Electric Flight Potential And Limitations

Aircraft Design

Hybrid Energy Systems: Strategy for Industrial Decarbonization demonstrates how hybrid energy and processes can decarbonize energy needs for power and heating and cooling. It describes the role of hybrid energy technologies in major industry sectors and discusses how hybrid energy systems offer sustainable solutions in each. It also surveys low-weight battery technologies and their use in electric aircraft propulsion. Includes PowerPoint slides for instructors using the text for classes. Dr. Ranjan Vepa earned his PhD in applied mechanics from Stanford University in 2005 and is currently a member of the Royal Institute of Navigation, London; and a chartered engineer.

New Results in Numerical and Experimental Fluid Mechanics XIII

The primary human activities that release carbon dioxide (CO2) into the atmosphere are the combustion of fossil fuels (coal, natural gas, and oil) to generate electricity, the provision of energy for transport, and as a consequence of some industrial processes. Although aviation CO2 emissions only make up approximately 2.0 to 2.5 percent of total global annual CO2 emissions, research to reduce CO2 emissions is urgent because (1) such reductions may be legislated even as commercial air travel grows, (2) because it takes new technology a long time to propagate into and through the aviation fleet, and (3) because of the ongoing impact of global CO2 emissions. Commercial Aircraft Propulsion and Energy Systems Research develops a national research agenda for reducing CO2 emissions from commercial aviation. This report focuses on propulsion and energy technologies for reducing carbon emissions from large, commercial aircraft and single-aisle and twin-aisle aircraft that carry 100 or more passengers. Because such aircraft account for more than 90 percent of global emissions from commercial aircraft. Moreover, while smaller aircraft also emit CO2, they make only a minor contribution to global emissions, and many technologies that reduce CO2 emissions for large aircraft also apply to smaller aircraft. As commercial aviation continues to grow in terms of revenue-passenger miles and cargo ton miles, CO2 emissions are expected to increase. To reduce the contribution of aviation to climate change, it is essential to improve the effectiveness of ongoing efforts to reduce emissions and initiate research into new approaches.

Electric Aircraft Dynamics

Electric Aircraft Design: 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 groundbreaking 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 long-life battery technologies and their use in electric aircraft propulsion Explores the design and use of plasma actuators for boundary layer flow control Considers the integrated design of electric motor-driven propellers Includes PowerPoint slides for instructors using the text for classes

Hybrid Energy Systems

Advancing Aerial Mobility

New Results in Numerical and Experimental Fluid Mechanics XII

This book presents the proceedings of the IDEAS Conference, which is intended as a forum for a new generation of researchers. IDEAS is an arena that encourages researchers to defy their field's boundaries, leveraging disciplinary mindsets into contributions to broad domains within the Science, Technology, Engineering, Entrepreneurship, and Management. Further, IDEAS explores novel questions and challenges existing policies and practices on how to apply science and technology as an input to design more innovative and sustainable systems that promote human well-being.

Training to Fly - Military Flight Training 1907-1945

Journalist Walls grew up with parents whose ideals and stubborn nonconformity were their curse and their salvation. Rex and Rose Mary and their four children lived like nomads, moving among Southwest desert towns, camping in mountains. Rex was a charismatic, brilliant man who, when sober, captured his children's imagination, teaching them how to embrace life fearlessly. Rose Mary painted and wrote and couldn't stand the responsibility of providing for her family. When the money ran out, the Walls retreated to the dismal West Virginia mining town Rex had tried to escape. As the dysfunction escalated, the children had to fend for themselves, supporting one another as they found the resources and will to leave home. Yet Walls describes her parents with deep affection in this tale of unconditional love in a family that, despite its profound flaws, gave her the fiery determination to carve out a successful life. — From publisher description.

New Materials for Next-Generation Commercial Transports

In the last few decades, electric drives have found their place in a considerable number of diverse applications. They are successfully replacing some other traditional types of drives owing to their better performance and excellent controllability. The introduction of electric drives is in most cases also beneficial from the ecological point of view as they are not directly dependent on fossil fuels and an increasing part of electric energy they consume is generated in renewable energy sources. This book focuses on applications of electric drives that emerged only recently and/or novel aspects that appear in them. Particular attention is given to using electric drives in vehicles, aircraft, non-road mobile machinery, and HVAC systems.

