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BREWER TOWNSEND

Fifth ASME Wind Energy Symposium Springer Nature
This volume contains the papers of the 11th Symposium of the AG STAB (German Aerospace Aerodynamics Association). In this association those scientists and engineers from universities, research-establishments and industry are involved, who are doing research and project work in numerical and experimental fluid mechanics and aerodynamics for aerospace and other applications. Many of the contributions are giving results from the "Luftfahrtforschungsprogramm der Bundesregierung (German Aeronautical Research Programme). Some of the papers report on work sponsored by the Deutsche Forschungsgemeinschaft, DFG, which also was presented at the symposium. The volume gives a broad overview over the ongoing work in this field in Germany.
Introduction to Wind Turbine Aerodynamics Springer Science & Business Media
Reproductions of reports, some declassified, of research done at Langley Memorial Aeronautical Laboratory during World War II. The order of reports does not represent when they were chronologically issued. Reference to the original version of each report is included.
Aerodynamic Characteristics of a Wing with Quarter-chord Line Swept Back 35©, Aspect Ratio 6, Taper Ratio 0.6, and NACA 65A006 Airfoil Section Springer Science & Business Media
This book offers an introduction to the topic for professionals and students with a diverse range of backgrounds. Wind Turbine Aerodynamics is a self-contained textbook that shows how to progress from the basics of fluid mechanics to modern wind turbine blade design. It presents the fundamentals of fluid dynamics and inflow conditions, as well as extensive information on theories describing the aerodynamics of wind turbines. After examining a number of related experiments, the book applies the lessons learned to blade design. The text of the 2nd edition has been thoroughly revised, with a focus on improved readability. The examples and solutions have been extended to explain each problem in much greater detail.
Damping-in-roll Calculations for Slender Swept-back Wings and Slender Wing-body Combinations Springer Science & Business Media
Advances in Wind Turbine Blade Design and Materials, Second Edition, builds on the thorough review of the design and functionality of wind turbine rotor blades and the requirements and challenges for composite materials used in both current and future designs of wind turbine blades. Reviews the design and functionality of wind turbine rotor blades Examines the requirements and challenges for composite materials used in both current and future designs of wind turbine blades Provides an invaluable reference for researchers and innovators in the field of wind
Aerodynamic Characteristics of a Wing with Quarter-chord Line Swept Back 45 Degrees, Aspect Ratio 4, Taper Ratio 0.3, and NACA 65A006 Airfoil Section Aero Publishers (CA)
This paper presents the results of the investigation of wing-alone and wing-fuselage combination employing a delta wing having 45 degree sweepback of the leading edge, aspect ratio 4, and an NACA 65A006 airfoil section. Lift, drag, pitching moment, and root bending moment were obtained for these configurations. In addition, effective downwash angles and dynamic-pressure characteristics in the region of a probable tail location also were obtained for these configurations, and are presented for a range of tail heights at one tail length. In order to expedite publishing of these data, only a brief analysis is included.
Advances in Wind Turbine Blade Design and Materials Elsevier
Wind energy provides an attractive power source as an alternative to fossil fuels because it is abundant, clean, and produces no harmful emissions. To extract more energy from the wind we need to increase the wind turbine size. However, the increase in size has begun to reach a limit in terms of material composition and structural stability. To quell the trend of increasing size in wind power systems alternative wind turbine blade designs are investigated and evaluated to increase power production and efficiency of present size machines. Flat back airfoils have been proposed for the inboard region of large wind turbine blades because they provide structural and aerodynamic advantages. In this work we will investigate the aerodynamic performance of flat back airfoils with computational fluid dynamics techniques. To reduce the drag and noise inherent from the blunt trailing edge, a splitter plate with varying lengths is added to the trailing edge of the airfoils. Comparisons are made with experimental data. Excellent agreement is achieved with the measurements. Our numerical simulations show that the flat back airfoil can increase lift production as much as 20%. The splitter can effectively reduce drag by as much as 20% and tonal noise by as much as 20 dB.
NASA Technical Memorandum Woodhead Publishing
This paper presents the results of an investigation to determine the control-effectiveness characteristics of 30-percent-chord flap-type control surfaces of various spans on a semispan wing-fuselage model. The wing of the mode had 35 degrees of sweepback of the quarter chord, an aspect ratio of 4.0, a taper ratio of 0.6, and an NACA 65A006 airfoil section parallel to the free stream. Lift, rolling moments, and pitching moments were obtained for several angle of attack throughout a small range of control-surface deflections. Most of the data are presented as control-effectiveness parameters which show their variation with Mach number.
Wind-tunnel Investigation at High Subsonic Speeds of the Effect of Spoiler Profile on the Lateral Control Characteristics of a Wing-fuselage Combination Winter Quarter-chord Line Swept Back 32.6© and NACA 65A006 Airfoil Section Courier Corporation
This volume contains the papers of a German symposium dealing with research and project work in numerical and experimental aerodynamics and fluidmechanics for aerospace and other applications. It gives a broad overview over the ongoing work in this field in Germany.
