

TSAGI SCIENCE JOURNAL

CONTENTS, VOLUME 49, 2018

Issue 1: 1-104; Issue 2: 105-208; Issue 3: 209-298; Issue 4: 299-475; Issue 5: 477-580; Issue 6: 581-682; Issue 7: 683-792; Issue 8: 793-913

Issue 1

Air Humidity Effect on Flow Parameters in Subsonic and Transonic Wind Tunnels <i>A.R. Gorbushin</i>	1
Numerical Investigation on the Interaction of a Pair of Hot Off-Design Supersonic Jets with a Jet Blast Deflector <i>L.A. Benderskiy, D.A. Lyubimov, & A.O. Chestnykh</i>	13
On the Compressible Couette Flow <i>V.N. Golubkin & G.B. Sizykh</i>	29
Estimation of Aerodynamic Forces and Moments Derivatives with Respect to the Angular Velocity Components of the Aircraft Model in a Wide Range of Angles of Attack <i>M.A. Golovkin, A.A. Efremov, & M.S. Makhnev</i>	43
Comparative Noise Estimation Method for Gas Turbine Power Plants of Jet Planes <i>V.G. Dmitriev & V.F. Samokhin</i>	65
Influence of Lateral Control System on Transport Aircraft Spin <i>D.A. Alieva, M.E. Sidoryuk, & A.N. Khrabrov</i>	77
Verification of a Computational Dynamic Model of a Launch Vehicle Structure <i>A.G. Bakhtin & V.A. Titov</i>	93

Issue 2

Shock Wave Interaction near a Cylinder Aligned Normal to a Blunted Plate-Part I: Gas Flow and Heat Transfer on a Plate near a Cylinder <i>V.Ya. Borovoy, V.E. Mosharov, V.N. Radchenko, & A.S. Skuratov</i>	105
Method of Solving the Inverse Problem for Wing-Fuselage Combination using Reynolds-Averaged Navier-Stokes Equations <i>A.L. Bolsunovskiy, N.P. Busoverya, I.A. Gubanova, N.A. Pushchin, & K.I. Cherniy</i>	119
Air Intake in the Transient Regime of Rarefied Gas Flow <i>A.I. Erofeev</i>	137
Design of Control System Algorithms for Unmanned Tiltrotor <i>A.G. Bushgens, A.J. Voronin, V.M. Kuvshinov, & V.A. Leontiev</i>	149
Empirical Mathematical Models in Optimal Design of the Engine Nacelle Suspension Unit under an Aircraft Wing <i>N.A. Zlenko, E.S. Matyash, S.V. Mikhaylov, & A.A. Savelyev</i>	175
Orthonormalizing Two Vectors of the Direction Cosine Matrix at the Numerical Integration of Kinematics Equations <i>N.V. Kulakov</i>	191

Strength Estimation of Metal-Composite Joints with Nuismer Criterion Application <i>J.a.S. Borovskaya, M.A. Glebova, V.I. Grishin, & N.V. Guseva</i>	199
<u>Issue 3</u>	
On the Asymptotic Theory of Interaction of the Running Pressure Perturbation with the Boundary Layer in a Supersonic Flow <i>V.V. Bogolepov & V.Ya. Neyland</i>	209
Self-Similar Solutions for Viscous Compressible Gas Flow inside a Cone <i>M.A. Brtyan & U.G. Ibragimov</i>	225
The Influence of the Wingtip on Airflow past a Wing <i>M.A. Golovkin, A.A. Efremov, & M.S. Makhnev</i>	239
Volume-Centered Discharge in Supersonic Air Flow at Concentrated Propane and Oxygen Injection to the Discharge Zone <i>V.K. Alatortsev, S.I. Inshakov, I.S. Inshakov, A.F. Rozhkov, V.V. Skvortsov, A.Yu. Urusov, & A.A. Uspenskii</i>	251
Effect of Model Attachment Brackets for the AV-102 Measurement System on the Results of Experimental Investigations in the TsAGI T-102 Wind Tunnel <i>A.A. Krivoschapov</i>	263
Determining Admissible Range Limits for Mounting Air Signal System Sensors <i>N.A. Zlenko</i>	273
Active Flutter Suppression of a High Aspect Ration Wing Aircraft <i>O.S. Mamedov, S.E. Paryshev, V.N. Popovskyi, & V.I. Smyslov</i>	289
<u>Issue 4</u>	
To the 100th Anniversary of TsAGI <i>S.L. Chernyshev</i>	299
Scientific Heritage of Nikolai Egorovich Zhukovsky Aviation <i>G.P. Svishchev (1912–1999)</i>	309
Basic Conditions for Determining Airplane Strength when Flying in Disturbed Air <i>A.I. Makarevskii (1904–1979)</i>	325
Concept of a Modern Fighter <i>G.S. Bushgens (1916–2013) & V.L. Sukhanov</i>	343
Propagation of a Sonic Boom Wave in a Turbulent Medium <i>S.L. Chernyshev</i>	361
On Steady Laminar Flow of a Fluid around a Bluff Body at High Reynolds Number <i>V.V. Sychev (1924–2016)</i>	373
About the Special Feature of Durability Characteristics for Aluminum Alloys <i>A.F. Selikhov & I.E. Ushakov</i>	385
Hydrodynamics of a Thin Flexible Body <i>G.V. Logvinovich (1913–2002)</i>	395
Estimation of the Limiting Deviations of the Trajectory Parameters of an Aircraft during Automatic Landing <i>V.A. Yaroshevsky & V.P. Kuzmin</i>	403

