



Mohammad H. Sadraey

Aircraft Design

A Systems Engineering Approach

Second Edition

Aerospace Series

Editors Peter Sclabebba, Jonathan Cooper
and Allan Seabridge



WILEY

Aircraft Design A Systems Engineering Approach

Saeed Farokhi



Aircraft Design A Systems Engineering Approach:

Aircraft Design Mohammad H. Sadraey, 2012-11-20 A comprehensive approach to the air vehicle design process using the principles of systems engineering Due to the high cost and the risks associated with development complex aircraft systems have become a prime candidate for the adoption of systems engineering methodologies This book presents the entire process of aircraft design based on a systems engineering approach from conceptual design phase through to preliminary design phase and to detail design phase Presenting in one volume the methodologies behind aircraft design this book covers the components and the issues affected by design procedures The basic topics that are essential to the process such as aerodynamics flight stability and control aero structure and aircraft performance are reviewed in various chapters where required Based on these fundamentals and design requirements the author explains the design process in a holistic manner to emphasise the integration of the individual components into the overall design Throughout the book the various design options are considered and weighed against each other to give readers a practical understanding of the process overall Readers with knowledge of the fundamental concepts of aerodynamics propulsion aero structure and flight dynamics will find this book ideal to progress towards the next stage in their understanding of the topic Furthermore the broad variety of design techniques covered ensures that readers have the freedom and flexibility to satisfy the design requirements when approaching real world projects Key features Provides full coverage of the design aspects of an air vehicle including aeronautical concepts design techniques and design flowcharts Features end of chapter problems to reinforce the learning process as well as fully solved design examples at component level Includes fundamental explanations for aeronautical engineering students and practicing engineers Features a solutions manual to sample questions on the book's companion website Companion website www.wiley.com/go/sadraey

Aircraft Design Mohammad H. Sadraey, 2024-10-15 Learn the aircraft design process from a systems engineering perspective designed for both aspiring and practicing aerospace engineers Aircraft design incorporates a range of technological areas including aerodynamics flight dynamics propulsion and structure Aircraft engineering design therefore requires techniques from systems engineering to integrate the requirements from these disparate areas into a coherent whole There has never been a greater need for successful aerospace engineers to have a grasp of systems engineering and its applications in the field Aircraft Design A Systems Engineering Approach meets this need with a volume which takes the reader from conceptual design to detail design Offering a systems engineering approach that weighs the needs of different aircraft components holistically it provides readers with a practical look into the process of aircraft design Now fully updated to reflect the latest industry developments it promises to continue as an indispensable tool for modern students in the field Readers of the second edition of Aircraft Design will also find Brand new material on structural design spoiler design winglets aircraft modification and modernization and more Detailed discussion of emerging topics including all electric aircraft design VTOL aircraft design and many others Guidance on the latest FAA

requirements with a design impact Aircraft Design is ideal for senior undergraduate and graduate students interested in aircraft design advanced aircraft design and air vehicle design The book may also be of interest to mechanical industrial and systems engineers working in the aerospace sector

Aircraft Performance Mohammad H. Sadraey, 2023-07-14 Aircraft Performance An Engineering Approach Second Edition introduces flight performance analysis techniques of fixed wing air vehicles particularly heavier than aircraft It covers maximum speed absolute ceiling rate of climb range endurance turn performance and takeoff run Enabling the reader to analyze the performance and flight capabilities of an aircraft by utilizing only the aircraft weight data geometry and engine characteristics this book covers the flight performance analysis for both propeller driven and jet aircraft The second edition features new content on vertical takeoff and landing UAV launch UAV recovery use of rocket engine as the main engine range for electric aircraft electric engine endurance for electric aircraft gliding flight pull up and climb turn In addition this book includes end of chapter problems MATLAB code and examples and case studies to enhance and reinforce student understanding This book is intended for senior undergraduate aerospace students taking courses in Aircraft Performance Flight Dynamics and Flight Mechanics Instructors will be able to utilize an updated Solutions Manual and Figure Slides for their course