An Evaluation of Three Experimental Processes for Two-dimensional Transonic Tests Burrard Press
The origins of turbulent flow and the transition from laminar to turbulent flow are among the most important unsolved problems of fluid mechanics and aerodynamics. Besides being a fundamental question of fluid mechanics, there are any number of applications for information regarding transition location and the details of the subsequent turbulent flow. The JUT AM Symposium on Laminar-Turbulent Transition, co-hosted by Arizona State University and the University of Arizona, was held in Sedona, Arizona. Although four previous JUT AM Symposia bear the same appellation (Stuttgart 1979, Novosibirsk 1984, Toulouse 1989, and Sendai 1994) the topics that were emphasized at each were different and reflect the evolving nature of our understanding of the transition process. The major contributions of Stuttgart 1979 centered on nonlinear behavior and later stages of transition in two-dimensional boundary layers. Stability of closed systems was also included with Taylor vortices in different geometries. The topics of Novosibirsk 1984 shifted to resonant wave interactions and secondary instabilities in boundary layers. Pipe- and channel-flow transition were discussed as model problems for the boundary layer. Investigations of free shear layers were presented and a heavy dose of supersonic papers appeared for the first time. The character of Toulouse 1989 was also different in that 3-D boundary layers, numerical simulations, streamwise vortices, and foundation papers on receptivity were presented. Sendai 1994 saw a number of papers on swept wings and 3-D boundary layers. Numerical simulations attacked a broader range of problems.
Theory of Flight Springer Science & Business Media
This report presents results of investigation of apparent variation of centrifugal-compressor adiabatic efficiency with inlet temperature; effects of heat transfer and Reynolds number were considered.
Aeronautical Engineering Springer Science & Business Media
The damping-in-roll parameter C(iota)(p) is calculated theoretically for triangular wings on cylindrical bodies and for a class of wings with sweptback plan forms. The analysis is based on the usual assumptions of linearized compressible-flow theory together with the added restrictions that at the free-stream Mach number M(omicron) the product of lM(omicron)(2) and the streamwise velocity gradient is small.
High Performance Computing in Science and Engineering 2000
Calculation and optimisation of flight performance is required to design or select new aircraft, efficiently operate existing aircraft, and upgrade aircraft. It provides critical data for aircraft certification, accident investigation, fleet management, flight regulations and safety. This book presents an unrivalled range of advanced flight performance models for both transport and military aircraft, including the unconventional ends of the envelopes. Topics covered include the numerical solution of supersonic acceleration, transient roll, optimal climb of propeller aircraft, propeller performance, long-range flight with en-route stop, fuel planning, zero-gravity flight in the atmosphere, VSTOL operations, ski jump from aircraft carrier, optimal flight paths at subsonic and supersonic speed, range-payload analysis of fixed- and rotary wing aircraft, performance of tandem helicopters, lower-bound noise estimation, sonic boom, and more. This book will be a valuable text for undergraduate and post-graduate level students of aerospace engineering. It will also be an essential reference and resource for practicing aircraft engineers, aircraft operations managers and organizations handling air traffic control, flight and flying regulations, standards, safety, environment, and the complex financial aspects of flying aircraft. Unique coverage of fixed and rotary wing aircraft in a unified manner, including optimisation, emissions control and regulation. Ideal for students, aeronautical engineering capstone projects, and for widespread professional reference in the aerospace industry. Comprehensive coverage of computer-based solution of aerospace engineering problems; the critical analysis of performance data; and case studies from real world engineering experience. Supported by end of chapter exercises
Drag Measurements of a 34 Degree Swept-forward and Swept-back NACA 65-009 Airfoil of Aspect Ratio 2.7 as Determined by Flight Tests at Supersonic Speeds
This paper presents the results of the investigation of a wing-alone and wing-fuselage configuration employing a wing with the quarter-chord line swept back 45 degrees, with aspect ratio 4, taper ratio 0.3, and an NACA 65A006 airfoil section. Lift, drag, pitching moment, and root bending moment were obtained for these configurations. In addition, effective downwash angles and dynamic-pressure characteristics in the region of a probable tail location were also obtained for these configurations and are presented for a range of tail heights at one tail length. In order to expedite the publishing of these data, only a brief analysis is included.
Lateral-control Investigation of Flap-type Controls on a Wing with Quarter-chord Line Sweptback 35©, Aspect Ratio 4, Taper Ratio 0.6, and NACA 65A006 Airfoil Section
Many of the earliest books, particularly those dating back to the 1900s and before, are now extremely scarce and increasingly expensive. We are republishing these classic works in affordable, high quality, modern editions, using the original text and artwork.
New Results in Numerical and Experimental Fluid Mechanics III
This report presents results of flight tests conducted at the NACA Pilotless Aircraft Test Station at Wallops Island, Va., to determine the zero-lift drag of an NACA 65-009 aerofoil of aspect ratio 2.7 swept-forward 34 degrees. The data were obtained by tracking rocket-propelled winged bodies moving at