Proceedings of IDEAS 2019

This book gathers contributions to the 21st biannual symposium of the German Aerospace Aerodynamics Association (STAB) and the German Society for Aeronautics and Astronautics (DGLR). The individual chapters reflect ongoing research conducted by the STAB members in the field of numerical and experimental fluid mechanics and aerodynamics, mainly for (but not limited to) aerospace applications, and cover both nationally and EC-funded projects. Special emphasis is given to collaborative research projects conducted by German scientists and engineers from universities, research-establishments and industries. By addressing the number of cutting-edge applications, together with the relevant physical and mathematics fundamentals, the book provides readers with a comprehensive overview of the current research work in the field. The book’s primary emphasis is on aerodynamic research in aeronautics and astronautics, and in ground transportation and energy as well.

Flight Physics

The control of space, aerial and underwater vehicles requires moment generation mechanisms to change their orientation. In addition to or in place of conventional moment generation actuators, internally moving-mass actuation has been proposed and/or used for such vehicles. The primary principle for mass-actuation is to reposition gravitational force to change the associated moment while the secondary effect may come from the inertial force due to the motion of the masses. Recent development/miniarization in flight control sensor, computing and actuation, and electric motors and expansion of applications for small UAV (Unmanned Aerial Vehicles) offer a potential for implementation of internal mass-actuation in small UAV. The mass-actuation offers various advantages over the conventional mechanisms in airplane flight such as reduced drag and lift loss due to aerodynamic control surface deflections, simplified wing and tail design, improved lift-generation performance of wing, smaller radar signature for stealth aircraft. This dissertation research investigates the feasibility and benefit of mass-actuation of a small UAV in various flight phases and full missions consisting of all these flight phases and transitions between them. A current configuration of the same airplane equipped with conventional control surfaces and conventional airframe with three standard aerodynamic control surfaces, aileron, elevator and rudder, (2) aero-actuated, a mass acting along the fuselage to mainly generate pitching moment, and another mass moving along the wing to generate rolling moment, and (3) mass-rubber actuated, mass-actuation as in case-2 augmented with a rubber. The airplane is an electric powered and has a single propeller at the nose. A full 6-DOF (Degrees of Freedom) nonlinear equations of motion are derived, including the terms modeling internal mass motion, internal mass moment, and the effect of this internal mass motion on the variation of the center of mass and inertia matrix. One dynamics of the electric motor of the propeller and the servos of the actuators are also modeled. The effect of the propeller on the dynamics of the airplane is also included. Modeling also includes electric power consumption by the electric motor driving the propeller, and servos of the aerodynamic and mass actuators. An integrated simulation environment is developed that includes all these factors and can be switched between the different configurations defined above. Trim analyses of all three configurations of the airplane are carried out in all four flight conditions (steady climb, cruise, steady turn, steady descent). Trim analysis consider all the constraints of the control and state variables such as limits on the deflections of the aerodynamic surfaces, position of the mass actuators, battery provided voltage, and angle of attack. These analyses demonstrate the feasibility of flying the airplane with mass-actuation only within varying speed ranges depending on the actuation mechanism. The results also show the benefit of mass-actuation over the conventional aero-actuation in terms of range and endurance especially in cruise flight, as compared to the other two configurations. In the second phase of the research, controllability of the airplane with each actuation mechanism is determined and compared over the feasible speed range of each trim condition. A new relative controllability metrics is defined and calculated for this purpose. This analysis, based on the above trimmed model of the aircraft in each trim flight condition, show that the mass-actuation provides full controllability with various degree over the speed ranges. Once the controllability is verified, an LQR-based gain scheduling controller is designed for each aircraft configuration to track commanded climb/decent rate, altitude, airspeed, and turn rate. These controllers are implemented in the integrated simulation environment to simulate various flight profiles including full trim missions that start with a hand-launch of the airplane, climb to a specified altitude, and cruise at that altitude with various commanded speed, and loiter with commanded left and right turn rates, and descend to land with varying approach speed. These simulations also demonstrate the feasibility potential benefits, and/or limitations of mass actuation.

