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Abstract title

Novel wing box design
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Main body of abstract

Gust loads are one of the critical load cases for commercial aircraft and have a varied effect on the structures, ranging from ride roughness up to total failure of the aircraft. The ability of an aircraft to withstand gust loads is one of the critical airworthiness requirements for certification but fatigue loading effects must also be considered. Gust alleviation research has concentrated in designing control systems to make use of control surface to alleviate the induced loading. LIDAR systems have been proposed to increase the effectiveness of the control laws. Gust alleviation systems in composite structures have concentrated in controlling the gust-induced vibration by embedding piezo-composite materials inside the composite lay-up.

The idea of using the directional property of composites for aeroelastic tailoring has been around since the 70s. However, since tailoring was demonstrated on the X-29 in the late 70s and early 80s, very few aircraft have used these directional properties to achieve beneficial aeroelastic effects. The original application was to reduce the likelihood of divergence occurring on forward-swept wings; recent applications have included weight reduction and drag reduction of composite wings. Although the new generation of commercial civil aircraft have started to use composites, they have only exploited the superior strength/weight ratio of composite materials rather than employ aeroelastic tailoring. Current composite designs can be considered to be only applied as a black metal, with the metal simply being replaced by the composite, rather than exploiting the unidirectional properties of the new materials. As with any new technology, designing with a new material brings new challenges and possibilities. Composite manufacturing does not have the same constraints as its metal equivalent, and the possibilities that this presents will be exploited here.

There are a wide range of different optimisation approaches that can be used for aeroelastic problems. Genetic algorithms have been proven to be effective for large parameter space solutions. They have been widely used as optimisation tools for a variety of problems, from plant processing system to nonlinear system identification. In the aeroelastic tailoring environment, genetic algorithms have been used to minimise the structural weight whilst satisfying a number of aeroelastic parameters such as flutter and divergence.

**Presenting author’s information**

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_Gareth Arthur Vio_