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1.1.1 - Flow Field Representations

Flight Vehicle Aerodynamics -

4.2.2 - Experimental Setup - Part
1

Flight Vehicle Aerodynamics -

6.2.2 - Aircraft Equations of
Motion I

Flight Vehicle Aerodynamics -

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2.9.1 - Transition to turbulence

~~Flight Vehicle Aerodynamics~~

~~6.2.1 Aircraft Motion Description~~

Flight Vehicle Aerodynamics -

4.2.3 - Force Measurements

2. Airplane Aerodynamics

~~Flight Vehicle Aerodynamics - 2.1.1~~

~~Inviscid model validity~~

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Flight Vehicle Aerodynamics -

1.1.2 - Velocity \u0026amp; Source

Vorticity relationsFlight Vehicle

Aerodynamics - 5.4.1 - Vortex

Sheet Discretization The

Aerodynamics of Flight

The Basics of Aerodynamics

Sporty's Tip: Aerodynamics of a

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Stall Wind tunnel - Part 1 -
Aerodynamics ~~How Do Airplanes
Fly?~~ Lecture 1 Basic

Aerodynamics Sports Car

Aerodynamics: Spoiler Alert! ~~How
do Vortex Generators Work?~~ THIN

AIRFOIL THEORY || KUTTA
CONDITION || KELVIN

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CIRCULATION Measurements -
Using the Pitot Static tube and
Pressure tap with Wind Tunnel

Flight Vehicle Aerodynamics -

1.8.2 - Airfoil farfield coefficients

~~Flight Vehicle Aerodynamics -~~

~~1.3.3 - Circulation \u0026 vorticity
relations~~ Flight Vehicle

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Aerodynamics - 6.1.2 - Axis

Transformation Flight Vehicle

Aerodynamics - 5.4.4 - Vortex

Lattice Trefftz Plane Calculation

Flight Vehicle Aerodynamics -

3.4.2 - Trefftz Plane Velocities

Flight Vehicle Aerodynamics -

2.8.2 - Thwaites method Flight

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~~Vehicle Aerodynamics - 6.3.2~~

~~Aerodynamic Force Derivatives~~

Flight Vehicle Aerodynamics -

8.3.1 - Prandtl-Glauert

Transformation Flight Vehicle

Aerodynamics

To describe the motion of a
maneuvering aircraft and quantify

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its aerodynamic forces. To predict the airloads on unsteady airfoils. To estimate the effects of compressibility in high-speed aerodynamic flows. Expand what you'll learn.

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Page 12/79

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PLAYLIST: <https://tinyurl.com/FlightVehicleAerodynamics> Unit 1 Flow Field Modelling Part 1 Flow-Field Representations Lesson 1 - ...

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1.1.1 - Flow Field ...

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Page 19/79

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move from 2D vortex panel method to 3D vortex lattice method in the AVL code. By considering aircraft performance during various manouvres this approach is absolutely relevant to aircraft optimisation - even in a world where freeware CFD codes

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such as Open Foam make serious aerodynamic investigation available to projects on a limited budget.

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their sheet, filament, or point-singularity idealizations. These models provide an intuitive feel for aerodynamic flow-field behavior and are the basis of aerodynamic force analysis, drag decomposition, flow ...

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basis of these methods, and how various parameters derived from the aircraft geometry can be used to estimate the requirements of control surfaces and the aerodynamic forces required to actuate these surfaces.

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An overview of the physics,

Page 41/79

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concepts, theories, and models underlying the discipline of aerodynamics. This book offers a general overview of the physics, concepts, theories, and models underlying the discipline of aerodynamics. A particular focus is the technique of velocity field

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representation and modeling via source and vorticity fields and via their sheet, filament, or point-singularity idealizations. These models provide an intuitive feel for aerodynamic flow-field behavior and are the basis of aerodynamic force analysis, drag

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decomposition, flow interference estimation, and other important applications. The models are applied to both low speed and high speed flows. Viscous flows are also covered, with a focus on understanding boundary layer behavior and its influence on

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aerodynamic flows. The book covers some topics in depth while offering introductions and summaries of others.