Physics of Electric Propulsion

Prepared at the request of NASA, Aeronautical Technologies for the Twenty-First Century presents steps to help prevent the erosion of U.S. dominance in the global aeronautics market. The book recommends the immediate expansion of research on advanced aircraft that travel at subsonic speeds and research on designs that will meet expected future demands for supersonic and short-haul aircraft, including helicopters, unmanned aircraft, "tiltrotor," and other advanced vehicle designs. These recommendations are intended to address the needs of improved aircraft performance, greater capacity to handle passengers and cargo, lower cost and increased convenience of air travel, greater aircraft and air traffic management system safety, and reduced environmental impacts.
As recently as the summer of 2001, many travelers were dreading air transportation because of extensive delays associated with undercapacity of the system. That all changed on 9/11, and demand for air transportation has not yet returned to peak levels. Most U.S. airlines continue to struggle for survival, and some have filed for bankruptcy. The situation makes it difficult to argue that strong action is urgently needed to avert a crisis of undercapacity in the air transportation system. This report assesses the visions and goals for U.S. civil aviation and technology goals for the year 2050.

The Airliner Cabin Environment and the Health of Passengers and Crew

Improving the Continued Airworthiness of Civil Aircraft

The Federal Aviation Administration’s Airplane Flying Handbook provides pilots, student pilots, aviation instructors, and aviation specialists with information on every topic needed to qualify for and excel in the field of aviation. Topics covered include: ground operations, cockpit management, the four fundamentals of flying, integrated flight control, slow flights, stalls, spins, takeoff, ground reference maneuvers, night operations, and much more. The Airplane Flying Handbook is a great study guide for current pilots and for potential pilots who are interested in applying for their first license. It is also the perfect gift for any aircraft or aeronautical buff.

Aeronautical Technologies for the Twenty-First Century

Conceptual Aircraft Design

The book focuses on the synthesis of the fundamental disciplines and practical applications involved in the investigation, description, and analysis of aircraft flight including applied aerodynamics, aircraft propulsion, flight performance, stability, and control. The book covers the aerodynamic models that describe the forces and moments on maneuvering aircraft and provides an overview of the concepts and methods used in flight dynamics. Computational methods are widely used by the practicing aerodynamicist, and the book covers computational fluid dynamics techniques used to improve understanding of the physical models that underlie computational methods.

Aerospace power in the twenty-first century a basic primer

The book addresses all major aspects to be considered for the design and operation of aircrafts within the entire transportation chain. It provides the basic information about the legal environment, which defines the basic requirements for aircraft design and aircraft operation. The interactions between airport, air traffic management and the airlines are described. The market forecast methods and the aircraft development process are explained to understand the very complex and risky business of an aircraft manufacturer. The principles of flight physics as basis for aircraft design are presented and linked to the operational and legal aspects of air transport including all environmental impacts. The book is written for graduate students as well as for engineers and experts, who are working in aerospace industry, at airports or in the domain of transport and logistics.

Aircraft Year Book

Throughout most of the twentieth century, electric propulsion was considered the technology of the future. Now, the future has arrived. This important new book explains the fundamentals of electric propulsion for spacecraft and describes in detail the physics and characteristics of the two major electric thrusters in use today, ion and Hall thrusters. The authors provide an introduction to plasma physics in order to allow readers to understand the models and derivations used in determining electric thruster performance. They then go on to present detailed explanations of: Thruster principles Ion thruster plasma generators and accelerator grids Hollow cathode Hall thrusters Ion and Hall thruster plumes Flight Ion and Hall thrusters Based largely on research and development performed at the Jet Propulsion Laboratory (JPL) and complemented with scores of tables, figures, homework problems, and references, Fundamentals of Electric Propulsion: Ion and Hall Thrusters is an indispensable textbook for advanced undergraduate and graduate students who are preparing to enter the aerospace industry. It also serves as an equally valuable resource for professional engineers already at work in the field.