To the Theory of Unsteady Separation and Interaction of Boundary Layer with Supersonic Gas Flow	415
<i>I.I. Lipatov & V.Ya. Neiland</i>	
Aircraft Environmental Noise Level Estimation at Landing Approach	429
<i>V.G. Dmitriev, V.F. Samokhin, & N.P. Maslova</i>	
Mathematical Model of the Aircraft Aerodynamics in a Vortex Wake	437
<i>A.M. Gaifullin & Yu.N. Sviridenko</i>	
The Interaction of Shock Waves with a Blunted Plate	455
<i>I.V. Egorov, V.Ya. Borovoy, V.E. Mosharov, V.N. Radchenko, & A.S. Skuratov</i>	

Issue 5

Influence of the Plate Surface Temperature on the Propagation of Disturbances in a Hypersonic Flow	477
<i>G.N. Dudin & V.Ya. Neiland</i>	
Direct Numerical Simulation of Laminar-Turbulent Transition at Supersonic Flow over a Sharp Flat Plate	495
<i>I.V. Egorov, A.V. Fedorov, & Q.H. Dihn</i>	
Extremal Properties of Pressure in Axisymmetric Vortex Gas Flows	507
<i>V.N. Golubkin, G.B. Sizykh, & S.V. Chernov</i>	
Steady Waves on the Water Surface in the Presence of Wind	515
<i>V.F. Molchanov</i>	
Hypersonic Wind Tunnels Based on Pressure Multipliers Part I, Practical Requirements: Schemes of Hypersonic Wind Tunnels	527
<i>A.P. Kurshin</i>	
Using Frequency Wavenumber Spectrum for Analysis of Airflows on a Surface	543
<i>A.A. Vyalkov</i>	
Design of Elastically Scaled Models of a Beam Idealization Wing	555
<i>G.A. Amiryants, F.Z. Ishmuratov, Yu.A. Naiko, J. Bo, J. Xiang, & J. Jion</i>	
Accounting for the Elastic Twist when Processing the Test Results for the Drained Wing Model of High Aspect Ratio in a Wind Tunnel	569
<i>M.F. Garifullin & O.A. Orlova</i>	

Issue 6

Interaction of Shock Waves near a Cylinder Perpendicular to a Blunt Plate, Part II: Heat Transfer on a Cylinder	581
<i>V.Ya. Borovoy, V.E. Mosharov, V.N. Radchenko, & A.S. Skuratov</i>	
Experimental Investigation of Boundary Layer State on the Model of Integrated Design High-Speed Vehicle and its Impact upon the Convergent Intake Starting	595
<i>S.S. Alyoshin, V.N. Golubkin, A.A. Gubanov, I.V. Nazhimov, V.A. Talyzin, Yu.G. Shvalev, & V.A. Yakovleva</i>	
Method of Computation of Aerodynamic Characteristics of the Wing-Tail Configuration in Transonic Cruise Flight	611
<i>L.L. Teperin, L.N. Teperina, & Myo Thein</i>	
Similarity in Nonequilibrium Thin Viscous Shock Layer	619

