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LINEAR VS NON-LINEAR AEROELASTIC ANALYSIS OF HIGH ASPECT-RATIO WINGS

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A current trend in the aeronautic industry is the increase of wing aspect-ratio to enhance aerodynamic efficiency by reducing the induced drag and thus designing a greener aircraft. Despite the associated benefits of increasing the wing's aspect-ratio, such as higher lift-to-drag ratios and ranges, the commercial jets usually have relatively low aspect-ratios. This is mainly explained by the fact that the wing becomes more flexible by increasing the aspect-ratio and thus more prone to high deflections which can cause aeroelastic instability problems, e.g., flutter.

The aerospace group at IST is developing a Fluid-Structure Interaction (FSI) software able to analyse wings with high aspect-ratio. For this work, a very simple rectangular wing model is employed, with a NACA0012 aerofoil. Different aspect-ratio wings are analysed with linear and non-linear static aeroelastic solvers. In the end, the flutter speed boundary is assessed for each aspect-ratio wing analysed at the linear or non-linear equilibrium deformed state. Comparisons will be performed between linear and non-linear displacements, natural frequencies and flutter boundary.