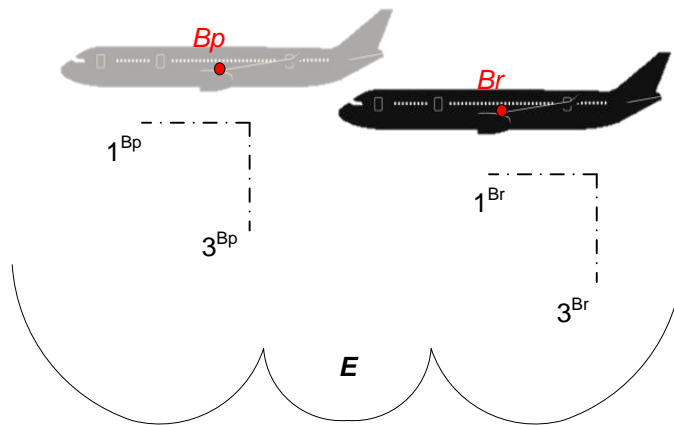


# Assignments

## Modeling Flight Dynamics with Tensors

### Lecture 10

#### Problem 1 Comparison of Perturbations



While an aircraft with c.m.  $B_r$  flies in a steady horizontal flight with  $\overline{[v_{B_r}^E]}^{B_r} = [V_r \ 0 \ 0]$ , its velocity is perturbed by a vertical gust  $\overline{[\Delta v]}^{B_p} = [0 \ 0 \ -\Delta V]$ . Express the perturbed flight both in total and component perturbations.

#### Problem 2 Aerodynamic Perturbations

The aerodynamic forces and moments are given in body coordinates:

$\overline{[f_a]}^B = [X \ Y \ Z]$ ,  $\overline{[m_a]}^B = [L \ M \ N]$ . Use the functional perturbation of Slide 6 to express the force and moment perturbations in component form.

#### Problem 3 Neglecting Terms of Small Order

On Slide 8, before the tensor forms of the translational and attitude equations-of-motion are converted to matrices, the equations have been simplified -- not shown -- by neglecting small terms of order two  $\mathcal{O}^2$ . You are to find these terms and justify their being neglected.