

Preface

This book is based on the outcome of the European Commission (EC)-funded research project “Active Control of a Flexible 2020 Aircraft” (ACFA 2020), which was conducted from 2008 to 2011. It succeeded the EC-funded research projects “Very Efficient Large Aircraft” (VELA) and “New Aircraft Concepts Research” (NACRE), which investigated concepts for a large blended wing body (BWB) commercial aircraft. The ACFA 2020 project worked out multi-objective control concepts as well as an ultra-efficient BWB predesign aircraft model for 450 passengers.

This book collects several major results from the ACFA 2020 project covering key developments in structural and dynamic modeling as well as multi-variable, multi-objective control design methods. The scope of the book covers the conceptual design as well as the modeling process to obtain a numerical simulation model and model reduction methods to obtain the basis for controller design. The second part is dedicated to control design, covering various advanced feedback and feed-forward design methods to address the multitude of arising control goals: stabilization, load alleviation, flight dynamics, and comfort. The last part comprises validation results of the proposed control concepts, especially the achieved loads alleviation and comfort aspects, and a discussion of further work and open issues.

The purpose of this book is two-fold: (i) promote the results obtained in the research project, illustrated at the considered BWB aircraft pre-design model and (ii) present the methods for modeling, control design, and optimization that have been developed. We believe that this book is a valuable source of information to both scientists and engineers active in the aerospace and control communities. It contains specific information about the problems and solutions found in the pre-design of a BWB concept and also demonstrates advanced control design methods on a complex application example.

The ACFA 2020 project answered several fundamental questions, such as the general load alleviation potential, but it was out of scope to produce a complete BWB control architecture or to conduct in-depth optimization of actuators. Therefore, several open issues remained and are addressed in the discussion and outlook.

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A Case Study

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