Electric Aircraft Dynamics Ranjan Vepa, 2020-07-29 Electric Aircraft Dynamics A Systems Engineering Approach surveys engineering sciences that underpin the dynamics control monitoring and design of electric propulsion systems for aircraft It is structured to appeal to readers with a science and engineering background and is modular in format The closely linked chapters present descriptive material and relevant mathematical modeling techniques Taken as a whole this ground breaking text equips professional and student readers with a solid foundation for advanced work in this emerging field Key Features Provides the first systems based overview of this emerging aerospace technology Surveys low weight battery technologies and their use in electric aircraft propulsion Explores the design and use of plasma actuation for boundary layer and flow control Considers the integrated design of electric motor driven propellers Includes PowerPoint slides for instructors using the text for classes Dr Ranjan Vepa earned his PhD in applied mechanics from Stanford University California He currently serves as a lecturer in the School of Engineering and Material Science Queen Mary University of London where he has also been the programme director of the Avionics Programme since 2001 Dr Vepa is a member of the Royal Aeronautical Society London the Institution of Electrical and Electronic Engineers IEEE New York a Fellow of the Higher Education Academy a member of the Royal Institute of Navigation London and a chartered engineer

Design of Unmanned Aerial Systems Mohammad H. Sadraey, 2020-02-20 Provides a comprehensive introduction to the design and analysis of unmanned aircraft systems with a systems perspective Written for students and engineers who are new to the field of unmanned aerial vehicle design this book teaches the many UAV design techniques being used today and demonstrates how to apply aeronautical science concepts to their design Design of Unmanned Aerial Systems covers the design of UAVs in three sections vehicle design autopilot design and ground

systems design in a way that allows readers to fully comprehend the science behind the subject so that they can then demonstrate creativity in the application of these concepts on their own It teaches students and engineers all about UAV classifications design groups design requirements mission planning conceptual design detail design and design procedures It provides them with in depth knowledge of ground stations power systems propulsion systems automatic flight control systems guidance systems navigation systems and launch and recovery systems Students will also learn about payloads manufacturing considerations design challenges flight software microcontroller and design examples In addition the book places major emphasis on the automatic flight control systems and autopilots Provides design steps and procedures for each major component Presents several fully solved step by step examples at component level Includes numerous UAV figures images to emphasize the application of the concepts Describes real stories that stress the significance of safety in UAV design Offers various UAV configurations geometries and weight data to demonstrate the real world applications and examples Covers a variety of design techniques processes such that the designer has freedom and flexibility to satisfy the design requirements in several ways Features many end of chapter problems for readers to practice Design of Unmanned Aerial Systems is an excellent text for courses in the design of unmanned aerial vehicles at both the upper division undergraduate and beginning graduate levels

Unmanned Aircraft Design Mohammad Sadraey, 2017-09-19 This book provides fundamental principles design procedures and design tools for unmanned aerial vehicles UAVs with three sections focusing on vehicle design autopilot design and ground system design The design of manned aircraft and the design of UAVs have some similarities and some differences They include the design process constraints e g g load pressurization and UAV main components autopilot ground station communication sensors and payload A UAV designer must be aware of the latest UAV developments current technologies know lessons learned from past failures and they should appreciate the breadth of UAV design options The contribution of unmanned aircraft continues to expand every day and over 20 countries are developing and employing UAVs for both military and scientific purposes A UAV system is much more than a reusable air vehicle or vehicles UAVs are air vehicles they fly like airplanes and operate in an airplane environment They are designed like air vehicles they have to meet flight critical air vehicle requirements A designer needs to know how to integrate complex multi disciplinary systems and to understand the environment the requirements and the design challenges and this book is an excellent overview of the fundamentals from an engineering perspective This book is meant to meet the needs of newcomers into the world of UAVs The materials are intended to provide enough information in each area and illustrate how they all play together to support the design of a complete UAV Therefore this book can be used both as a reference for engineers entering the field or as a supplementary text for a UAV design course to provide system level context for each specialized topic