Commercial Aircraft Propulsion and Energy Systems Research

This book offers timely insights into research on numerical and experimental fluid mechanics and aerodynamics, mainly for (but not limited to) aerospace applications. It reports on findings by members of the SAB (German Aerospace Aerodynamics Association) and DGLR (German Society for Aeronautics and Astronautics) and covers both nationally and EC-funded projects. Continuing on the tradition of the previous volumes, the book highlights innovative solutions, promoting translation from fundamental research to industrial applications. It addresses academics and professionals in the field of aeronautics, astronautics, ground transportation, and energy alike.

Lightning Protection of Aircraft

The origin of Aerodynamic Design of Transport Aircraft stems from the time when the author was appointed part-time professor in the Aerospace Faculty of Delft University of Technology. At the time his main activities were those of leading the departments of Aerodynamics, Performance and Preliminary Design at Fokker Aircraft Company. The groundwork for this book started in 1987 as a series of lecture notes consisting mainly of pictorial material with a minimum of English explanatory text. After the demise of Fokker in 1996 one feared that interest in aeronautical engineering would strongly diminish. As a result of this, the course was discontinued and the relationship between the author and the faculty came to an end. Two years later the situation was reappraised, and the interest in aeronautical engineering remained, so the course was reinstalled with a former Fokker colleague Ronald Slingerland as lecturer. The lecture notes from these courses form the foundation of this publication.

Powered Parachute Flying Handbook (FAA-H-8083-29)

Green Aviation is the first authoritative overview of both engineering and operational measures to mitigate the environmental impact of aviation. It addresses the current status of measures to reduce the environmental impact of air travel. The chapters cover such items as: Engineering and technology-related subjects (aerodynamics, engines, fuels, structures, etc.), Operations (air traffic management and infrastructure) Policy and regulatory aspects regarding atmospheric and noise pollution. With contributions from leading experts, this volume is intended to be a valuable addition, and useful resource, for aerospace manufacturers and suppliers, governmental and industrial aerospace research establishments, airline and aviation industries, university engineering and science departments, and industry analysts, consultants, and researchers.
Environmental Impacts of Wind-Energy Projects

The major objective of this book was to identify issues related to the introduction of new materials and the effects that advanced materials will have on the durability and technical risk of future civil aircraft throughout their service life. The committee investigated the new materials and structural concepts that are likely to be incorporated into next generation commercial aircraft and the factors influencing application decisions. Based on these predictions, the committee attempted to identify the design, characterization, monitoring, and maintenance issues that are critical for the introduction of advanced materials and structural concepts into future aircraft.

Distributed Propulsion Technology

General Aviation Aircraft Design, Second Edition, continues to be the engineer's best source for answers to realistic aircraft design questions. The book has been expanded to provide design guidance for additional classes of aircraft, including seaplanes, biplanes, UAV, high-speed business jets, and electric airplanes. In addition to conventional powerplants, design guidance for battery systems, electric motors, and complete electric powertrains is offered. The second edition contains new chapters: Thrust Modeling for Gas Turbines Longitudinal Stability and Control Lateral and Directional Stability and Control These new chapters offer multiple practical methods to simplify the estimation of stability derivatives and introduce hinge moments and basic control system design. Furthermore, all chapters have been reorganized and feature updated material with additional analysis methods. This edition also provides an introduction to design optimization using a wing optimization as an example for the beginner. Written by an engineer with more than 20 years of design experience, professional engineers, aircraft designers, aerodynamicists, structural analysts, performance analysts, researchers, and aerospace engineering students will value the book as the classic go-to for aircraft design. The printed book is now in color, with 1001 figures and illustrations! Presents the most common methods for conceptual aircraft design Clear presentation splits text into shaded regions, separating engineering topics from mathematical derivations and examples Design topics range from the "new" 14 CFR Part 23 to analysis of ducted fans. All chapters contain material with practical analysis methods. Many chapters have been reorganized for further help. Introduction to design optimization is provided using a wing optimization as an example for the beginner. Three new chapters are offered, two of which focus on stability and control. These offer multiple practical methods to simplify the estimation of stability derivatives. The chapters introduce hinge moments and basic control system design. Real-world examples using aircraft such as the Cirrus SR-22 and Learjet 45

