Wolnik, Stanley J. (see Gannon, Richard E.)
Wood, G. P. (see Carter, A. F.)
Woods, W. C. (see Henderson A.)
Woodward, Henry T. (see Aronld, James O.)
Wu, Ching-Sheng (see Smith, Myron C.)
Wu, Y. C. Lin (see Duclos, Donald P.)
Xerikos, J. and Anderson, W. A. An experimental investigation of the shock layer surrounding a sphere in supersonic flow..... 451
——**and Anderson, W. A.** Blunt-body integral method for air in thermodynamic equilibrium (TN)..... 1531
Yamane, J. R. Natural frequency curves of simply supported cylindrical shells (TN)..... 180
Yang, Wen-Jei and Izumi, Tomoaki. Influence of fluctuating circulations on the transport phenomena from cylinders including uniform suction or blowing..... 622
——Effects of suction and blowing on oscillatory boundary layers over cylinders (TN)..... 1343
Yeh, P. S. (see Chow, W. L.)
Yen, J. T. Electrostatic probe performance as influenced by its magnetogas dynamic boundary layer (TN)..... 2146
Yen, K. T. Modification of magnetic energy by differential fluid motions (TN)..... 1526
Yettram, Alan L. and Husain, Husain M. Generalized matrix force and displacement methods of linear structural analysis (TN)..... 1154
Yokota, L. T. (see Lin, T. H.)
Young, Donovan H. (see Zagustin, Anatol)
Young, F. L. and Westkaemper, J. C. Experimentally determined Reynolds analogy factors for flat plates (TN)..... 1201
Young, Lee A. Infrared temperature measurement of the laminar wake of a hypersonic sphere..... 610
Yu, C. P. Combined forced and free convection channel flows in magnetohydrodynamics (TN)..... 1184
Yuan, S. W. Thin cylindrical shells under surface torques (TN)..... 178
—— **and Bloom, A. M.** Reply by authors to T. A. Zaker (TC)..... 1373
Zadoff, Leon N. (see Payne, William T.)
Zagustin, Anatol and Young, Donovan H. Equilibrium equation for radially loaded thin circular rings (TN)..... 533
Zajac, E. E. Comments on "Stability of damped mechanical systems" and a further extension (TN)..... 1749
Zaker, T. A. Comments on "An analytic approach to hypervelocity impact" (TC)..... 1372
Zappa, O. (see Levine, P.)
Zatlers, J. (see Humphreys, J. S.)
Zeiberg, Seymour L. and Kaplan, Brent. Approximate analysis of free-mixing flows (TN)..... 552
——(see Lane, Frank)
Zeydel, E. F. E. and Kobett, D. R. Flutter of flat plates with partially clamped edges in the low supersonic region..... 17
Ziemer, Richard W. (see Duclos, Donald P.)
Zucrow, M. J., Osborn, J. R., and Murphy, J. M. An experimental investigation of the erosive burning characteristics of a nonhomogeneous solid propellant (TN)..... 523
Zukoski, Edward E. and Pinchak, Alfred C. Gas phase and surface phenomena in seeded plasmas..... 270
——**and Cool, Terrill A.** Nonequilibrium electrical conductivity measurements in argon and helium seeded plasmas (TN)..... 370

SUBJECTS

AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Magnus characteristics of finned and nonfinned projectiles. Anders S. Platou..... 83
Angle of attack envelope for a spinning re-entry body. Richard R. Auelmann..... 465
Hypersonic stability derivatives of blunted slender cones. Otto Walchner and James T. Clay (TN)..... 752
Shock predictions in conical nozzles. D. Migdal and R. Kosson (TN)..... 1554
Unsteady flow phenomena in nozzles. Benjamin E. Nevis (TN)..... 1556

AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

New directions in lifting surface theory. Holt Ashley, Sheila Windall, and Marten T. Landahl..... 3
Wing sweep and blunting effects on delta planforms at $M = 20$. Robert D. Witcofski and Don C. Marcum Jr. (TN)..... 547

ASTRONOMY AND ASTROPHYSICS

An approximation of the integrated infrared starlight at 2.2 and 3.6 μ over the sky. James N. Hanson..... 395
Libration damping and lunar mass. Irving Michelson (TN)..... 172
Matrizant of Keplerian motion. J. M. A. Danby (TN)..... 769

CHEMISTRY

Evaporation coefficients and recoil pressures for biphenyl and naphthalene. B. Paul and L. G. Lyon..... 1067
Spectroscopic constants for the N+ ion. M. S. Wecker (TC)..... 572

COMMUNICATIONS

Effect of azimuth on the accuracy of an interferometer radar. C. W. Pittman (TN)..... 170
Principle of blackout communications. S. N. Samaddar (TN)..... 349
Visibility of a lunar satellite from an earth ground station. P. R. Escobal (TN)..... 740

FACILITIES, RESEARCH, AND SUPPORT

Preliminary results with a free piston shock tunnel. R. J. Stalker (TN)..... 1170

FLUID DYNAMICS

A synthetic view of the mechanics of rarefied gases. Gordon N. Patterson (SA)..... 577
Continuum-source molecular beams. J. Barry French (SA)..... 993
Estimates for collision-induced dissociation rates. C. Frederick Hansen..... 61
Inviscid, nonadiabatic flow about blunt bodies. K. H. Wilson and H. Hoshizaki..... 67
Similar solutions for the hypersonic laminar boundary layer near a plane of symmetry. Massimo Trella and Paul A. Libby..... 75
Linearized vortex flows. W. S. Lewellen..... 91
A parametric study of gas-particle flows in conical nozzles. J. D. Hoffman and S. A. Lorenc..... 103
A one-dimensional treatment of inviscid jet or duct flow. Philip A. Thompson..... 212
Interaction of a starting vortex as well as a vortex street with a traveling shock wave. Darshan S. Dosanjh and Thomas M. Weeks..... 216
A new technique for the numerical analysis of nonequilibrium flows. Gino Moretti..... 223
Experimental study of nonequilibrium expanding flows. Robert E. Duffy..... 237
Investigation of the charge-to-mass ratio of electrically sprayed liquid particles. J. J. Hogan and C. D. Hendricks..... 296
Thickness effect on the force of slender delta wings in hypersonic flow. Kinzo Hida..... 427
Hypersonic flow over an oscillating wedge. S. C. McIntosh Jr..... 433
Second-order forces and pressure distributions on three-dimensional bodies by reverse-flow integral method. S. P. Sutera..... 441
An experimental investigation of the shock layer surrounding a sphere in supersonic flow. J. Xerikos and W. A. Anderson..... 451
Calculation of hypersonic flow over bodies of revolution at small angles of attack. John V. Rakich..... 458
A new model for mixing and fluctuations in a turbulent wake. Andrew P. Proudian and Saul Feldman..... 602
Unsteady three-dimensional laminar jet mixing of a compressible fluid. S. I. Pai..... 617
Influence of fluctuating circulations on the transport phenomena from cylinders including uniform suction or blowing. Wen-Jei Yang and Tomoaki Izumi..... 622
Machine calculation of compressible laminar boundary layers. A. M. O. Smith and Darwin W. Clutter..... 639
Satellite potential in an ionized atmosphere. Norman C. Jen..... 714
Small disturbance phenomena in rarefied gas fields. Joseph G. Logan (TN)..... 744
Calculations of the turbulent boundary layer. B. G. J. Thompson (TN)..... 746
An aerofoil probe for measuring the transverse component of turbulence. Thomas E. Siddon and Herbert S. Ribner (TN)..... 747
Static pressure measurements in a hypervelocity shock tunnel. Gary H. Bowman and Grant W. Coon (TN)..... 751
A simple approach to the multicomponent laminar boundary layer. A. Casaccio and S. Cousin (TN)..... 756
Stagnation-point velocity distribution for a compressible fluid. Robert A. Graff (TN)..... 762
Accurate values of the exponent governing potential flow about semi-infinite cones. John L. Hess and Sue Faulkner (TN)..... 767
Preliminary results on boundary-layer stability on a flexible plate. F. D. Hains (TN)..... 775
Bow shock shape about a spherical nose. Richard J. Berman (TN)..... 778
A simple universal velocity profile equation. Ralph A. Burton (TN)..... 784
Velocity defect laws for transpired turbulent boundary layers. H. S. Mickley, K. A. Smith, and M. D. Fraser (TN)..... 787
Drag coefficients of particles in gas-particle flow. C. F. Chen (TN)..... 788
Velocity profile in the half-jet mixing region of turbulent jets. Wing T. Chu (TN)..... 789
A miniature strain-gage balance for hypersonic force measurements. Bing H. Lieu and Eugene V. Horanoff (TN)..... 793
Sensitivity of flow visualization methods at low-density flow conditions. W. F. Merzkirch (TN)..... 794
Interaction of a shock wave and a wedge: an application of the hydraulic analogy. Enrique J. Klein..... 801
Asymptotic boundary layer over a slender body of revolution in axial compressible flow. Michael H. Wei..... 809
Turbulent diffusion of a reacting wake. Wilmot H. Webb and Leslie A. Hromas..... 826