Design of Unmanned Aerial Systems Mohammad H. Sadraey, 2020-04-13 Provides a comprehensive introduction to the design and analysis of unmanned aircraft systems with a systems perspective Written for students and engineers who are

new to the field of unmanned aerial vehicle design this book teaches the many UAV design techniques being used today and demonstrates how to apply aeronautical science concepts to their design Design of Unmanned Aerial Systems covers the design of UAVs in three sections vehicle design autopilot design and ground systems design in a way that allows readers to fully comprehend the science behind the subject so that they can then demonstrate creativity in the application of these concepts on their own It teaches students and engineers all about UAV classifications design groups design requirements mission planning conceptual design detail design and design procedures It provides them with in depth knowledge of ground stations power systems propulsion systems automatic flight control systems guidance systems navigation systems and launch and recovery systems Students will also learn about payloads manufacturing considerations design challenges flight software microcontroller and design examples In addition the book places major emphasis on the automatic flight control systems and autopilots Provides design steps and procedures for each major component Presents several fully solved step by step examples at component level Includes numerous UAV figures images to emphasize the application of the concepts Describes real stories that stress the significance of safety in UAV design Offers various UAV configurations geometries and weight data to demonstrate the real world applications and examples Covers a variety of design techniques processes such that the designer has freedom and flexibility to satisfy the design requirements in several ways Features many end of chapter problems for readers to practice Design of Unmanned Aerial Systems is an excellent text for courses in the design of unmanned aerial vehicles at both the upper division undergraduate and beginning graduate levels

Future Propulsion Systems and Energy Sources in Sustainable Aviation Saeed Farokhi, 2020-01-21 A comprehensive review of the science and engineering behind future propulsion systems and energy sources in sustainable aviation Future Propulsion Systems and Energy Sources in Sustainable Aviation is a comprehensive reference that offers a review of the science and engineering principles that underpin the concepts of propulsion systems and energy sources in sustainable air transportation The author a noted expert in the field examines the impact of air transportation on the environment and reviews alternative jet fuels hybrid electric and nuclear propulsion and power He also explores modern propulsion for transonic and supersonic hypersonic aircraft and the impact of propulsion on aircraft design Climate change is the main driver for the new technology development in sustainable air transportation The book contains critical review of gas turbine propulsion and aircraft aerodynamics followed by an insightful presentation of the aviation impact on environment Future fuels and energy sources are introduced in a separate chapter Promising technologies in propulsion and energy sources are identified leading to pathways to sustainable aviation To facilitate the utility of the subject the book is accompanied by a website that contains illustrations and equation files This important book Contains a comprehensive reference to the science and engineering behind propulsion and power in sustainable air transportation Examines the impact of air transportation on the environment Covers alternative jet fuels and hybrid electric propulsion and power Discusses modern propulsion for transonic supersonic

