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BRAZIER LOADS IN AEROELASTIC TOPOLOGY OPTIMIZATION

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The aim of this study is to investigate how to include Brazier loads in aeroelastic topology optimization of aircraft wings and observe the effect on the optimal design. The application of topology optimization to aircraft wing design promises significant benefits in reduced mass and increased fuel-efficiency. Several studies have investigated how topology optimization can be applied to improve aircraft wing design. However, for practical applications it is clear that a realistic 3D structural model is required and that the aeroelastic coupling between aerodynamic loads and structural deformation should be included during analysis and optimization [1]. Furthermore, aerodynamically efficient wings are characterised by being high aspect ratio and the structural deformation can be large enough that linear structural analysis does not capture the full behaviour required to obtain a practical optimal design. This is especially important to capture the nonlinear crushing effect (Brazier loads) that can be important for driving the design of internal stiffening members [2]. Thus, topology optimization for aircraft wings should include both the aeroelastic and geometrically nonlinear behaviour of the wing. However, this is expensive and approximate models exist to capture the effect. Therefore, this study will compare the results using a full nonlinear geometric analysis, with those using a simpler approximate model.

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