A.L. Ankudinov

Hypersonic Wind Tunnels Based on Pressure Multipliers, Part II: Capabilities of Hypersonic Wind Tunnels based on Various Schemes	625
---	------------

A.P. Kurshin

Effect of the Porosity Parameter of Perforated Walls on the Amplitude of the Reflected Disturbance in the Vicinity of a Model for Supersonic Flows	645
---	------------

S.A. Glazkov

The Effect of Cyclic Loading on the Residual Stresses and Stress Intensity Factors	653
---	------------

Ya.S. Borovskaya, S.I. Eleonsky, & V.S. Pisarev

The Inverse Problem of Determining the Temperature Dependence of Hemispherical Total Emissivity	675
--	------------

D.V. Burgov & V.M. Yudin

Issue 7

Marginal Separation into Reverse-Flow Region	683
---	------------

Vic.V. Sychev

On Drag Minimization of Axisymmetric Noses in the Range of High Subsonic Speeds	701
--	------------

S.S. Takovitskii & D.S. Ivanyushkin

Gas Extraction from Air Intake in the Transient Regime of Rarefied Gas Flow	713
--	------------

A.I. Erofeev

Numerical Investigation of the Secondary Separation in a Subsonic Flow over a Backward-Facing Step	723
---	------------

T.A. Pimenova

Estimation of Aerodynamic and Acoustic Performances of Counter-Rotating Open Rotors	733
--	------------

I.A. Brailko, V.I. Mileshev, A.A. Rossikhin, & A.F. Chevagin

Air-to-Air Missile Guidance for Nonmaneuverable Target Interception at Maximum Distance	753
--	------------

L.A. Bilich, S.A. Lyovin, & V.V. Ostapova

Investigation of the Effect of Elastic Deformations of the Wing Model of a Wide-Body Commercial Transport Aircraft on its Aerodynamic Characteristics	771
--	------------

V.V. Vozhdaev & L.L. Teperin

Determining Hinge Momenrs of the Main Landing Gear Fuselage Door by Means of Numerical Flow Simulation	781
---	------------

O.V. Pavlenko & A.V. Chuban

Issue 8

Inverse Problems of Boundary Layer Theory	793
--	------------

V.E. Kovalev

About Methods of Determining Buffet Onset Boundary for a Passenger Aircraft Wing	809
---	------------

N.N. Bragin

Application of a Partially Stirred Reactor Model for Taking into Account the Turbulence-Combustion Interaction on the Basis of Reynolds Equations A.A. Shiryaeva	825
Determining Acoustic Efficiency of Materials and Structures in Laboratory and Real Conditions Part 1: Sound Absorption and Sound Insulation AYa.. Zverev & V.V. Chernyh	841
Application of Aircraft Carrier Motion Prediction in Stabilization Algorithms of the Optical Landing System S.A. Kovtun & O.I. Tkachenko	861
Computational-Experimental Investigations of Business Jet Static Aeroelastic Characteristics G.A. Amiryants, F.Z. Ishmuratov, Yu.A. Nayko, M. Jingzhong, W. Guoliang, & L. Min	877
Analysis of Elasticity of a Laminated Composite with Anisotropic Heteromodular Layers A.I. Oleinikov	889
Application of the Finite Element Method for Investigation of Influence of Technological Damage on Strength Characteristic of Layered Composite Structures V.I. Mitryaykin, D.V. Nedelko, S.V. Saltykov, & V.A. Shuvalov	903
Index, Volume 49, 2018	913

TSAGI SCIENCE JOURNAL

AUTHOR INDEX, VOLUME 49, 2018

Issue 1: 1-104; Issue 2: 105-208; Issue 3: 209-298; Issue 4: 299-475; Issue 5: 477-580; Issue 6: 581-682; Issue 7: 683-792; Issue 8: 793-913