supersonic speeds. A comparison is made between the results of similar tests of an unswept and a 34 degree swept-back arrangement of a previous report, MR No. L6E17, and of this report. The test results show that for the comparable Mach number range investigated both the 34 degree swept-forward and swept-back airfoils produced lower values of zero-lift drag than the unswept airfoil. At Mach numbers between 1.0 and 1.3, the drag of the swept-back wing was about 50 percent and that of the swept-forward wing was about 65 percent of the drag of the unswept wing.

Pressure Distributions from High Reynolds Number Tests of a Boeing BAC I Airfoil in the Langley 0.3-Meter Transonic Cryogenic Tunnel

An overview of recent developments in high performance computing and simulation, with special emphasis on the industrial relevance of the presented results and methods. The book showcases an innovative combination of the state-of-the-art modeling, novel numerical algorithms and the use of leading-edge high-performance computing systems.

Wartime Report

Shape optimization is widely used in the design of wind turbine blades. In this dissertation, a numerical optimization method called Genetic Algorithm (GA) is applied to address the shape optimization of wind turbine airfoils and blades. In recent years, the airfoil sections with blunt trailing edge (called flatback airfoils) have been proposed for the inboard regions of large wind-turbine blades because they provide several structural and aerodynamic performance advantages. The FX, DU and NACA 64 series airfoils are thick airfoils widely used for wind turbine blade application. They have several advantages in meeting the intrinsic requirements for wind turbines in terms of design point, off-design capabilities and structural properties. This research employ both single- and multi-objective genetic algorithms (SOGA and MOGA) for shape optimization of Flatback, FX, DU and NACA 64 series airfoils to achieve maximum lift and/or maximum lift to drag ratio. The commercially available software FLUENT is employed for calculation of the flow field using the Reynolds-Averaged Navier-Stokes (RANS) equations in conjunction with a two-equation Shear Stress Transport (SST) turbulence model and a three equation k-kl-[omega] turbulence model. The optimization methodology is validated by an optimization study of subsonic and transonic airfoils (NACA0012 and RAE 2822 airfoils). All the optimization results have demonstrated that the GA technique can be employed efficiently and accurately to produce globally optimal airfoils with excellent aerodynamic properties using a desired objective value (minimum Cd and/or maximum Cl /Cd). It is also shown that the multi-objective genetic algorithm based optimization can generate superior airfoils compared to those obtained by using the single objective genetic algorithm. The applications of thick airfoils are extended to the assessment of wind turbine performance. It is well established that the power generated by a Horizontal-Axis Wind Turbine (HAWT) is a function of the number of blades B, the tip speed ratio [lambda] (blade tip speed/wind free stream velocity) and the lift to drag ratio (Cl /Cd) of the airfoil sections of the blade. The airfoil sections used in HAWT are generally thick airfoils such as the S, DU, FX, Flat-back and NACA 6-series of airfoils. These airfoils vary in (Cl /Cd) for a given B and [lambda], and therefore the power generated by HAWT for different blade airfoil sections will vary. Another goal of this study is to evaluate the effect of different airfoil sections on HAWT performance using the Blade Element Momentum (BEM) theory. In this dissertation, we employ DU 91-W2-250, FX 66-S196-V1, NACA 64421, and Flat-back series of airfoils (FB-3500-0050, FB-3500-0875, and FB-3500-1750) and compare their performance with S809 airfoil used in NREL Phase II and III wind turbines; the lift and drag coefficient data for these airfoils sections are available. The output power of the turbine is calculated using these airfoil section blades for a given B and [lambda] and is compared with the original NREL Phase II and Phase III turbines using S809 airfoil section. It is shown that by a suitable choice of airfoil section of HAWT blade, the power generated by the turbine can be significantly increased. Parametric studies are also conducted by varying the turbine diameter. In addition, a simplified dynamic inflow model is integrated into the BEM theory. It is shown that the improved BEM theory has superior performance in capturing the instantaneous behavior of wind turbines due to the existence of wind turbine wake or temporal variations in wind velocity. The dissertation also considers the Wind Farm layout optimization problem using a genetic algorithm. Both the Horizontal -Axis Wind Turbines (HAWT) and Vertical-Axis Wind Turbines (VAWT) are considered. The goal of the optimization problem is to optimally position the turbines within the wind farm such that the wake effects are minimized and the power production is maximized. The reasonably accurate modeling of the turbine wake is critical in determination of the optimal layout of the turbines and the power generated. For HAWT, two wake models are considered; both are found to give similar answers. For VAWT, a very simple wake model is employed. Finally, some preliminary investigation of shape optimization of 3D wind turbine blades at low Reynolds numbers is conducted. The optimization employs a 3D straight untapered wind turbine blade with cross section of NACA 0012 airfoils as the geometry of baseline blade. The optimization objective is to achieve maximum Cl /Cd as well as maximum Cl. The multi-objective genetic algorithm is employed together with the commercially available software FLUENT for calculation of the flow field using the Reynolds-Averaged Navier-Stokes (RANS) equations in conjunction with a one-equation Sparlart-Allmaras turbulence model. The results show excellent performance of the optimized wind turbine blade and indicate the feasibility of optimization on real wind turbine blades with more complex shapes in the future.

NASA SP.

Mises' classic avoids the formidable mathematical structure of fluid dynamics, while conveying — by often unorthodox methods — a full understanding of the physical phenomena and mathematical concepts of aeronautical engineering.

Flight Performance of Fixed and Rotary Wing Aircraft

The Collaborative Research Center SFB 401: Flow Modulation and Fluid-Structure Interaction at Airplane Wings investigates numerically and experimentally fundamental problems of very high capacity aircraft having large elastic wings. This issue summarizes the findings of the 12-year research program at RWTH Aachen University which was funded by the Deutsche Forschungsgemeinschaft (DFG) from 1997 through 2008. The research program covered the following three main topics of large transport aircraft: (i) Model flow, wakes, and vortices of airplanes in high-lift-configuration, (ii) Numerical tools for large scale adaptive flow simulation based on multiscale analysis and a parametric mapping concept for grid generation, and (iii) Validated computational design tools based on direct aeroelastic simulation with reduced structural models.

Government Reports Announcements & Index