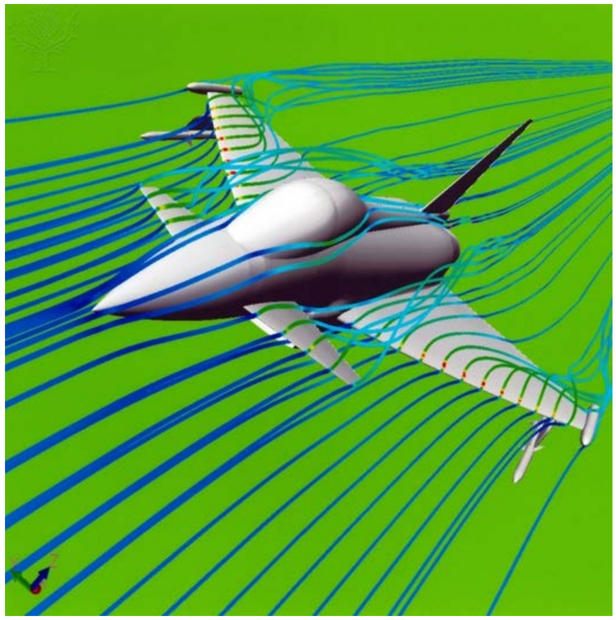
Aerodynamics



Aerodynamics refers to the study of the characteristics of moving air and how the air interacts with solid bodies moving through it. It mainly emphasizes the forces of drag and lift. Drag opposes the forward motion of a body and lift helps keep the body airborne. Thus in aerodynamics, minimizing the drag force while maximizing the lift force is paramount. The principles of aerodynamics are applied to the designs of various things, such as bridges, buildings, cars and airplanes to improve their performance and stability. This list of reading materials has articles published over the past 16 years and aims to gives insight to various topics.

The Library will periodically add new resources to this list. Links to the full-text are indicated. If you encounter any problem in retrieving the materials, please contact library@sutd.edu.sg for assistance.

Please also forward to us titles that you would like to share with others in this list.

TOPICS

Fundamentals of Aerodynamics

Books that help in the understanding the basic concepts of aerodynamics are listed below.

Anderson, J. (2010). *Fundamentals of aerodynamics* (5th ed.). Boston: McGraw-Hill Education.
Available at Library Pedagogy Collection (TL570 AND)

Flandro, G., McMahon, H., & Roach, R. (2012). *Basic aerodynamics-Incompressible Flow*. Cambridge: Cambridge University Press.

MacLean, D. (2012). *Understanding aerodynamics*. Weinheim: Wiley.

Sengupta, T. (2014). *Theoretical and Computational Aerodynamics* (Aerospace Series). Hoboken: Wiley.

Back to top

Aerodynamics Equations

Presents the main equations used in aerodynamics and explains how they can be derived and used.

Amiralaei, M., Alighanbari, H., & Hashemi, S. (2011). Flow field characteristics study of a flapping airfoil using computational fluid dynamics. *Journal Of Fluids And Structures*, *27*(7), 1068-1085.

Flandro, G. A., Mcmahon, H. M., & Roach, R. L. (2011). Equations of Aerodynamics. In *Basic Aerodynamics* (pp. 48-109). Cambridge: Cambridge University Press.

Mifsud, M., Zimmermann, R., & Görtz, S. (2015). Speeding-up the computation of high-lift aerodynamics using a residual-based reduced-order model. *CEAS Aeronautical Journal, 6*(1), 3-16.

Morino, L., & Gradassi, P. (2015). From Aerodynamics towards Aeroacoustics: A Novel Natural Velocity Decomposition for the Navier-Stokes Equations. *International Journal of Aeroacoustics, 14*(1-2), 161-192.

Vendl, A., Faßbender, H., Görtz, S., Zimmermann, R., & Mifsud, M. (2014). Model order reduction for steady aerodynamics of high-lift configurations. *CEAS Aeronautical Journal, 5*(4), 487-500.

Zeytounian, R. (2012). *Navier-Stokes-Fourier Equations A Rational Asymptotic Modelling Point of View*. Berlin: Springer Berlin Heidelberg.

Back to top

Aerodynamics for Aircraft

Explains how aerodynamics can be employed to enhance aircraft design and performance.

Abbas, A., de Vicente, J., & Valero, E. (2013). Aerodynamic technologies to improve aircraft performance. *Aerospace Science And Technology*, *28*(1), 100-132.

Austin, R. (2010). Aerodynamics and Airframe Configurations. In *Aerospace Series List* (pp. 25-43). Chichester, UK: John Wiley & Sons.

Benedict, M., Jarugumilli, T., Lakshminarayan, V., & Chopra, I. (2014). Effect of Flow Curvature on Forward Flight Performance of a Micro-Air-Vehicle-Scale Cycloidal-Rotor. *AIAA Journal*, *52*(6), 1159-1169.

Jung, U., & Breitsamter, C. (2012). Aerodynamics of Multifunctional Transport Aircraft Devices. *Journal of Aircraft, 49*(6), 1755-1764.

Kuhn, R., Margason, Richard J, & Curtis, Peter. (2000). *Jet-Induced Effects The Aerodynamics of Jet- and Fan-Powered V/STOL Aircraft in Hover and Transition* (Progress in astronautics and aeronautics Jet-induced effects). Reston: American Institute of Aeronautics and Astronautics.

Risse, K., & Stumpf, E. (2014). Conceptual aircraft design with hybrid laminar flow control. *CEAS Aeronautical Journal, 5*(3), 333-343.