Alatortsev, V.K., 251	Dmitriev, V.G., 65, 429	Kulanov, N.V., 191
Alieva, D.A., 77	Dudin, G.N., 477	Kurshin, A.P., 527, 625
Alyoshin, S.S., 595	Efremov, A.A., 43, 239	Kuvshinov, V.M., 149
Amiryants, G.A., 555, 877	Egorov, I.V., 455, 495	Kuzmin, V.P., 403
Ankudinov, A.L., 619	Eleonsky, S.I., 653	Leontiev, V.A., 149
Bakhtin, A.G., 93	Erofeev, A.I., 137, 713	Lipatov, I.I., 425
Benderskiy, L.A., 13	Fedorov, A.V., 495	Logvinovich, G.V., 395
Bilich, L.A., 753	Gaifullin, A.M., 437	Lyovin, S.A., 753
Bo, J., 555	Garifullin, M.F., 569	Lyubimov, D.A., 13
Bogolepov, V.V., 209	Glazkov, S.A., 645	Makarevskii, A.I., 325
Bolsunovskiy, A.L., 119	Glebova, M.A., 199	Makhnev, M.S., 43, 239
Borovoy, V.Ya., 105, 455, 581	Golovkin, M.A., 43, 239	Mamedov, O.S., 289
Borovskaya, Ja.S., 199, 653	Golubkin, V.N., 29 , 507, 595	Maslova, N.P., 429
Bragin, N.N., 809	Gorbushin, A.R., 1	Matyash, E.S., 175
Brailko, I.A., 733	Grishin, V.I., 199	Mikhaylov, S.V., 175
Brutyan, M.A., 225	Gubanov, A.A., 595	Mileshin, V.I., 733
Burgov, D.V., 675	Gubanova, I.A., 119	Min, L., 877
Bushgens, A.G., 149	Guoliang, W., 877	Mitryaykin, V.I., 903
Bushgens, G.S., 343	Guseva, N.V., 199	Molchanov, V.F., 515
Busoverya, N.P., 119	Ibragimov, U.G., 225	Mosharov, V.E., 105, 455 581
Cherniy, K.I., 119	Inshakov, I.S., 251	Naiko, Yu.A., 555
Chernov, S.V., 507	Inshakov, S.I., 251	Nayko, Yu.A., 877
Chernyh, V.V., 841	Ishmuratov, F.Z., 555, 877	Nazhimov, I.V., 595
Chernyshev, S.L., 299, 361	Ivanyushkin, D.S., 701	Nedelko, D.V., 903
Chestnykh, A.O., 13	Jion, J., 555	Neyland, V.Ya., 209, 415, 477
Chevagin A.F., 733	Khrabrov, A.N., 77	Oleinikov, A.I., 889
Chuban, A.V., 781	Kovalev, V.E., 793	Orlova, O.A., 569
Dihn, Q.H., 495	Kovtun, S.A., 861	Ostapova, V.V., 753
	Krivoschapov, A.A., 263	Paryshev, S.E., 289
		Pavlenko, O.V., 781

- Pimenova, T.A., 723
Pisarev, V.S., 653
Popovskiy, V.N., 289
Pushchin, N.A., 119
Radchenko, V.N., 105,
455, 581
Rossikhin, A.A., 733
Rozhkov, A.F., 251
Saltykov, S.V., 903
Samokhin, V.F., 65, 429
Savelyev, A.A., 175
Selikhov, A.F., 385
Shiryaeva, A.A., 825
Shuvalov, V.A., 903
Shvalev, Yu.G., 595
Sidoryuk, M.E., 77
- Sizykh, G.B., 29
Sizykh, G.B., 507
Skuratov, A.S., 105,
455, 581
Skvortsov, V.V., 251
Smyslov, V.I., 289
Sukhanov, V.L., 343
Sviridenko, Yu. N., 437
Svishchev, G.P., 309
Sychev, V.V., 373
Sychev, Vic.V., 683
Takovitskii, S.S., 701
Talyzin, V.A., 595
Teperin, L.L., 611, 771
Teperina, L.N., 611
Thein, M., 611
- Titov, V.A., 93
Tkachenko, O.I., 861
Urusov, A.Yu., 251
Ushakov, I.E., 385
Uspenskii, A.A., 251
Voronin, A.J., 149
Vozhdaev, V.V., 771
Vyalkov, A.A., 543
Xiang, J., 555
Yakovleva, V.A., 595
Yaroshevsky, V.A., 403
Yudin, V.M., 675
Zlenko, N.A., 175, 273
Zverev, A.Ya., 841

TSAGI SCIENCE JOURNAL

SUBJECT INDEX, VOLUME 49, 2018

Issue 1: 1-104; Issue 2: 105-208; Issue 3: 209-298; Issue 4: 299-475; Issue 5: 477-580; Issue 6: 581-682; Issue 7: 683-792; Issue 8: 793-913