and hypersonic aircraft Examines the impact of propulsion system integration on aircraft design Written for engineers graduate and senior undergraduate students in mechanical and aerospace engineering Future Propulsion Systems and Energy Sources in Sustainable Aviation explores the future of aviation with a guide to sustainable air transportation that includes alternative jet fuels hybrid electric propulsion all electric and nuclear propulsion *Systems Engineering for Aerospace* Richard Sheng, 2019-02-23 *Systems Engineering for Aerospace* A Practical Approach applies insights gained from systems engineering to real world industry problems The book describes how to measure and manage an aircraft program from start to finish It helps readers determine input process and output requirements from planning to testing Readers will learn how to simplify design through production and acquire a lifecycle strategy using Integrated Master Plan Schedule IMP IMS The book directly addresses improved aircraft system design tools and processes which when implemented contribute to simpler lower cost and safer airplanes The book helps the reader understand how a product should be designed identifying the customer's requirements considering all possible components of an integrated master plan and executing according to the plan with an integrated master schedule The author demonstrates that systems engineering offers a means for aircraft companies to become more effective and profitable Describes how to measure and manage an aircraft program Instructs on how to determine essential input process and output requirements Teaches how to simplify the design process thus allowing for increased profit Provides a lifecycle strategy using Integrated Master Plan Schedule IMP IMS Identifies cost driver influences on people products and processes **Unmanned Aircraft Design** Mohammad H. Sadraey, 2024-09-07 This book provides fundamental principles design procedures and design tools for unmanned aerial vehicles UAVs with three sections focusing on vehicle design autopilot design and ground system design The design of manned aircraft and the design of UAVs have some similarities and some differences They include the design process constraints e.g. load pressurization and UAV main components autopilot ground station communications system sensors and payload A UAV designer must be aware of the latest UAV developments current technologies know lessons learned from past failures and they should appreciate the breadth of UAV design options The contribution of unmanned aircraft continues to expand every day and over 67 countries are developing and employing UAVs for both military and civil scientific purposes A UAV system is much more than a reusable air vehicle or vehicles UAVs are air vehicles they fly like airplanes and operate in an airplane environment They are designed like air vehicles they have to meet critical air vehicle requirements A designer needs to know how to integrate complex multi disciplinary systems and to understand the environment the requirements and the design challenges and this book is an excellent overview of the fundamentals from an engineering perspective This book is meant to meet the needs of newcomers into the world of UAVs The materials are intended to provide enough information in each area and illustrate how they all play together to support the design of a complete UAV Therefore this book can be used both as a reference for engineers entering the field or as a supplementary text for a UAV design course to provide system level context for each

specialized topic The second edition is extensively revised Some of the new terminologies concepts and specific unmanned aircraft systems are introduced The revisions make the book clearer and easier to understand and will add number of new subjects in areas that have become more prominent in the unmanned aviation world

Sustainable Aviation Technology and Operations Roberto Sabatini,Alessandro Gardi,2023-09-06 Sustainable Aviation Technology and Operations Comprehensively covers research and development initiatives to enhance the environmental sustainability of the aviation sector Sustainable Aviation Technology and Operations provides a comprehensive and timely outlook of recent research advances in aeronautics and air transport with emphasis on both long term sustainable development goals and current achievements This book discusses some of the most promising advances in aircraft technologies air traffic management and systems engineering methodologies for sustainable aviation The topics covered include propulsion aerodynamics avionics structures materials airspace management biofuels and sustainable lifecycle management The physical processes associated with various aircraft emissions including air pollutants noise and contrails are presented to support the development of computational models for aircraft design flight path optimization and environmental impact assessment Relevant advances in systems engineering and lifecycle management processes are also covered bridging some of the existing gaps between academic research and industry best practices A collection of research case studies complements the book highlighting opportunities for a timely uptake of the most promising technologies towards a more efficient and environmentally sustainable aviation future Key features Contains important research and industry relevant contributions from world class experts Addresses recent advances in aviation sustainability including multidisciplinary design approaches and multi objective operational optimisation methods Includes a number of research case studies addressing propulsion aerostructures alternative aviation fuels avionics air traffic management and sustainable lifecycle management solutions Sustainable Aviation Technology and Operations is an excellent book for aerospace engineers aviation scientists researchers and graduate students involved in the field

Systems Approach to the Design of Commercial Aircraft Scott Jackson,Ricardo Moraes dos Santos,2020-09-01 While aviation fatalities have thankfully fallen dramatically in recent years the phenomena of complexity and cognitive bias have been shown to be factors in many accidents An understanding of these phenomena promises to bring the fatality rate even lower and a deeper understanding of commercial aircraft in the context of systems engineering will contribute to that trend Systems Approach to the Design of Commercial Aircraft describes commercial aircraft from an advanced systems point of view addressing complexity cybersecurity and systems architecting In addition it provides an explanation of systems engineering describes how systems engineering forms a framework for commercial aircraft covers how systems engineering and systems architecting relate to commercial aircraft addresses complexity and shows how humans fit into systems engineering and the importance for commercial aircraft It goes onto present how cybersecurity plays an important role in the mix and how human interface fits in The readership includes

designers of aircraft manufacturers researchers systems engineers and students Scott Jackson is a fellow of the International Council on Systems Engineering INCOSE and the author of Systems Engineering for Commercial Aircraft 1997 and 2015 in English and Chinese Ricardo Moraes dos Santos is a senior systems engineer at EMBRAER S A and an INCOSE Brazil chapter director He works with Architecting process Corporate and is head of Cybersecurity and Safety STPA Applications at EMBRAER S A

