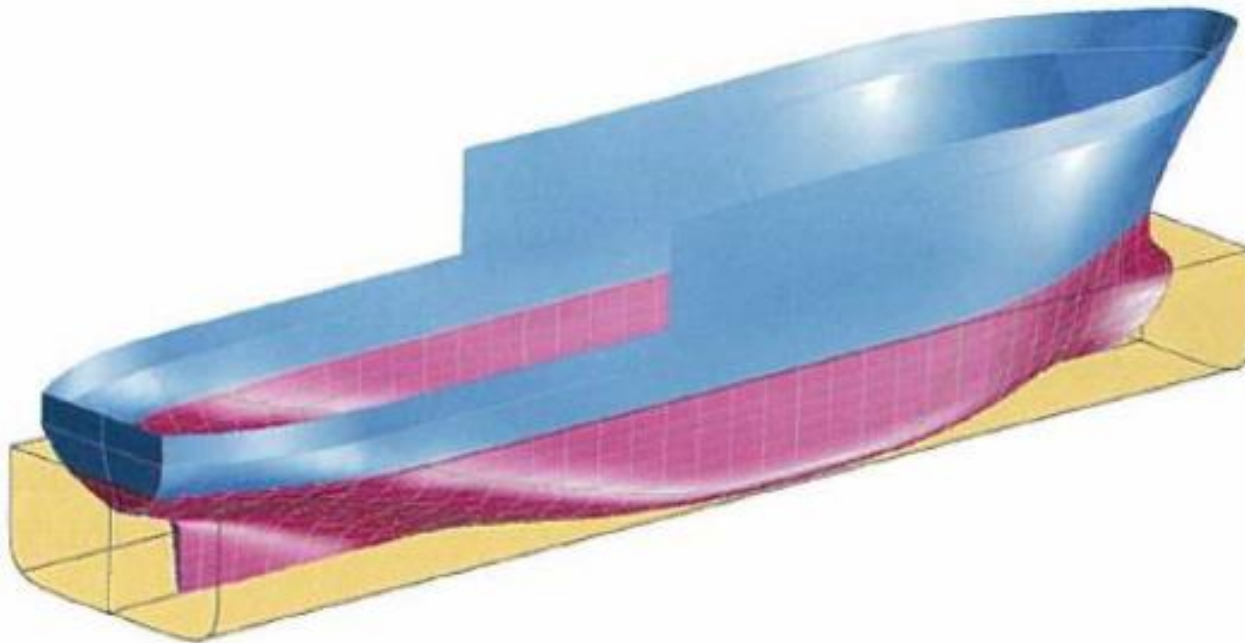


Ship type	Block coefficient $C_b$	Appr. ship speed
Lighter	0.90	5 – 10 knots
Bulk carrier	0.80 – 0.85	12 – 17 knots
Tanker	0.80 – 0.85	12 – 16 knots
General cargo	0.55 – 0.75	13 – 22 knots
Container ship	0.50 – 0.70	14 – 26 knots
Ferry boat	0.50 – 0.70	15 – 26 knots

# Coeficiente Prismático

## 2.4 Prismatic coefficient, $C_p$ (phi)

$$\frac{V}{L_{pp} \times A} = \frac{L_{pp} \times B \times T \times C_b}{L_{pp} \times B \times T \times C_m} = \frac{C_b}{C_m}$$



# Medidas de Capacidade

- **Deslocamento** – Corresponde ao peso do volume líquido deslocado pelo casco submerso.
- **Porte Bruto, deadweight (TPB, DWT)** - É constituído pelo somatório dos pesos do combustível, água, mantimentos, consumíveis, tripulantes, passageiros, bagagens e carga embarcados.
- **Porte líquido (Payload)** – É o peso da carga que pode ser transportada mais combustível.
- **Porte Bruto Operacional** – É A diferença entre o Porte Bruto e o Porte Líquido.
- **Compensated Gross Tonnage (CGT)** – É o porte bruto multiplicado por um coeficiente dependente do tipo da embarcação.
- **Twenty Foot Equivalent (TEU)** – Indica o volume padrão de um container de 20 ft.
- **Peso Leve** – É o peso da estrutura do navio totalmente vazio.
- **Fator de Estiva** – É o coeficiente indicativo do volume ocupado pela carga no porão de carga.

# Arqueação: relacionada aos espaços fechados

Cálculo da **arqueação bruta** regulado pela convenção da IMO de 1969, aplicável após 1982:

$$AB = K \times V$$

Sendo:  $V$  o volume dos espaços fechados em  $m^3$

$K$  um adimensional de 0,22 a 0,32, calculado como

$$K = 0,2 + 0,02 \times \log_{10} V$$

**Arqueação líquida:** espaços de carga

# Arqueação