-
- | | | |
|--|--|---|
| 13-moment kinetic equations, 619
acoustics, 841
active suppression, 289
aerodynamic characteristics, 733
aerodynamic forces and moments, 43
aerodynamic loads, 781
aerodynamics characteristics, 239
aerodynamics, 569, 809
aeroelastic wing deformation, 771
aeroelasticity, 555, 569
aeroelasticity, 877
air humidity, 1
air intake, 137, 713
air signal system sensor, 273
aircraft carrier, 861
aircraft noise at landing, 429
aircraft trajectory parameters, 403
aircraft, 437
airfield jets, 13
airflows on surface analysis, 543
airframe, 429
airplane load factor, 325
airplane strength, 325 horizontal gust, 325
air-to-air missile, 753
analysis of load conditions, 93
angular velocity components, 43
ANSYS Fluent, 119
approximation of a thin shock layer, 619
asymptotic relation, 415 | automatic aircraft flareout, 403
automatic landing, 403
automatic stabilization, 149
axisymmetric flow of viscous gas, 225
axisymmetric subsonic vortex gas flows, 507
backward-facing step, 723
base pressure, 415
beam flexural and torsional stiffness, 555
beam idealization, 555
bluntness, 455
body drag, 373
boundary conditions, 793
boundary layer separation, 105, 581
boundary layer state hysteresis, 595
boundary layer, 209, 455, 495, 683, 793
boundary value problem, 415
buffet, 809
capabilities, 527, 625
CFD, 273
collocation method, 753
combat effectiveness, 343
composite, metal, 199
computation, 289
computational fluid dynamics methods, 781
computational fluid dynamics, 175, 771
computational grid, 771
computational model, 877
concept of a fifth-generation fighter, 343
conditions of normalization and orthogonality, 191 | configuration, 175
control system, 149
convergent intake start, 595
correction, 1
Couette flow, 29
counter-rotating fan, 733
cyclic loading, 653
dense atmosphere, 93
direct numerical simulation, 495
Direct Simulation Monte Carlo (DSMC) method, 137
direct statistical (Monte Carlo) simulation method, 713
direction cosine matrix, 191
disturbance, 495
disturbed air, 325
drag, 701
durability curve, 385
durability of aluminum alloys, 385
durability range, 385
durability, 385
dynamic experiment, 77
dynamic pressure, 515
elastically scaled model, 555, 877
electronic speckle pattern interferometry, 653
empirical mathematical model, 273
energy capacity of a wave, 515
entropy layer, 455
equations of kinematics, 191
estimation of noise level of airplane power plants, 65 |
|--|--|---|
-

- Euler equations, 507
 exact solutions of Navier–Stokes equations, 29
 exact solutions, 225
 experiment, 569
 experimental methodology in a wind tunnel, 263
 external supersonic flow, 415
 extremal properties of pressure, 507
 extreme formulation of the inverse problem, 675
 finite-element method, 199, 903
 finite-rate reactions, 825
 fish swimming mechanism, 395
 fixed-wing aircraft, 149
 flap, 415
 flat plate, 477
 flight envelope protection, 149
 flight range, 403
 flight simulator PS-10M, 861
 flow parameters, 1
 flow pattern, 251
 flows behind a detached bow shock wave, 507
 flutter, 289
 fourth-generation fighter, 343
 free jets, 13
 frequency wavenumber spectrum, 543
 full-potential equation, 611
 geometric acoustics equations, 361
 gravitational pressure, 515
 grid verification of the solution, 723
 guidance method, 753
 heat flux peaks, 105, 581
 heat flux peaks
 heat flux, 455
 heat transfer, 105, 581, 675
 helicopter, 149
 hemispherical total emissivity, 675
 high lift devices, 429
 high Reynolds numbers, 527, 625
 hinge moments, 781
 hydrodynamic characteristics of fish motion, 395
 hydrodynamics of a thin flexible body, 395
 hypersonic flow, 105, 477
 influence coefficients matrix, 555
 integrated design vehicle, 595
 interaction, 455
 inverse method, 119
 inverse problem, 675, 793
 inviscid stationary approximation, 209
 jet interaction with the jet blast deflector, 13
 jets with a co-flow, 13
 joints, 199
 Knudsen number, 137, 713
 k- ω diagram, 543
 laminar and turbulent boundary layers, 595
 laminar boundary layer, 415
 laminar–turbulent transition, 495
 laminated composites, 889
 landing gear, 429
 large angles of attack, 43
 lateral control system, 77
 launch vehicle, 93
 level of nominal stresses, 385
 lift force, 309
 lift, 809
 load, 385
 main landing gear fuselage door, 781
 main rotor hub, 903
 marginal separation, 683
 mathematical model, 289
 measurement techniques, 455
 method of plane sections, 395
 method of successive crack length extension, 653
 methods of heat transfer investigation, 105
 methods of investigation of heat transfer in wind tunnels, 581
 mixing layer, 373, 683
 nacelle, 175
 Navier–Stokes equations, 119, 225, 771
 Navier–Stokes thin shock layer, 619
 neural networks, 437
 Nikolai Egorovich Zhukovsky (Joukowski), 309
 noise of power plants of jet planes, 65
 noise of transport category airplanes, 65
 noise, 733
 nonequilibrium flow, 619
 nonlinear mathematical model of aerodynamics, 77
 noses, 701
 N-shaped wave, 361
 Nuismser criterion, 199
 numerical investigation, 723
 numerical methods, 239
 numerical simulation, 455, 701, 825
 numerical test, 543
 oblique breakdown, 495
 off-design supersonic jets, 13
 open rotor, 733
 optical landing system (OLS), 861
 optimal porosity (permeability) parameter, 645

