Optimisation of postbuckling composite aerostructures

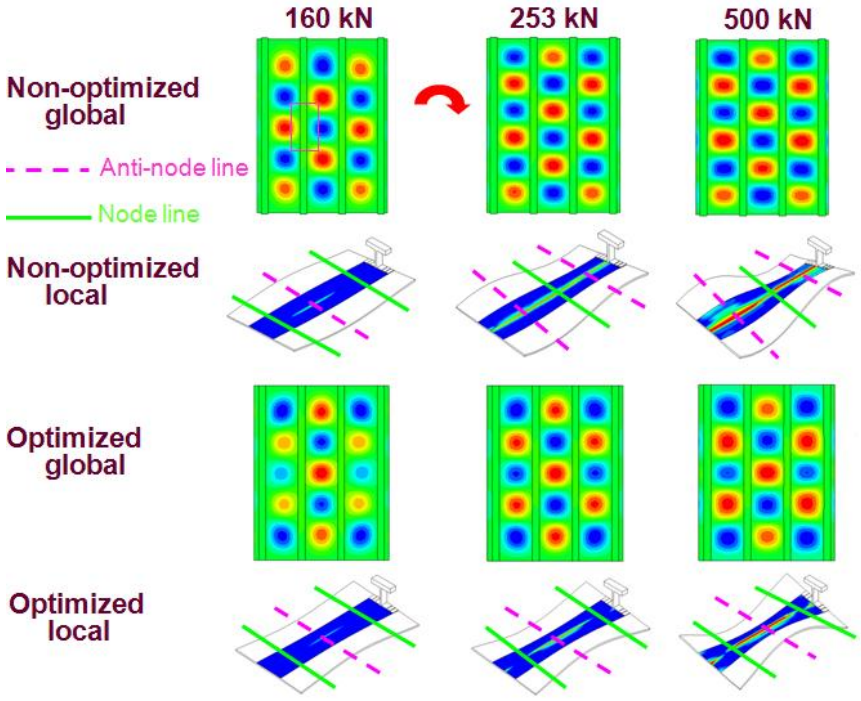
Supervisor: Prof Brian G. Falzon

Background

A major distinction between designing a metallic aircraft structure and a composite one is that the latter invariably entails designing the material concurrently with the structure. This presents unique challenges and opportunities in the optimisation of composite structures. Moreover, significantly lighter composite aerostructures may be developed by allowing certain components to operate in a postbuckled state. Previous work, by the group, in this area has investigated the structural integrity of postbuckling composite structures and the feasibility of optimising the lay-up of a stiffened panel to delay the onset of damage by skin-stiffener separation.

Proposed Reseach

The primary objective of this project is to explore multi-objective optimisation of postbuckling composite aerostructures using finite element methods and genetic algorithms. The optimisation methodology will be extended to include a comprehensive topological design space where thickness variations and changes in local structural features will be explored. This may lead to novel structural shapes which differ significantly from current designs. This work will also consider the geometric and material imperfection sensitivity of optimised structures and their response to load perturbations.



A comparison between an optimised and non-optimised postbuckled panel showing the extent of skin-stiffener joint damage [Faggiani & Falzon 2007].