Measured transition from laminar to turbulent flow and subsequent growth of turbulent wakes. W. G. Clay, M. Labitt, and R. E. Slattery ... 837
Near wake of a blunt body at hypersonic speeds. C. Forbes Dewey Jr. ... 1001
Supersonic flow past pointed bodies. J. C. South Jr. and P. A. Newman ... 1019
Stability of a panel in incompressible, unsteady flow. R. E. Kelly ... 1113
Some effects of finite particle volume on the dynamics of gas-particle mixtures. George Rudinger ... 1217
Influence of pressure gradients on nonhomogeneous dissipative free flows. L. G. Napolitano ... 1223
Inviscid hypersonic flow around blunt bodies. Elliott D. Katzen and George E. Kaattari ... 1230
Studies of wakes of support-free spheres at $M = 16$ in helium. Irwin E. Vas, Earll M. Murman, and Seymour M. Bogdonoff ... 1237
A theory for the ablation of non-Newtonian liquids near the stagnation point. B. Steverding ... 1245
Hypersonic viscous effects on free-flight slender cones. Bain Dayman Jr. ... 1391
Comparison of measured and predicted flows through conical supersonic nozzles, with emphasis on the transonic region. L. H. Back, P. F. Massier, and H. L. Gier ... 1606
A theorem concerning the stagnation streamline in potential flow with zero circulation. Jack D. Dennon ... 1631
Application of the method of integral relations to real-gas flows past pointed bodies. J. C. South Jr. and P. A. Newman ... 1645
Anomalous turbulent flow of non-Newtonian fluids. C. Sinclair Wells Jr. ... 1800
Incompressible laminar axisymmetric near wake behind a very slender cylinder in axial flow. Henri Viviand and Stanley A. Berger ... 1806
Computer analysis of condensation in highly expanded flows. James L. Griffin and Pauline M. Sherman ... 1813
Electron density decay in wakes. Wade M. Kornegay ... 1819
A suggestion for the numerical solution of the steady Navier-Stokes equations. Luigi Crocco ... 1824
Turbulence spectra in a reacting gas. Alan Q. Eschenroeder ... 1839
Extensions of the Falkner-Skan similar solutions to flows with surface curvature. James S. Murphy ... 2043
Boundary-layer transition on a 10° cone in hypersonic flows. H. T. Nagamatsu and R. E. Sheer Jr. ... 2054
Theory of laminar near wake of blunt bodies in hypersonic flow. Barry L. Reeves and Lester Lees ... 2061
Near wake flow field measurement. Antonio Todisco and Adrian J. Pallone ... 2075
Numerical calculation of supersonic wake flow. Anthony A. Amsden and Francis H. Harlow ... 2081
Aerodynamic blast simulation in hypersonic tunnels H. Mirels and J. F. Mullen ... 2103
Approximate solution of second-order boundary-layer equations. Leroy Devan ... 2189
Effects of ablation products on ionization in hypersonic wakes. W. T. Langan, J. D. Cresswell, and W. G. Browne ... 2211
Choked flow: a generalization of the concept and some experimental data. Harold J. Hoge and Ronald A. Segars ... 2177
Chemical and nozzle flow losses in hypersonic ramjets. V. J. Sarli, A. W. Blackman, and D. Migdal (TN) ... 139
Liquid film drain from an accelerating tank wall. John R. O'Loughlin (TN) ... 158
A new technique for the direct calculation of blunt-body flow fields. Hsiao C. Kao (TN) ... 161
Radial lag of solid particles in delaval nozzles. E. Doughman and C. H. Lewis Jr. (TN) ... 169
Shock standoff distance for equilibrium flow around hemispheres obtained from numerical calculations. Manoru Inouye (TN) ... 172
Separated flow behind a rearward-facing step with and without combustion. J. M. Bowyer Jr. and W. V. Carter (TN) ... 181
Measurements in a free piston shock tube. Ralph Grief and Arthur E. Bryson Jr. (TN) ... 183
Shock shape generalization for inverse blunt body methods. Richard A. Batchelder (TN) ... 353
Step induced boundary-layer separation phenomena. Robert W. Halprin (TN) ... 357
Measurements of panel response to turbulent boundary-layer excitation. Lucio Maestrello (TN) ... 359
Drag on blunt bodies with and without spikes in low-density hypersonic flow. William H. Sims, David E. Boylan, and Jerry S. Hahn (TN) ... 365
Variation of entropy through a shock wave. Thomas E. Chamberlain (TN) ... 367
Ionization of trace species in slender cone boundary layers. M. Lenard (TN) ... 367
Similarity solutions of the flow of power law fluids near an accelerating plate. Tsung Yen Na (TN) ... 378
Comparisons of free-flight and wind-tunnel data on slender cones. Jack D. Whitfield and B. J. Griffith (TN) ... 379
Newtonian entropy layer in the vicinity of a conical symmetry plane. R. E. Melnik (TN) ... 520
Characteristics of supersonic ejector system with nonconstant area shroud. W. L. Chow and P. S. Yeh (TN) ... 525
Further similarity solutions of two-dimensional wakes and jets. Martin H. Steiger and Karl Chen (TN) ... 528
Parameters affecting the normal shock location in underexpanded gas jets. L. D'Attorre and F. C. Harshbarger (TN) ... 530
Correlation of two-dimensional and axisymmetric boundary-layer flows for purely viscous non-Newtonian fluids. Nisiki Hayasi (TN) ... 532
Oblique injection of a jet into a stream. Lu Ting and Charles J. Ruger (TN) ... 534
Extension of reaction control effectiveness criteria to Mach 10: experiment and theory. Paul W. Vinson (TN) ... 536
Near-equilibrium criterion for complex reacting flows. J. P. Gurney (TN) ... 538
Relationships between drag and periodic vortex shedding. Brian P. Quinn (TN) ... 542
Flow field for sonic jet exhausting counter to a hypersonic mainstream. David J. Romeo and James R. Sterrett (TN) ... 544
Further similarity solutions of axisymmetric wakes and jets. Martin H. Steiger and Martin H. Bloom (TN) ... 548
Wave intersection limits for focused compression of air in chemical equilibrium. Lowell W. Pearson and Francis J. Schoelen (TN) ... 550
Approximate analysis of free-mising flows. Seymour L. Zeiberg and Brent Kaplan (TN) ... 552
Normal shock-wave properties in imperfect air and nitrogen. Clark H. Lewis and E. G. Burgess III (TN) ... 554
Effects of diffusion in laminar hypersonic wakes. J. J. Kane (TN) ... 556
Simulation of the interaction of a hypersonic body and a blast wave. Gene J. Bingham and Theodore E. Davidson (TN) ... 564
Influence of turbulent boundary layer on shock tube text time. Peter Jeanmaire and Eric F. Brocher (TN) ... 960
Boundary-layer control for increasing lift by blowing. F. Thomas (TN) ... 967
Flow of viscoelastic Maxwell fluid in a circular pipe. Vyenkatesh M. Soundalgekar (TN) ... 968
Linear jet and wake solutions with pressure gradients. George L. Mellor (TN) ... 975
A solution of the base pressure problem applicable to transient external flows. H. K. Ihrig Jr. (TN) ... 979
Transition of air laminar boundary layers. D. E. Bloxsom Jr. (TN) ... 982
Supersonic and hypersonic flow of an ideal gas around an elliptic nose. R. Douglas Archer and Rudolf Hermann (TN) ... 987
Review of recent developments in turbulent supersonic base flow. Ahmed R. Wazzan (TN) ... 1135
Production of supersonic flows with honeycomb-supported screens. H. N. Powell, R. K. Suri, and W. G. Steenken (TN) ... 1138
Hypersonic sharp-leading-edge problem for axially symmetric bodies. Jay M. Solomon (TN) ... 1156
Turbulent mixing of reactive gases. Anthony Casaccio (TN) ... 1160
Viscous drag effects on slender cones in low-density hypersonic flow. Jack D. Whitfield and B. J. Griffith (TN) ... 1165
Correlation of the sudden freezing point in nonequilibrium nozzle flows. James C. Williams III (TN) ... 1169
An estimate of the decay of turbulent intensity in a shear flow. J. Menkes (TN) ... 1182
More general solutions of the incompressible boundary-layer equations. William C. Meecham (TN) ... 1192
Use of equilibrium constants in nonequilibrium flow computations. Chong-Wei Chu (TN) ... 1193
A simple relationship between the drag near zero lift and the initial normal-force-curve slope obtained from Newtonian theory. Gary T. Chapman (TN) ... 1194
Unsteady reacting boundary layer on a vaporizing flat plate. Warren C. Strahle (TN) ... 1195
Expansion of a finite mass of gas into vacuum. C. Greifinger and J. D. Cole (TN) ... 1200
An extended use of the hydrogen bubble flow visualization method. William O. Criminale Jr. and R. W. Nowell (TN) ... 1203
Strouhal numbers for the hypersonic wakes of spheres and cones. A. Goldburg, W. K. Washburn, and B. H. Florsheim (TN) ... 1332
Effects of suction and blowing on oscillatory boundary layers over cylinders. Wen-Jei Yang (TN) ... 1343
Exploratory hypersonic boundary-layer transition studies. A. Henderson, R. S. Rogallo, W. C. Woods, and C. R. Spitzer (TN) ... 1363
Numerical treatment of turbulent flows. Cecil E. Leith (TN) ... 1364
Magnetohydrodynamic-hypersonic viscous and inviscid flow near the stagnation point of a blunt body. Myron C. Smith, H. Suzanne Schwimmer, and Ching-Sheng Wu (TN) ... 1365
An MHD boundary-layer compatibility condition. Rodney D. Hugelman and Donald R. Haworth (TN) ... 1367
Invariancy of total shear stress for compressible turbulent flows. L. I. Deverall and R. S. Channapragada (TN) ... 1513
Validity of triple-point calculation applied to jet Mach disk. L. D'Attorre and F. C. Harshbarger (TN) ... 1515
Hypersonic flow visualization using tufts of pure carbon yarn. H. Harvey Album (TN) ... 1520
Optimum hypersonic lifting surfaces close to flat plates. J. D. Cole and J. Aroesty (TN) ... 1520
Modified blast-analogy for the blunt flat plate with sweep and attack. John D. Lee (TN) ... 1533
Approximate computation of underexpanded jet structure. Frank A. Albini (TN) ... 1535
Approximate solution of laminar free layers with initial thickness. James E. Hubbartt (TN) ... 1538
Impact pressure behavior in rarefied hypersonic flow. F. L. Daum, J. S. Shang, and G. A. Elliott (TN) ... 1546
Similar solutions for merging shear flows II. R. J. Hakkinen and Nicholas Rott (TN) ... 1553
Ablation effect on RF attenuation in the turbulent boundary layer. John J. Kane and Frank Li (TN) ... 1558
Cross-flow effects in the plane-wall jet. L. G. Napolitano and F. Manzo (TN) ... 1746
Similar flow boundary layer on bodies in the presence of shear flow. Leroy Devan (TN) ... 1747
Chemical nonequilibrium studies in supersonic nozzle flows. David Migdal and Arnold Goldford (TN) ... 1750
Kinetic theory analysis of diffusion of discontinuity plane of flow velocity. Yoshio Sone and Makoto Shibata (TN) ... 1763
A single formula for the velocity distribution in the turbulent inner and outer boundary layers. Hwachii Lien (TN) ... 1766
Nearly self-similar unsteady motion. R. S. Lee (TN) ... 1773
An approximate solution to hypersonic blunt-body problem. Monty D. Coffin (TN) ... 1780