optimization, 175, 191, 273, 675, 701
pair of jets, 13
parametric continuation technique, 77
partially stirred reactor, 825
passenger airplane, 809
perforation, 645
power plant, 429
pressure measurement systems, 543
pressure, 455
primary structure of model, 555
propane and oxygen injection through an anode, 251
propulsion system, 157
prospects for the future, 299
pylon, 175
RANS/ILES method, 13
regression analysis, 273
residual stresses, 653
reverse laminar–turbulent transition, 105
Reynolds equations, 825
Reynolds-averaged Navier–Stokes (RANS) methods, 119
rotary derivatives, 43
running pressure perturbation, 209
secondary separation, 723
self-induction mechanism, 209
separated region, 373, 683
separation, 455
shearing loads of bolts, 199
ship motion prediction, 861
ship motion, 861
shock wave interference, 581
shock wave, 361, 455
shock wind tunnel, 455
similarity variables, 619
sonic boom, 361
sound absorption, 841
sound insulation, 841
specified probability, 403
spectroscopic studies, 251
spin recovery, 77
spin, 77
stability and controllability, 149
stages of the institute development, 299
stiffness, 889
stochastic model of uniform isotropic turbulence, 361
stress concentrators, 385
stress intensity factor, 385, 653
stress sign, 889
stress-strain state, 889, 903
strip support system, 263
strong interaction, 477
subsonic flow, 723
subsonic wind tunnels, 43
suction–blowing, 793
supersonic flow, 209, 251, 495
supporting device, 263
Sutherland formula, 29
T-116 wind tunnel, 595
target pressure distribution, 119
technological damage, 903
technologies of obtaining hypersonic high-density gas flows, 625
technologies used to obtain hypersonic high-density gas flows, 527
temperature dependence, 675
temperature factor, 477
thermal method, 595
thermophysical properties of materials, 675
thick high-camber shape, 239
three-dimensional boundary layer, 477
throttle characteristic, 713
tiltrotor, 149
time-domain simulation, 77
trajectory optimization, 753
transient flow regime, 713
transient processes, 93
transition regime, 137
transonic cruise flight, 611
TsAGI, 299
turbulence model, 771
turbulence models, 723
turbulence stimulators, 595
turbulence, 543
turbulence/combustion interaction, 825
turbulent combustion, 825
turbulent jets, 13
unsteady perturbations, 415
unsteady separation, 415
variation of dynamic characteristics, 93
verification of calculations, 507
vertical air gust, 325
vertical speed, 403
viscous compressible flow, 29
volume-centered discharge, 251
vortex model of a lifting surface, 611
vortex wake, 437
wall interference, 645
welded joints, 653
wide-body commercial transport aircraft, 771
wind tunnel suspension system, 263
wind tunnel tests, 543
wind tunnel, 1, 569, 877
wind tunnels, 527, 625
wing–fuselage combination, 119
wing–tail configuration, 611
wingtip, 239

worst longitudinal wind realizations, 403

Zhukovsky theorem
(Joukowski theorem),
309

Zhukovsky, 299