AIAA Aircraft Design Systems and Operations Meeting: 93-3970 - 93-4023 (93-4735) ,1993

Space Architecture Education for Engineers and Architects Sandra Häuplik-Meusburger, Olga Bannova, 2016-03-30 This book considers two key educational tools for future generations of professionals with a space architecture background in the 21st century 1 introducing the discipline of space architecture into the space system engineering curricula and 2 developing space architecture as a distinct complete training curriculum Professionals educated this way will help shift focus from solely engineering driven transportation systems and sortie missions towards permanent off world human presence The architectural training teaches young professionals to operate at all scales from the overall picture down to the smallest details to provide directive intention not just analysis to design opportunities to address the relationship between human behavior and the built environment and to interact with many diverse fields and disciplines throughout the project lifecycle This book will benefit individuals and organizations responsible for planning transportation and habitat systems in space while also providing detailed information on work and design processes for architects and engineers

A Model-Based Systems Engineering Approach for Efficient System Architecture Representation in Conceptual Design Andrew Kingsley Jeyaraj, 2019 The reduction of the environmental footprint of aviation requires the development of more efficient aircraft Emergent technologies in aircraft systems such as more electrical aircraft are potential enablers for the next generation of aircraft To support the adoption of these new technologies and to tackle the underlying integration challenges aircraft system architectures need to be considered earlier in the aircraft design process specifically within the conceptual design stage To deal with the complexity and to make the system architecture development process more efficient and effective a key enabler is to improve the representation of system architectures early in the design process Introducing better architecture representations removes ambiguity and allows engineers to develop a shared understanding of the system Model Based Systems Engineering MBSE has emerged as a systematic methodology to address complexity in systems design and overcome the drawbacks of the traditional paper based systems engineering approach used in aircraft development This thesis investigates the use of the ARCADIA Capella MBSE environment for the representation and specification of aircraft systems architecture in conceptual design This thesis includes survey on the needs for system architecture representations in conceptual design A methodology is developed within Capella to create architecture representations that are suitable for use in conceptual design The primary flight control systems PFCS which by extension also includes the associated power systems is selected to illustrate the proposed methodology The proposed methodology consists of capturing architectural features

such as interfaces exchanges and variability A catalog of modelling artifacts representing the various flight control actuation technologies at system level logical and physical level has been developed These elements can be combined to define any primary flight control system architecture The model based specification addresses the need to define rapidly many architecture variants for conventional and more electrical technologies The developed methodology is applicable to other aircraft systems Overall this work is an initial step towards introducing MBSE earlier in the aircraft development process thereby making it more efficient and responsive to the emerging needs of aircraft development

An Introductory Guide to EC Competition Law and Practice Valentine Korah,1994 *Automatic Flight Control Systems* Mohammad

Sadraey,2022-05-31 This book provides readers with a design approach to the automatic flight control systems AFCS The AFCS is the primary on board tool for long flight operations and is the foundation for the airspace modernization initiatives In this text AFCS and autopilot are employed interchangeably It presents fundamentals of AFCS autopilot including primary subsystems dynamic modeling AFCS categories functions modes servos actuators measurement devices requirements functional block diagrams design techniques and control laws The book consists of six chapters The first two chapters cover the fundamentals of AFCS and closed loop control systems in manned and unmanned aircraft The last four chapters present features of Attitude control systems Hold functions Flight path control systems Navigation functions Stability augmentation systems and Command augmentation systems respectively *NASA SP.* ,1989 *Aerospace America* ,2005

Aeronautical Engineering ,1992 A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in Scientific and technical aerospace reports STAR and International aerospace abstracts IAA

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