Flow fields about highly yawed cones by the inverse method. D. W. Eastman and M. E. Omar (TN) ... 1782
A random signal multiplier for turbulence measurements. V. Kruka (TN) ... 1784
Flow visualization using a traversing electron beam. Dietmar E. Rothe (TN) ... 1945
Velocity-defect laws for transpired turbulent boundary layers. H. Tennekes (TN) ... 1950
An analytical method for evaluating the optimum depth in hydraulic analogy experiments. O. P. Gupta (TN) ... 1953
An edge suction effect. Gunnar Heskestad (TN) ... 1958
Relationship of laminar wake width to wake transition distance. E. Waldbusser (TN) ... 1965
Drag reduction on bodies of revolution by use of area suction. G. F. Anderson and S. P. Sutera (TN) ... 1970
Nonequilibrium effects on high-enthalpy expansions of air. J. A. Lordi and R. E. Mates (TN) ... 1972
Supersonic flow around a hemi-axisymmetric body resting on a flat plate. Steven S. Cherry (TN) ... 2152
Effect of base bleeding on the near wake for very low Reynolds numbers. S. A. Berger and H. Viviand (TN) ... 2154
Application of Pohlhausen's method to stagnation-point flow. R. D. Hugelman (TN) ... 2158
Approximate expression for the boundary-layer shape factor. Brian L. Hunt and Merwin Sibulkin (TN) ... 2159
Eigenvalues and norms arising in perturbations about the Blasius solution. Paul A. Libby (TN) ... 2164
Technique for studying the shock-on-shock problem. E. A. Brown Jr. and G. J. Mullaney (TN) ... 2167
Experiments on the head-on shock-shock interaction. E. A. Brown Jr. and G. J. Mullaney (TN) ... 2168
A hypersonic wake transition map. Arnold Goldburg (TN) ... 2170
Some results in the theory of almost axisymmetric flow at transonic speed. David G. Randall (TN) ... 2339
Field fluctuations in radar scattering from turbulent wakes. Donald A. Jacobson (TN) ... 2341
Streamline curvature effect on mixing within the boundary layer. Gdalia Kleinstein (TN) ... 2343
A definition of the time duration of pressure phase resulting from intersecting shock waves. E. W. Beans (TN) ... 2344
On the upstream length of turbulent boundary-layer separation. J. C. Williams III (TN) ... 2347
Displacement thickness of the boundary layer with blowing. Nisiki Hayasi (TN) ... 2348
Viscous flow properties on slender cones. R. A. Peter, M. D. High, and E. F. Blick (TC) ... 572
Comments on "Turbulent mixing of coaxial jets." George L. Mellor (TC) ... 798
Reply by author to G. L. Mellor. L. J. Alpinieri (TC) ... 799
Comment on "Hypersonic wakes and trails." Arnold Goldburg (TC) ... 991
Reply by authors to A. Goldburg. Wilhelm Behrens and Lester Lees (TC) ... 991
Comments on "Recent studies of the laminar base-flow region." Arthur N. Tifford (TC) ... 1211
Reply by authors to A. N. Tifford. Eric Baum, Hartley H. King, and M. Richard Denison (TC) ... 1212
Comments on "Hypersonic viscous flow near the stagnation streamline of a blunt body: I. A test of local similarity." Roy Krupp (TC) ... 1374
Comments on "Nonequilibrium sodium ionization in laminar boundary layers." M. Lenard (TC) ... 1375
Reply by author to M. Lenard. J. J. Kane (TC) ... 1376
An improved error estimate for Sychev's entropy layer solution. Dale B. Henderson (TC) ... 1563
Validity of integral methods in MHD boundary-layer analyses. John B. Heywood and W. Craig Moffatt (TC) ... 1565
Errata: "An aerodynamic analysis for flutter in oseen-type viscous flow." Wen-Hwa Chu (TC) ... 1568
Direct blunt-body integral method. Donald R. Chenoweth (TC) ... 1788
Comment on "Proposal concerning laminar wakes behind bluff bodies at large Reynolds numbers." Peter D. Richardson (TC) ... 1982
Wedge and cone theory for $M_\infty = \infty$. Joseph W. Cleary (TC) ... 1983
Comment on "Measured transition from laminar to turbulent flow and subsequent growth of turbulent wakes." J. Menkes (TC) ... 2174
Reply by authors to J. Menkes. R. E. Slattery and W. G. Clay (TC) ... 2174
Erratum: "Expansion of a finite mass of gas into vacuum." C. Greifinger and J. D. Cole (TC) ... 2176
Erratum: Alternate proposal concerning laminar wakes behind bluff bodies at large Reynolds number. Peter D. Richardson (TC) ... 2352