Computational methods are indispensable for the practicing aerodynamicist, and the book covers several computational

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methods in detail, with a focus on vortex lattice and panel methods. The goal is to improve understanding of the physical models that underlie such methods. The book also covers the aerodynamic models that describe the forces and moments

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on maneuvering aircraft, and provides a good introduction to the concepts and methods used in flight dynamics. It also offers an introduction to unsteady flows and to the subject of wind tunnel measurements. The book is based on the MIT graduate-level course

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“Flight Vehicle Aerodynamics” and has been developed for use not only in conventional classrooms but also in a massive open online course (or MOOC) offered on the pioneering MOOC platform edX. It will also serve as a valuable reference for

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professionals in the field. The text assumes that the reader is well versed in basic physics and vector calculus, has had some exposure to basic fluid dynamics and aerodynamics, and is somewhat familiar with aerodynamics and aeronautics

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chapters that address vortices in aerodynamics, transonic and supersonic flows, transonic/supersonic aircraft configurations, and high-supersonic/hypersonic flows.

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Annotation "Flight Vehicle Performance and Aerodynamic Control is designed to serve as a text for either an 11-week or a 16-week course at the sophomore level. It explains typical methods used to estimate aircraft

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performance, the theoretical basis of these methods, and how various parameters derived from the aircraft geometry can be used to estimate the requirements of control surfaces and the aerodynamic forces required to actuate these surfaces. This book

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including those in the stochastic framework and focusing on nonlinear models, cost functions, optimization methods, and residual analysis. A pragmatic and balanced account of pros and cons in each case is provided. The book also presents data gathering

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aerodynamics, stability, and control derivatives from flight data, flight path reconstruction, nonlinearities in control surface effectiveness, stall hysteresis, unstable aircraft, and other critical considerations.

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Flight Vehicle Dynamics and Control Rama K. Yedavalli, The Ohio State University, USA A comprehensive textbook which presents flight vehicle dynamics and control in a unified

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framework Flight Vehicle Dynamics and Control presents the dynamics and control of various flight vehicles, including aircraft, spacecraft, helicopter, missiles, etc, in a unified framework. It covers the fundamental topics in the

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dynamics and control of these flight vehicles, highlighting shared points as well as differences in dynamics and control issues, making use of the 'systems level' viewpoint. The book begins with the derivation of the equations of motion for a general rigid body

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and then delineates the differences between the dynamics of various flight vehicles in a fundamental way. It then focuses on the dynamic equations with application to these various flight vehicles, concentrating more on aircraft

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and spacecraft cases. Then the control systems analysis and design is carried out both from transfer function, classical control, as well as modern, state space control points of view. Illustrative examples of application to atmospheric and

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space vehicles are presented, emphasizing the 'systems level' viewpoint of control design. Key features: Provides a comprehensive treatment of dynamics and control of various flight vehicles in a single volume. Contains worked out examples

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a solutions manual. The book is essential reading for undergraduate students in mechanical and aerospace engineering, engineers working on flight vehicle control, and researchers from other engineering backgrounds working

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on related topics.

This title reports on the latest research in the area of aerodynamic efficiency of various fixed-wing, flapping wing, and rotary wing concepts. It presents the progress made by over fifty

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active researchers in the field.

Two research activities directed at hypersonic vehicle configurations are currently underway. The first involves the validation of a number of classical local surface inclination methods

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commonly employed in preliminary design studies of hypersonic flight vehicles. Unlike studies aimed at validating such methods for predicting overall vehicle aerodynamics, this effort emphasizes validating the prediction of forces and moments

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for flight control studies. Specifically, several vehicle configurations for which experimental or flight-test data are available are being examined. By comparing the theoretical predictions with these data, the strengths and weaknesses of the

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local surface inclination methods can be ascertained and possible improvements suggested. The second research effort, of significance to control during take-off and landing of most proposed hypersonic vehicle configurations, is aimed at determining the

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change due to ground effect in control effectiveness of highly swept delta planforms. Central to this research is the development of a vortex-lattice computer program which incorporates an unforced trailing vortex sheet and an image ground plane. With this

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program, the change in pitching moment of the basic vehicle due to ground proximity, and whether or not there is sufficient control power available to trim, can be determined. In addition to the current work, two different research directions are suggested

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for future study. The first is aimed at developing an interactive computer program to assist the flight controls engineer in determining the forces and moments generated by different types of control effectors that might be used on hypersonic

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vehicles. The first phase of this work would deal in the subsonic portion of the flight envelope, while later efforts would explore the supersonic/hypersonic flight regimes. The second proposed research direction would explore methods for determining the

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aerodynamic trim drag of a
generic hypersonic flight vehicle

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