Securing the Future of U.S. Air Transportation

The generation of electricity by wind energy has the potential to reduce environmental impacts caused by the use of fossil fuels. Although the use of wind energy to generate electricity is increasing rapidly in the United States, government guidance to help communities and developers evaluate and plan proposed wind-energy projects is lacking. Environmental Impacts of Wind-Energy Projects offers an analysis of the environmental benefits and drawbacks of wind energy, along with an evaluation guide to aid decision-making about projects. It includes a case study of the mid-Atlantic highlands, a mountainous area that spans parts of West Virginia, Virginia, Maryland, and Pennsylvania. This book will inform policy makers at the federal, state, and local levels.

The Glass Castle

The series Topics in Current Chemistry Collections presents critical reviews from the journal Topics in Current Chemistry organized in topical volumes. The scope of coverage is all areas of chemical science including the interfaces with related disciplines such as biology, medicine and materials science. The goal of each thematic volume is to give the non-specialist reader, whether in academia or industry, a comprehensive general area overview emerging which is of interest to a larger scientific audience. Each review within the volume critically surveys one aspect of that topic and places it within the context of the volume as a whole. The most significant developments of the last 5 to 10 years are presented using selected examples to illustrate the principles discussed. The coverage is not intended to be an exhaustive summary of the field or include large quantities of data, but should rather be conceptual, concentrating on the methodological thinking that will allow the non-specialist reader to understand the information presented. Contributions also offer an outlook on potential future developments in the field. The chapters "Assessment of Simple Models for Molecular Simulation of Ethylene Carbonate and Propylene Carbonate as Solvents for Electrolyte Solutions" and "Elucidating Solvation Structures for Rational Design of Multivalent Electrolytes- A Review" are available open access under a CC BY 4.0 License via link.springer.com.

Modeling Electrochemical Energy Storage at the Atomic Scale

It has, improbably, been called uncommonly lucid, even riveting by The New York Times, and it was a finalist for the 2004 National Book Awards nonfiction honor. It is a literally chilling read, especially in its minute-by-minute description of the events of the morning of 9/11 inside the Twin Towers. It is The 9/11 Commission Report, which was, before its publication, perhaps one of the most anticipated government reports of all time, and has been since an unlikely bestseller. The official statement by the National Commission on Terrorist Attacks Upon the United States—which was instituted in late 2002 and chaired by former New Jersey Governor Thomas Kean—details what went wrong on that day (such as intelligence failures), what went right (the heroic response of emergency services and self-organizing civilians), and how to avert similar future attacks. Highlighting evidence from the day, from airport surveillance footage of the terrorists to phone calls from the doomed flights, and offering details that have otherwise gone unheard, this is an astonishing firsthand document of contemporary history. While controversial in parts—it has been criticized for failing to include testimony from key individuals, and it completely omits any mention of the mysterious collapse of WTC 7—it is nevertheless an essential record of one of the most transformational events of modern times.

Fundamentals of Aircraft and Airship Design

Geared toward advanced undergraduates and graduate students, this text develops the concepts of electrical acceleration of gases for propulsion, from primary physical principles to realistic space thruster designs. 1968 edition.

Uninhabited Air Vehicles

Air Transport System

From the FAA, the only handbook you need to learn to fly a powered parachute.

