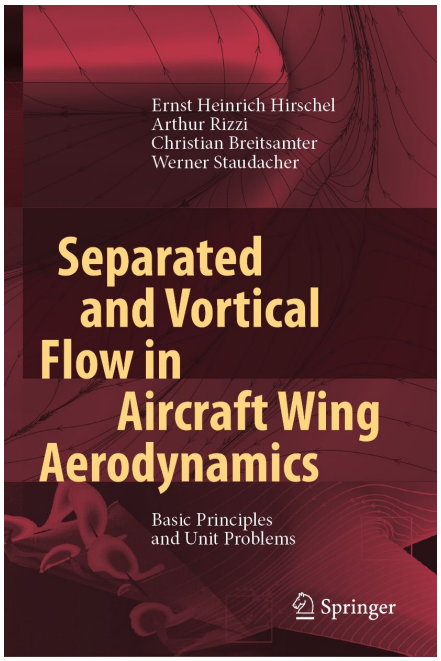

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Separated and Vortical Flow in Aircraft Wing Aerodynamics

Basic Principles and Unit Problems

- Presents the basic principles of separated and vortical flow, investigates the capabilities of numerical computation methods
- Introduces the concept of kinematically active and inactive vorticity content of a shear layer, and to the topology of skin-friction and velocity fields
- Investigates the evolution of the trailing vortex layer and the pair of trailing vortices of the wing of the NASA Common Research Model and other wings
- Illustrates the tip-vortex system with its minute non-linear lift, spans a bridge to the small aspect-ratio delta-type wing
- Treats the lee-side vortex systems of the Vortex-Flow Experiment and other delta-wing configurations, studies non-linear lift and vortex breakdown

Fluid mechanical aspects of separated and vortical flow in aircraft wing aerodynamics are treated. The focus is on two wing classes: (1) large aspect-ratio wings and (2) small aspect-ratio delta-type wings. Aerodynamic design issues in general are not dealt with. Discrete numerical simulation methods play a progressively larger role in aircraft design and development. Accordingly, in the introduction to the book the different mathematical models are considered, which underlie the aerodynamic computation methods (panel methods, RANS and scale-resolving methods). Special methods are the Euler methods, which as rather inexpensive methods embrace compressibility effects and also permit to describe lifting-wing flow. The concept of the kinematically active and inactive vorticity content of shear layers gives insight into many flow phenomena, but also, with the second break of symmetry---the first one is due to the Kutta condition---an explanation of lifting-wing flow fields. The prerequisite is an extended definition of separation: "flow-off separation" at sharp trailing edges of class (1) wings and at sharp leading edges of class (2) wings.