GEOPHYSICS

Physics of meteor entry. Mary F. Romig (SA) ... 385
Geomagnetically trapped radiation. M. B. Baker (SA) ... 1569
Effects of atomic and molecular impacts on spacecraft. D. McKeown, M. G. Fox, and J. J. Schmidt ... 710

HEAT TRANSFER AND THERMODYNAMICS

Review of theoretical investigations on effect of heat transfer on laminar separation. Morris Morduchow (SA) ... 1377
Couette flow of a radiating and conducting gas. Ralph Greif ... 98
Measurements of radiative heating on sharp cones. Dale L. Compton and David M. Cooper ... 107
Heat transfer from a nonequilibrium turbulent boundary layer to catalytic surfaces. Norman G. Kulgein ... 230
Infrared temperature measurement of the laminar wake of a hypersonic sphere. Lee A. Young ... 610
Experimental investigations of the compressible turbulent boundary layer at very high Reynolds numbers. D. R. Moore and J. Harkness ... 631
Heat-transfer analysis of rocket nozzles using very high temperature propellants. John R. Howell, Mary Kern Strite, and Harold Renkel ... 669
Shock-tube studies of equilibrium air radiation. Robert M. Nerem and George H. Stickford ... 1011
Erosion of graphite in solid-propellant combustion gases and effects on heat transfer. Allan J. McDonald and Paul O. Hedman ... 1250
Effect of polarization on spacecraft radiation heat transfer. D. K. Edwards and J. T. Bevans ... 1323
Vibrational relaxation and recombination of nitrogen and air in hypersonic nozzle flows. H. T. Nagamatsu and R. E. Sheer Jr. ... 1386
Transparency assumption in hypersonic radiative gas dynamics. P. D. Thomas ... 1401
Transport properties of hydrogen. Dieter Brezing ... 1422
Viscous, radiating shock layer about a blunt body. H. Hoshizaki and K. H. Wilson ... 1614
Heat-transfer measurements in partially ionized air. P. H. Rose and J. O. A. Stankevics ... 1623
Sublimation of graphite at hypersonic speeds. Sinclaire M. Scala and Leon M. Gilbert ... 1635
Melting ablation about decelerating spherical bodies. Simon Ostrach and Dudley G. McConnell ... 1883
Experimental investigation of a charring ablative material exposed to combined convective and radiative heating. John H. Lundell, Roy M. Lakefield, and Jerold W. Jones ... 2087
Combustion and sublimation of cones, spheres, and wedges at hypersonic speeds. Leon M. Gilbert and Sinclaire M. Scala ... 2124
Local heat-transfer coefficients in a nozzle with high-speed laminar-flow. William H. Carden ... 2183
Stagnation-point heat transfer for a new binary air model including dissociation and ionization. S. J. Fenster ... 2189
Effects of electron bombardment on the optical properties of spacecraft temperature control coatings. R. A. Breuch, N. J. Douglas, and D. Vance ... 2316
Longitudinal flow over a circular cylinder with surface mass transfer. D. J. Wanous and E. M. Sparrow (TN) ... 147
Heating of the cavity inside a spherical shell satellite. J. E. Phythian (TN) ... 151
An estimation lemma for laminar compressible boundary-layer velocity profiles. K. P. Kerney (TN) ... 160
Measurement of errors caused by misalignment of floating-element skin-friction balances. F. B. O'Donnell and J. C. Westkaemper (TN) ... 163
Some recent data on stagnation-point convective heat transfer in partially ionized air. Dale L. Compton and David M. Cooper (TN) ... 165
Heat transfer from an impinging rocket jet. D. A. Cose and B. T. Lee (TN) ... 173
Mass injection contours for a hypersonic leading edge at an angle of attack. Chang-Yi Wang (TN) ... 184
Thermorheologically simple viscoelastic materials. M. Shinozuka (TN) ... 375
Radiation stresses on real surfaces. D. K. Edwards and J. T. Bevans (TN) ... 522
Convection from heated wires at moderate and low Reynolds numbers. Peter D. Richardson (TN) ... 537
Thermodynamics of turbine and piston Rankine space power cycles. P. C. Chang and J. R. Powell (TN) ... 754
Hypersonic boundary-layer transition data for a cold-wall slender cone. R. J. Sanator, J. P. DeCarlo, and D. T. Torrillo (TN) ... 758
Application of the modified Bartz analysis to very large nozzles. Robert L. Glick and Reginald I. Vachon (TN) ... 562
A method of estimating the effect of shock interaction on stagnation line heating. John E. Fontenot Jr. (TN) ... 562
Comparison of stability data obtained in free-flight and steady-state facilities. Davis H. Crawford (TN) ... 764
Flame stabilization in laminar boundary layers. T. P. Torda and S. N. Busenberg (TN) ... 764
Spectrographic determination of species in a high-temperature gas. David K. Taylor (TN) ... 771
Stagnation-point nonequilibrium heat transfer. Henry Tong (TN) ... 773
Heat-transfer measurements of entry cones with maneuvering surfaces. George C. Lorenz (TN) ... 774
Ablation of a hollow sphere. Richard F. Parisse and Jerome M. Klosner (TN) ... 777
A heat-transfer criterion for the detection of incipient separation in hypersonic flow. David A. Needham (TN) ... 781
Analog networks for high heat-transfer-rate measurements. Z. A. Walenta (TN) ... 786
Catalytic probe response to high atom flux in a glow discharge shock tube. W. P. Thompson and R. A. Hartunian (TN) ... 790
Pressure orifice shape effect in rarefied flow with heat transfer. H. Eugene Deskins and David E. Boylan (TN) ... 956
Prediction of adiabatic wall temperatures in film-cooling systems. D. B. Spalding (TN) ... 965
Effect of thermal radiation on thin shock structure. Reuben R. Chow (TN) ... 973
Radiative heat-flux potential. Ira M. Cohen (TN) ... 981
Simplified solutions for ablation in a finite slab. Ning Hsing Chen (TN) ... 1148
Boundary conditions for some surface-catalyzed reactions. Paul A. Libby and Forman A. Williams (TN) ... 1152
Exact expressions for composition of gas mixture at equilibrium. C. P. Kentzer and W. A. Anderson (TN) ... 1166
Altitude-velocity charts for imperfect air. Clark H. Lewis and E. G. Burgess III (TN) ... 1176
Weak radiation from a hypersonic shock. Inge L. Ryhming (TN) ... 1178
Mass transfer cooling in laminar hypersonic cavity flow. L. Wolf Jr., H. J. Obremski, and W. J. Christian (TN) ... 1118

