MDAO for Aerodynamic Assessment of a Morphed Wing for the Loiter Segment of a UAV Flight Mission

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In this paper a detailed overview of a framework for an optimization of a morphing wing is presented. The framework presented here aids the design process of a morphing UAV wing which includes the variety of the flight phases and morphing concepts. The framework consists of two main solvers to compute the aerodynamic assessment of the wing: a fast lowfidelity module that solves the aeroelastic problem by coupling a geometrically nonlinear structural model to a potential flow aerodynamic model and a high-fidelity CFD module for detailed RANS simulation. This framework is later applied to the optimization of a morphing UAV wing for the loiter phase of the flight. The wing described in this paper is the focus of the European Union FP7 CHANGE project.

I. Introduction

The objective of the European FP7 project CHANGE (Combined morpHing Assessment software usiNG flight Envelope data and mission based morphing prototype wing development) is to develop, build and flight-test a novel morphing Unmanned Aerial Vehicle (UAV), with the aim of performance improvement over a range of flight missions. The CHANGE wing combines telescopic span extension and retraction, as well as different leading and trailing edge systems, to actively modify both local camber and twist. A schematic of the modular wing concept is shown in Figure 1. It contains several regions: an inner fixed wing (IFW, orange regions) with different leading and trailing edge morphing devices (blue regions); and an outer morphing wing (OMW) with telescopic span and fixed cross section (green regions).

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