

Thesis proposal

Determination of critical loads for aeroplane wing optimisation

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Introduction

In order to reduce the fuel consumption of an aeroplane the weight is a significant contributor. In this work specifically the wing component is considered, even though the results should be applicable to other components as well.

In previous work a more flexible wing was investigated, which also lowers the loads exerted on the wing structure. When the interaction between the change of structure flexibility and change of external loads is being taken into account, the wing can be designed even lighter.

Critical loadcases

One of the challenges in the optimization setup is the definition of external loads. In general, the aeroplane should be able to withstand all forces it can endure during its lifetime.

In accordance with the regulations this may result in a very large numbers of situations considered leading to only very few envelope cases.

In order to save computation time usually the number of load cases taken into account for multidisciplinary optimization needs to be limited.

The purpose of this project is to investigate, when it is valid to define the set of envelope load cases based on a stiffness distribution from the previous optimization step. Are these envelope loadcases equal to the envelope loadcases for the optimised, more flexible wing design? What is the relation between a change in the stiffness matrix of the wing and the hierarchy of the loadcases?

Boundaries

The loadcases that are investigated will come from gust and manoeuvres. Other loadcases (e.g. ground loads) are not taken into account. Geometrically nonlinear effects will be neglected as the deformations are considered to be sufficiently small.