Normal shock location of under-expanded gas-particle jets. Andrew B. Bauer (TN) ... 1187
Direct measurement of velocity by hot-wire anemometry. Andrew B. Bauer (TN) ... 1189
Experimentally determinated Reynolds analogy factors for flat plates. F. L. Young and J. C. Westkaemper (TN) ... 1201
Transient stresses in solids induced by radiant surface heating. Ulric S. Lindholm (TN) ... 1203
Shock-layer radiation for yawed cones with radiative decay. Jin H. Chin and L. F. Hearne (TN) ... 1205
Stagnation-point heat transfer and shock-detachment distance for ellipsoids of revolution. E. J. Felderman and R. C. Fellinger (TN) ... 1207
A self-calibrating probe for measuring atom concentration in a hypersonic flow. N. M. Reddy (TN) ... 1336
Plane Poiseuille flow of a radiating and conducting gas. Ralph Greif (TN) ... 1340
Mass-transfer cooling of a flat plate with various transpiring gases. E. M. Sparrow, W. J. Minkowycz, and E. R. G. Eckert (TN) ... 1341
Wave motion in a radiating simple dissociating gas. Inge L. Ryhming (TN) ... 1348
An analysis of a compressible, turbulent boundary layer on a chemically-reacting pyrolytic boron nitride surface. M. D. Bowen and C. W. Gorton (TN) ... 1354
Determination of hot-gas temperature profiles from infrared emission and absorption spectra. Burton Krakow (TN) ... 1359
Free convection on a vertical plate with concentration gradients. Philip F. Dickson and John J. Traxler (TN) ... 1511
Liquid to gas heat transfer in a nuclear reactor. Richard J. Rosa (TN) ... 1516
High-temperature kinetics of graphite oxidation by dissociated oxygen. Daniel E. Rosner and H. Donald Allendorf (TN) ... 1522
Use of Biot's variational technique in heat conduction. Ashley F. Emery (TN) ... 1525
Equilibrium flow of an ideal dissociating gas over a cone. F. Edward Ehlers (TN) ... 1529
Calibration of Preston tubes in supersonic flow. Armand Sigalla (TN) ... 1531
Blunt-body integral method for air in thermodynamic equilibrium. J. Xerikos and W. A. Anderson (TN) ... 1531
Further results of high Reynolds number skin-friction tests. D. R. Moore (TN) ... 1548
Effect of ablation on momentum deposition in the wake of a re-entry vehicle. A. G. Hammitt (TN) ... 1552
Hypersonic turbulent boundary-layer interference heat transfer in vicinity of protuberances. Robert W. Truitt (TN) ... 1754
An approximate expression for laminar skin-friction coefficient. A. Pozzi (TN) ... 1756
Body shape effects on skin friction in supersonic flow. Ahmed R. Wazzan and W. H. Ball (TN) ... 1770
Ablation mechanism for impregnated tungsten. E. W. Ungar and K. J. Touryan (TN) ... 1949
Evidence of surface waves and spreading of turbulence on ablating models. Max E. Wilkins (TN) ... 1963
Transient response of a transpiration-cooled cylindrical surface. Latif M. Jiji (TN) ... 2156
Comments on "Effect of gas composition on the ablation behavior of a charring material." Claude L. Arne (TC) ... 187
Reply by authors to C. L. Arne. Nick S. Vojvodich and Ronald B. Pope (TC) ... 189
Erratum: "Experimental convective heat-transfer measurements." P. Levine and O. Zappa (TC) ... 575
Comments on "Some effects of planform modification on the skin friction drag." Milton J. Thompson (TC) ... 798
Evaluation of a temperature difference method of computing convective heat transfer. L. B. Weckesser (TC) ... 1978
Comments on "Transient stresses in solids induced by radiant surface heating." Raymond M. Measures (TC) ... 2252

HUMAN BEHAVIOR

Controllability limit of a human pilot. Kyuichiro Washizu and Katsuyuki Miyajima ... 941
Comment on "Controllability limit of a human pilot." Ralph H. Smith (TC) ... 1980
Reply by authors to R. H. Smith. K. Washizu and K. Miyajima (TC) ... 1981

INSTRUMENTATION AND PHOTOGRAPHY

A microwave technique of determining growth to detonation. Edgar G. Johnson Jr. ... 2109
A laser grating interferometer. James R. Sterrett, James C. Emery, and John B. Barber (TN) ... 963
A simple schlieren interferometer system. W. F. Merzkirch (TN) ... 1974

MATERIALS, METALLIC

An appraisal of titanium research and development. Robert I. Jaffee (SA) ... 1793
Normal spectral emissivity of isotropic and anisotropic materials. G. W. Autio and E. Scala (TN) ... 738
Comments on "Particle size analysis of ammonium perchlorate by liquid sedimentation." V. S. de Marchi (TC) ... 796