General Aviation Aircraft Design

As part of the national effort to improve aviation safety, the Federal Aviation Administration (FAA) charted the National Research Council to examine and recommend improvements in the aircraft certification process currently used by the FAA, manufacturers, and operators.
Aerodynamic Design of Transport Aircraft

Distributed propulsion technology is one of the revolutionary candidates for future aircraft propulsion. In this book, which serves as the very first reference book on distributed propulsion technology, the potential role of distributed propulsion technology in future aviation is investigated. Following a historical journey that revisits distributed propulsion technology in unmanned air vehicles, commercial aircrafts, and military aircrafts, features of this specific technology are highlighted in synergy with an electric aircraft concept and a first-of-its-kind comparison between commercial and military aircrafts employing distributed propulsion arrangements. In light of propulsion-airframe integration and complementary technologies, such as boundary layer ingestion, thrust vectoring and circulation control, transpired opportunities and challenges are addressed in addition to a number of identified research directions proposed for future aircrafts. Moreover, a diverse set of distributed propulsion arrangements are considered. These include: small engines, gas-driven multi-fan architectures, turboelectric systems featuring superconductive and non-superconducting electrical machine technology, and electromagnetic fans. This book features contributions by the National Aeronautics and Space Administration (NASA) and the United States Air Force (USAF), and includes the first proposed official definition for distributed propulsion technology in subsonic wing aircrafts.

Fundamentals of Electric Propulsion

Advanced aerial mobility is a newly emerging industry that aims to develop and operate new air vehicles potentially capable of safe, reliable, and low-noise vertical flight. The world has seen a recent increase in the adoption of electric vertical lift aircraft for urban, suburban and rural operations. These new innovations and technologies change the way that we move cargo and people, affecting industries across the economy. These changes will challenge today's airspace monitoring systems and regulatory environment. The U.S. government and its regulatory agencies need technical guidance to facilitate the development of these technologies, and to create the regulatory framework to foster the growth of this vertical flight industry to the benefit of the aviation industry. Advancing Aerial Mobility evaluates the potential benefits and challenges associated with this emerging industry. This report provides recommendations that seek to foster an environment in which the nation can maintain its leading position in developing, deploying, and embracing these new technologies. This publication presents a national vision for advanced aerial mobility, market evolution, and safety and security management.

Equipment Cooling Systems for Aircraft

Although poor air quality is probably not the hazard that is foremost in peoples' minds as they board planes, it has been a concern for years. Passengers have complained about dry eyes, sore throat, dizziness, headaches, and other symptoms. Flight attendants have repeatedly raised questions about the safety of the air that they breathe. The Airliner Cabin Environment and the Health of Passengers and Crew examines in detail the aircraft environmental control systems, the sources of chemical and biological contaminants in aircraft cabins, and the toxicity and health effects associated with these contaminants. The book provides some recommendations for potential approaches for improving cabin air quality and a surveillance and research program.

Propulsion Systems

The aircraft is only a transport mechanism for the payload, and all design decisions must consider payload first. Simply stated, the aircraft is a dust cover. "Fundamentals of Aircraft and Airship Design, Volume 1: Aircraft Design" emphasizes that the science and art of the aircraft design process is a compromise and that there is no right answer; however, there is always a best answer based on existing requirements and available technologies.

Airplane Flying Handbook (FAA-H-8083-3A)

Performance Analysis, Dynamic Simulation and Control of Mass-actuated Airplane

New Applications of Electric Drives

X-15

U.S. Air Force (USAF) planners have envisioned that uninhabited air vehicles (UAVs), working in concert with inhabited vehicles, will become an integral part of the future force structure. Current plans are based on the premise that UAVs have the potential to augment, or even replace, inhabited aircraft in a variety of missions. However, UAV technologies must be better understood before they will be accepted as an alternative to inhabited aircraft on the battlefield. The U.S. Air Force Office of Scientific Research (AFOSR) requested that the National Research Council, through the National Materials Advisory Board and the Aeronautics and Space Engineering Board, identify long-term research opportunities for supporting the development of technologies for UAVs. The objectives of the study were to identify technological developments that would improve the performance and reliability of "generation-after-next" UAVs at lower cost and to recommend areas of fundamental research in materials, structures, and aeronautical technologies. The study focused on innovations in technology that would "leapfrog" current technology development and would be ready for scaling-up in the post-2010 time frame (i.e., ready for use on aircraft by 2025).