

## Movimento Paterno: Direcional

### Exemplo 1

Airbus (com simplificações  $C_{l_{\dot{\delta}_r}} = C_{n_{\dot{\delta}_a}} = C_{y_{\dot{\delta}_a}} = 0$ )

$$\frac{\dot{\delta}_r}{\beta_e} = - \frac{C_{n_{\beta}}}{C_{n_{\dot{\delta}_r}}} \Rightarrow \dot{\delta}_r = - \frac{C_{n_{\beta}}}{C_{n_{\dot{\delta}_r}}} \beta_e = 8,75^\circ$$

$$\frac{\dot{\delta}_a}{\beta_e} = - \frac{C_{l_{\beta}}}{C_{l_{\dot{\delta}_a}}} \Rightarrow \dot{\delta}_a = - \frac{C_{l_{\beta}}}{C_{l_{\dot{\delta}_a}}} \beta_e = -19,68^\circ$$

$$\frac{\sin \phi_1}{\beta_e} = - \frac{1}{2m\gamma C_{n_{dr}}} \rho_e S V_e^2 (C_{n_{dr}} C_{y_{dr}} - C_{y_{dr}} C_{n_{dr}})$$

$$\phi_1 = \arcsin \left( - \frac{\beta_e}{2m\gamma C_{n_{dr}}} \rho_e S V_e^2 \left( \frac{l_F - a}{l} \right) C_{y_{dr}} C_{y_{dr}} \right)$$

$$\phi_1 = 6,0011^\circ$$

Airbus (sem simplificações)

$$\delta r' = \beta_e \frac{C_{l\beta} C_{n_{da}} - C_{n\beta} C_{l_{da}}}{C_{n_{dr}} C_{l_{da}} - C_{n_{da}} C_{l_{dr}}}$$

$$\Rightarrow \delta r' = 10,24^\circ$$

$$\delta a' = \beta_e \frac{C_{n\beta} C_{l_{dr}} - C_{l\beta} C_{n_{dr}}}{C_{n_{dr}} C_{l_{da}} - C_{n_{da}} C_{l_{dr}}}$$

$$\Rightarrow \delta a' = -11,93$$

$$\phi_1' = \arcsin \left\{ \frac{\rho_a S V_e^2 \beta_e}{2m g} \left\{ C_{y\beta} + \left[ (C_{l\beta} C_{n_{da}} - C_{n\beta} C_{l_{da}}) C_{y_{dr}} + (C_{n\beta} C_{l_{dr}} - C_{l\beta} C_{n_{dr}}) C_{y_{da}} \right] \right. \right. \\ \left. \left. \times \frac{1}{C_{n_{dr}} C_{l_{da}} - C_{n_{da}} C_{l_{dr}}} \right\} \right\}$$

$$\phi_1' = 6.18^\circ$$

Example 2

Mirage (com simplificações)

$$L_r = 2,11^\circ$$

$$L_a = -0,16^\circ$$

$$\varphi_\perp = 7,17^\circ$$

Mirage (sem simplificações)

$$L_r' = 2,11^\circ$$

$$L_a' = -0,0039^\circ$$

$$\varphi_\perp' = 7,17^\circ$$