MATERIALS, NONMETALLIC

Linear pyrolysis of thermoplastics in chemically reactive environments. Robert F. McAlevy III and James G. Hansel ... 244
Continuous pyrolytic graphite composite filaments. Ralph L. Hough ... 291
Mechanical properties of pyrolytic graphite. J. J. Gebhardt and J. M. Berry ... 302
Analysis of ultraviolet radiation effects on yield stress of polymethyl methacrylate. Jerome J. Lohr and John A. Parker ... 666
Hugoniot equations of state for plastics: A comparison. E. J. Mills (TN) ... 742
Erratum: "Ablation mechanisms in plastics with inorganic reinforcement." Norman Beecher and Ronald E. Rosensweig (TC) ... 1567
Erratum: "Theory for the ablation of fiberglas-reinforced phenolic resin." Ronald E. Rosensweig and Norman Beecher (TC) ... 1567

MATHEMATICS

Numerical stability of hyperbolic equations in three independent variables. H. Heie and D. C. Leigh ... 1099
Maximum likelihood estimates of linear dynamic systems. H. E. Rauch, F. Tung, and C. T. Striebel ... 1445
Newton-Raphson operator; problems with undetermined end points. Robert S. Long (TN) ... 1351
Stability analysis of a simplified flexible vehicle via Lyapunov's direct method. P. K. C. Wang (TN) ... 1764
Resolution of the 90° Euler angle singularity. Carl Grubin (TN) ... 2147
A property of the differential correction algorithm. D. D. Williams (TN) ... 2340
Comment on "A transient solution of the Fokker-Planck equation." Yun-Yuan Shi (TC) ... 1212
Comments on "Covariance matrix approximation." Donald L. Hitzl (TC) ... 1977

METEOROLOGY

Kármán vortex streets in wakes of islands. Kuldip P. Chopra and Lester F. Hubert (TN) ... 1941

NAVIGATION AND GUIDANCE

Optimal control: a review of theory and practice. Bernard Paiewonsky (SA) ... 1985
Estimation of local vertical and orbital parameters for an earth satellite using horizon sensor measurements. A. L. Knoll and M. M. Edelstein ... 338
Attitude stability of earth-pointing satellites. T. R. Kane ... 726
Application of the continuous and discrete strategies of minimum effort theory to interplanetary guidance. J. V. Breakwell, F. Tung, and R. R. Smith ... 907
Quadratic and higher-order feedback gains for control of nonlinear systems. Andrew H. Jazwinski ... 925
Effect of a rotor on the attitude stability of a satellite in a circular orbit. T. R. Kane and D. L. Mingori ... 936
Tumbling motions of an artificial satellite. Ralph Pringle Jr. ... 1087
An application of the quadratic penalty function criterion to the determination of a linear control for a flexible vehicle. E. E. Fisher ... 1262
Optimum control of an unstable booster with actuator position and rate limits. Bernard Friedland ... 1268
Stability of gyroscopes orbiting in a gravitational field. T. R. Kane and C. F. Wang ... 1290
A natural first approximation to low-thrust trajectories between satellite orbits of the earth and moon. Joseph C. King ... 1432
Necessary conditions for singular extremals. Richard E. Kopp and H. Gardner Moyer ... 1439
A dynamic programing analysis of multiple guidance corrections of a trajectory. Carl G. Pfeiffer ... 1674
Extension of second-order theory of entry mechanics to oscillatory entry solutions. W. H. T. Loh ... 1688
A variational method for optimal staging. Joseph D. Mason, William D. Dickerson, and David B. Smith ... 2007
Application of midcourse guidance technique to orbit determination. Gerald M. Levine (TN) ... 137
Implementation of an optimal adaptive guidance mode. Richard J. Vance (TN) ... 141
A practical note on the use of Lambert's equation. Geza S. Gedeon (TN) ... 149
A steepest-ascent solution of multiple-arc optimization problems. Rollyn G. Graham (TN) ... 154
Stability of damped mechanical systems. Ralph Pringle Jr. (TN) ... 363
Jet damping of symmetric rockets. Albert E. Seames (TN) ... 749
Nonzero average rate-gyro output from sinusoidal inputs. Taft Murray (TN) ... 1337
Experiment in solar orientation of spin stabilized satellite. M. C. Crocker II and E. A. Vrablik (TN) ... 1350
Kinetic energy and angular momentum about the variable center of mass of a satellite. Bertrand T. Fang (TN) ... 1540
Linear feedback solutions for minimum effort interception, rendezvous, and soft landing. Arthur E. Bryson Jr. (TN) ... 1542
Linearized impulsive guidance laws. Wayne Templeman (TN) ... 2148

Comment on "Angle of attack from body-fixed rate gros." Albert E. Seames (TC) ... 571
Comment on "Motion of the center of gravity of a variable-mass body." Virgil W. Snyder (TC) ... 571
Comment on "Torque on a satellite due to gravity gradient and centrifugal force." Bernard C. Sherman (TC) ... 1562
Comment on "Torque on a satellite due to gravity gradient and centrifugal force." W. Göschel and H. Vieler (TC) ... 1562
Comment on "Torque on a satellite due to gravity gradient and centrifugal force." A. Peracchio, J. Patrick, and R. Turek (TC) ... 1563

PHYSICS, GENERAL

Depth of penetration of hypervelocity projectiles. T. D. Riney ... 52
Natural pulsations in electrical spraying of liquids. Ralph S. Carson and Charles D. Hendricks ... 1072
Effect of microparticle impact on the optical properties of metals. Richard E. Gannon, Tibor S. Laszlo, Charles H. Leigh, and Stanley J. Wolnik ... 2096
Noise of highly turbulent jets at low exhaust speeds. J. E. Efowcs Williams and C. G. Gordon (TN) ... 791
Hypervelocity impact and spot welding. Robert F. Rolsten, William A. Dean, and Richard W. O'Neil (TN) ... 1966
Hypervelocity crater depth and target strength. Robert F. Rolsten (TN) ... 2149
Comments on "An analytic approach to hypervelocity impact." T. A. Zaker (TC) ... 1372
Reply by authors to T. A. Zaker. S. W. Yuan and A. M. Bloom (TC) ... 1373