Zhang, Q., Ye, K., Ye, Z., & Zhang, W. (2016). Aerodynamic Optimization for Hypersonic Wing Design Based on Local Piston Theory. *Journal Of Aircraft*, *53*(4), 1065-1072.

Back to top

Aerodynamic Modelling and Simulation

Describes how aerodynamics can be used in product design simulations and for modelling of air flow around objects.

Arko, B. & McQuilling, M. (2013). Computational Study of High-Lift Low-Pressure Turbine Cascade Aerodynamics at Low Reynolds Number. *Journal Of Propulsion And Power*, *29*(2), 446-459.

Bruno, L., Fransos, D., Coste, N. & Bosco, A. (2010). 3D flow around a rectangular cylinder: A computational study. *Journal of Wind Engineering & Industrial Aerodynamics, 98*(6), 263-276.

Goulos, I. (2016). Generalized Aerodynamic Modeling of Dynamic Wake Curvature for Open Rotors With Slender Blades. *Journal Of Turbomachinery*, *138*(6), 061001-1-16.

Khalid, M.S.U. & Akhtar, I. (2015). *Modeling the Aerodynamic Lift Produced by Oscillating Airfoils at Low Reynolds Number*. Department of Mechanical Engineering, College of Electrical & Mechanical Engineering, National University of Sciences & Technology.

Lackner, M.A., Develder, N. & Sebastian, T. (2013). On 2D and 3D potential flow models of upwind wind turbine tower interference. *Computers and Fluids, 71*, 375-379.

Ladopoulos, E. (2011). Unsteady inviscid flowfields of 2D airfoils by non-linear singular integral computational analysis. *International Journal of Non-Linear Mechanics, 46*(8), 1022-1026.

Sengupta, T.K., Bhole, A. & Sreejith, N.A. (2013). Direct numerical simulation of 2D transonic flows around airfoils. *Computers and Fluids, 88*, 19-37.

Shen, X., Chen, J., Zhu, X., Liu, P., & Du, Z. (2015). Multi-objective optimization of wind turbine blades using lifting surface method. *Energy*, *90*(1), 1111-1121.

Shen, X., Korakianitis, T., & Avital, E. (2015). Numerical Investigation of Surface Curvature Effects on Aerofoil Aerodynamic Performance. *Applied Mechanics And Materials*, *798*, 589-595.

Skinner, S. & Zare-Betash, H. (2016). *Aerodynamic Design Optimisation of Non-planar Lifting Surfaces*. School of Engineering, University of Glasgow.

Wang, J., Gu, Q., Hu, X., & Wang, B. (2014). Numerical Simulation of the Influence of Curvature Radius on Aerodynamic Characteristics of the Moving Vehicle. *Applied Mechanics And Materials*, *532*, 328-331.

Yang, Z., Yang, W., & Jia, Q. (2010). Ground Viscous Effect on 2D Flow of Wing in Ground Proximity. *Engineering Applications of Computational Fluid Mechanics, 4*(4), 521-531.

Ye, K., Zhang, Q., Main, H. H., Wang, G., Ye, Z., & Qu, Z. (2016, 12-16 January 2016). *Aerodynamic optimization for hypersonic airfoil design based on local piston theory.* Paper presented at the 2016 13th International Bhurban Conference on Applied Sciences and Technology (IBCAST).

Back to top

Boundary Layer

Details on boundary layer, which is a layer of stationary fluid around a moving object. The boundary layer concept is employed to simplify the aerodynamics equations of fluid flow as the flow field is split into two areas, one within the boundary layer and one outside it.

Lakebrink,M.T., Paredes,P. & Borg, M.P. (2017). Toward robust prediction of crossflow-wave instability in hypersonic boundary layers. *Computers and Fluids, 144*, 1-9.

McBain, G. (2012). Laminar Boundary Layers. In *Aerospace Series List* (pp. 251-262). Chichester, UK: John Wiley & Sons.

Neophytou, M., Markides, C., & Fokaides, P. (2014). An experimental study of the flow through and over two dimensional rectangular roughness elements: Deductions for urban boundary layer parameterizations and exchange processes. *Physics Of Fluids*, *26*(8), 086603-1-22.

Poirel, D. & Yuan, W. (2010). Aerodynamics of laminar separation flutter at a transitional Reynolds number. *Journal of Fluids and Structures, 26*(7), 1174-1194.

Smith, L., Oxtoby, O., Malan, A., & Meyer, J. (2013). An interactive boundary layer modelling methodology for aerodynamic flows. *International Journal of Numerical Methods for Heat & Fluid Flow*, *23*(8), 1373–1392.

Willingham, D., Anderson, W., Christensen, K., & Barros, J. (2014). Turbulent boundary layer flow over transverse aerodynamic roughness transitions: Induced mixing and flow characterization. *Physics Of Fluids*, *26*(2), 025111-1-17.

Back to top

Shock-Expansion Theory

Shock expansion theory combines both oblique shock wave theory and wave relationships linked by an expansion fan. It aids in the analysis of two-dimensional supersonic airflow. These articles describe shock-expansion theory to help you understand it better.

Meijer, M. & Dala, L. (2015). Zeroth-order flutter prediction for cantilevered plates in supersonic flow. *Journal of Fluids and Structures*, *57*, 196-205.

Vos, R. & Farokhi, S. (2015). Shock-Expansion Theory. In R. Vos & S. Farokhi, *Introduction to Transonic Aerodynamics* (pp. 145-209). Dordrecht: Springer Netherlands.

Zeng, K., Xiang, J., & Li, D. (2013). Aeroservoelastic modeling and analysis of a canard-configured air-breathing hypersonic vehicles. *Chinese Journal of Aeronautics*, *26*(4), 831-840.

Back to top