PHYSICS, PLASMA

Magnetohydrodynamic generators with nonequilibrium ionization. Jack L. Kerrebrock (SA) ... 591
Experiments on a quasi-steady $J \times B$ accelerator. R. Leon Leonard and James A. Fay ... 115
Inelastic atomic collisions in plasmas. S. N. Milford ... 201
Gas phase and surface phenomena in seeded plasmas. Edward E. Zukoski and Alfred C. Pinchak ... 270
Magnetogasdynamic channel flows. S. G. Rubin ... 277
Experiments on heat transfer to wires in a partially ionized argon plasma. I. Kimura and A. Kanzawa ... 476
Study of fluctuations in an arc plasmajet using electromagnetic induction. Allen E. Fuhs ... 482
Nonequilibrium ionization in wet alkali metal vapors. John Marlin Smith ... 648
A hypersonic plasma power generator. K. J. Touryan ... 652
Radiative flux from an argon plasma. E. A. Brown Jr. and P. A. Ross ... 660
Weakly ionized nonequilibrium viscous shock-layer and electrostatic probe characteristics. Paul M. Chung ... 817
Compressible plasma flow over a biased body. C. H. Su ... 842
Determination of direct current arc plasma current density by Hall-effect magnetic probe. Pin-Seng Tschang ... 849
Further experimental investigations of a cesium Hall-current accelerator. Clyde O. Brown and Edward A. Pinsley ... 853
Analog studies of upstream-inclined waves in magnetogasdynamic flow. Lawrence S. Iwan ... 860
Nonequilibrium ionization in magetoplasmadynamic power generation: theory and experiment. Mostafa E. Talaat ... 1022
Transverse traveling wave plasma engine. Lee Heflinger, Stuart Ridgway, and Allen Schaffer ... 1028
Experiments with a coaxial Hall current plasma accelerator. William Grossmann Jr., Robert V. Hess, and H. A. Hassan ... 1034
Research on a linear direct-current plasma accelerator. A. F. Carter, G. P. Wood, D. R. McFarland, and W. R. Weaver ... 1040
Energy loss in pulsed coaxial plasma guns. D. E. T. F. Ashby ... 1045
Properties of porous tungsten for surface ionizers. Robert G. Wilson, Peter Schwarzkopf, Gordon D. Seele, and J. F. Hon ... 1048
Plasma nonuniformity and grid erosion in an electron bombardment ion engine. Daniel J. Kerrisk and T. D. Masek ... 1060
Two-dimensional computer experiments on ion-beam neutralization. R. P. Wadhwa, O. Buneman, and D. F. Brauch ... 1076
Electromagnetic diffusion into a moving conductor. William T. Payne and Leon N. Zadoff ... 1294
Cesium ion-beam neutralization with energetic electrons. George C. Theodoridis and Elias P. Gytopoulos ... 1414
Detailed theoretical and experimental study on a large MHD generator. J. F. Louis, G. Gal, and P. R. Blackburn ... 1482
Generation and characteristics of plasma wind-tunnel streams. David F. Hall, Robert F. Kemp, and J. M. Sellen Jr ... 1490
High-performance cesium ionizers made from sized spherical tungsten powder. M. LaChance, G. Kuskevics, and B. Thompson ... 1498
Experimental studies of strong Hall effects and U x B induced ionization. James Klepeis and Richard J. Rosa ... 1659
Magnetohydrodynamic flow in the entrance region of a parallel-plate channel. William T. Snyder ... 1833
Flow of a collisionless plasma over a cone. S. H. Lam and M. Greenblatt ... 1850
Collisionless flow of an ionized gas through a channel with an imposed magnetic field. Morris Perlmutter ... 1855
Ejection of a pinched plasma from an axial orifice. Robert G. Jahn, Woldemar von Jaskowsky, and Rodney L. Burton ... 1862
Temperature field in an arc with a transpiration-cooled anode. C. J. Cremers and E. R. G. Eckert ... 1876
Physical property distributions in a low-pressure crossed-field plasma accelerator. Donald P. Duclos, Y. C. Lin Wu, M. Richard Denison, and Richard W. Ziemer ... 2026
Plasma waves. E. L. Resler Jr. and F. T. Harris ... 2033
Exact criterion of hydromagnetic stability of inviscid vortex flow with finite conductivity. Tien Sun Chang ... 2050
Rayleigh's problem in magnetogasdynamics with Hall effect. Pau-Chang Lu ... 2219
Magnatic confinement of an electric arc in transverse supersonic flow. Charles E. Bond (TN) ... 142
Determination of mass eroded from pusled plasma accelerator electrodes. T. L. Rosebrock, D. L. Clingman, and D. G. Gubbins (TN) ... 150
Tidal wave propagation in a rotating conducting fluid with a magnetic field. Anadi Sankar Gupta (TN) ... 156
Aligned magnetic field problem. S. Leibovich and G. S. S. Ludford(TN) ... 166
One-dimensional flow in MHD generators. Edgar Bendor (TN) ... 167
Nonequilibrium electrical conductivity measurements in argon and helium seeded plasmas. Edward E. Zukoski and Terrill A. Cool (TN) ... 370
A microwave probe for plasma plumes. A. J. Kelly (TN) ... 372
Energy partition in the current layers in plasma. Jan Rosciszewski (TN) ... 373
Electrical properties of rocket nozzle boundary layers. Leroy J. Krzycki (TN) ... 558
Variable collision frequency effects on a Hall-current accelerator characteristics. H. E. Brandmaier (TN) ... 767
Radiant energy loss from a seeded plasma. Michael A. Lutz (TN) ... 772
Hall potentials in nonequilibrium MHD generators. Arthur Sherman (TN) ... 783
Numerical solution of magnetohydrodynamic stagnation-point flow equations. R. J. Gribben (TN) ... 972
An energy inventory in a coaxial plasma accelerator driven by a pulse line energy source. A. V. Larson, T. J. Gooding, B. R. Hayworth, and D. E. T. F. Ashby (TN) ... 977
Exhaust measurements on the plasma from a pulsed coaxial gun. D. E. T. F. Ashby, T. J. Gooding, B. R. Hayworth, and A. V. Larson (TN) ... 1140
Switch-triggered pulsed plasma accelerator thrust measurements. William J. Guman (TN) ... 1158
Radar absorption effect in hypersonic ballistic ranges. William E. Blore and Henry M. Musal Jr. (TN) ... 1171
Magnetohydrodynamic effect on open-channel flow. Walter J. Bornhorst (TN) ... 1180
Combined forced and free convection channel flows in magnetohydrodynamics. C. P. Yu (TN) ... 1184
Minimum length MHD accelerator with constant enthalpy. Harold Mirels, Richard R. Gold, and James F. Mullen (TN) ... 1191
Electrode drops and current distributions in an MGD channel. John J. Karkosak and Myron A. Hoffman (TN) ... 1198
Dynamic efficiency of pulsed plasma accelerators. Neville A. Black and Robert G. Jahn (TN) ... 1209
Remarks and an experiment on magnetogasdynamic flow about a sphere. A. Goldburg and P. O. Jarvinen (TN) ... 1330
A thermal boundary-layer problem in magnetohydrodynamics. John Fillo (TN) ... 1339
Steadiness of a plasmajet. Emil Pfender and Clifford J. Cremers (TN) ... 1345
Simulation of rocket-nozzle environments with an arc-plasma generator. D. T. Flood and J. W. Schaefer. (TN) ... 1361
Laminar MHD channel entrance flows. C. W. Tan (TN) ... 1369
Modification of magnetic energy by differential fluid motions. K. T. Yen (TN) ... 1526
Propellant triggered gas discharges in pulsed plasma engines. M. E. Levy and A. J. Schwalb (TN) ... 1743
An MHD channel flow with temperature dependent electrical conductivity. John B. Heywood (TN) ... 1752
High current steady state coaxial plasma accelerators. T. F. Stratton (TN) ... 1961
Electrostatic probe performance as by its magnetogasdynamic boundary layer. J. T. Yen (TN) ... 2146
Experiments on a Faraday-type MHD accelerator with series-connected electrodes. K. E. Tempelmeyer, L. E. Rittenhouse, and D. R. Wilson (TN) ... 2160
Photoelectric screening of objects moving in an ionized medium. K. P. Chopra and C. S. Shen (TN) ... 2337
Effect of turbulence intermittency on the scattering of electromagnetic waves by underdense plasmas. K. T. Yen (TN) ... 2351
Comments on "Electron fluctuations in an equilibrium turbulent plasma." Frank Lane and Seymour L. Zeiberg (TC) ... 989
Reply by author to F. Lane and S. L. Zeiberg. Anthony Demetriades (TC) ... 990
Comments on "Laminar flow in plane wakes of a conducting fluid in the presence of a transverse magnetic field." Lit S. Han (TC) ... 1214
Reply by author to L. S. Han. A. S. Gupta (TC) ... 1214

PHYSICS, SOLID-STATE

Inertial rotation sensor. S. P. Heims (TN) ... 377
A laser density probe. J. F. Newton and M. J. Walsh (TN) ... 2335

PROPELLANTS AND COMBUSTION

Performance of solid propellants containing metal additives. Henry Cheung and Norman S. Cohen ... 250
Structural integrity of an ablating rocket subjected to axial acceleration. Gerald H. Lindsey and M. L. Williams ... 258
Flame spreading and ignition transients in solid grain propellants. S. DeSoto and H. A. Friedman ... 405

Effects of thermal radiation on the acoustic response of solid propellants. R. H. Cantrell, F. T. McClure, and R. W. Hart 418
Determination of induction times in one-dimensional detonations ($H_2C_2H_2$,and C_2H_4). G. J. Mullaney, Peh S. Kuy, and W. D. Botch 873
Gasdynamic effects of shock-flame interactions in an explosive gas. A. J. Laderman, P. A. Urtiew, and A. K. Oppenheim 876
Ignition of composite propellants by low radiant fluxes. A. D. Baer and N. W. Ryan 884
Transient effects in solid propellant burning. M. Imber 890
Linear pyrolysis rate measurements of propellant constituents. R. L. Coates 1257
Regression rates of nonmetalized hybrid fuel systems. L. D. Smoot and C. F. Price 1408
Measurement of temperature profiles through solid-propellant flames using fine thermocouples. A. J. Sabadell, J. Wenograd, and M. Summerfield 1580
Ignition of an evaporating fuel in a hot, stagnant gas containing an oxidizer. C. E. Hermance, R. Shinnar, and M. Summerfield 1584
A study of composite solid-propellant flame structure using a spectral radiation shadowgraph technique. Louis A. Povinelli 1593
Supersonic combustion in premixed hydrogen-air flows. S. Slutsky, J. Tamagno, and N. Trentacoste 1599
Complex kinetics in adiabatic flow: C-H-O(N) systems. Kenneth A. Wilde 1846
Microscopic determination of near solid state changes in aged propellants. J. L. McGurk 1890
Response of a burning fuel plate to sound vibrations. F. A. Williams 2112
Millimeter measurements of resonance and continuum emission from flames. Bernard J. Peyton, Karl Speh, and Frank R. Arams 2225
Theorectical detonation characteristics of solid composite propellants. P. K. Salzman, O. R. Irwin, and W. H. Anderson 2230
Ignition and combustion of aluminum and beryllium. Donald K. Kuehl 2239
Finite acoustic oscillations and erosive burning in solid fuel rockets. J. F. Bird, R. W. Hart, and F. T. McClure 2248
Plateau ballistics in nitrocellulose propellants. R. F. Preckel (TN). 346
An experimental investigation of the erosive burning characteristics of a nonhomogeneous solid propellant. M. J. Zucrow, J. R. Oxborn, and J. M. Murphy (TN) 523
Temperature effect of gaseous hydrogen on cooling effectiveness. Albert J. Hayek (TN) 527
Hexanitroethane propellant slurries. Milton B. Frankel, Leland D. Christensen, and Edgar R. Wilson (TN) 540
Ignitability of nonhypergolic propellants in presence of potassium permanganate. R. P. Rastogi, Kaushal Kishore, and N. L. Munjal (TN) 554
Nuclear heating and propellant stratification. Edward E. Duke (TN) 760
Unsteady laminar jet flame at large frequencies of oscillation. Warren C. Strahle (TN) 957
Acceleration of burning rate of composite propellants by sound waves. Isidor Elias, Henry Cheung, and Norman S. Cohen (TN) 1167
Low-pressure combustion of solid propellants. Robert Sehgal and Leon Strand (TN) 1524
Feasibility study of the use of antimatter as a rocket propellant. Gordon H. Miller (TN) 1758
Structure of gaseous detonations in a convergent-divergent channel. John H. Lee, Romas Knystautas, and Benedict H. K. Lee (TN) ... 1786
A computation of one-dimensional combustion of methane. James J. DeGroat and Michael J. Abbett (TC) 381
Comments on "Alumina size distributions from high-pressure composite solid-propellant combustion." E. W. Price, J. E. Crump, H. C. Christensen, and R. Sehgal (TC) 1790
Combustion instability in gas rockets. C. T. Bowman, I. Glassman, and L. Crocco (TC) 1981

PROPULSION

Development of a regeneratively cooled 30-kw arcjet engine. James P. Todd and Ronald E. Sheets 122
Electron bombardment heating for electrothermal propulsion. K. E. Starner and W. R. Grabowsky 127
Ion beam neutral component determination by resonance radiation absorption. Robert K. Cole, David F. Hall, Robert F. Kemp, and J. M. Sellen Jr. 263
Investigation of the prebreakdown gap currents between clean and cesium-coated tungsten electrodes. Carol J. Bennette, R. W. Strayer, E. C. Cooper, and L. W. Swanson 284
Jet damping of a solid rocket: theory and flight results. W. T. Thomson and G. S. Reiter 413
Horizontal slump of solid propellant motors. L. R. Herrmann and M. Tamekuni 696
Evaluation of electrode shapes for ion engines. S. L. Eilenberg, W. Seitz, and E. Caplinger 866
Goddard problem with bounded thrust. H. Munick 1283
Effect of ion engine exhaust on the propagation of electromagnetic waves. A. R. M. Rashad 1418
Constant-attitude thrust program optimization. W. G. Melbourne and C. G. Sauer Jr. 1428
Characteristics of porous tungsten ionizers. O. K. Husmann and R. Turk 1653
Electrode materials for cesium contact ion engines. Hugh L. Garvin and Robert G. Wilson 1867
Accelerator electrode currents in ion engines. David Moore and A. Theodore Forrester 2013
Experimental determination of velocity lag in gas-particle nozzle flows. Donald J. Carlson (TN) 354
Nonequilibrium electric conductivity of two-phase metal vapors. A. W. Rowe and J. L. Kerrebrock (TN) 361
Prediction of instability zones in liquid rocket engines. M. R. Beltran and N. A. Frankel (TN) 516
A new concept in rocket engine baffles. W. A. Sirignano and W. C. Strahle (TN) 954
Thermal radiation from solid rocket plumes at high altitude. John E. Fontenot Jr. (TN) 970
Specifie impulse calculations for air-breathing propulsion. Donald R. Allen and William M. Byrne Jr. (TN) 984
A model for low-pressure extinction of solid rocket motors. R. F. Chaiken (TN) 1144
Measurement of individual particle velocities in a simulated rocket exhaust. R. D. Fulmer and D. P. Wirtz (TN) 1506
Experimental analysis of the exhaust beam from a colloid thrustor. Carl T. Norgren and Daniel S. Goldin (TN) 1943

SPACE RADIATION

Cosmic ray hazards in the solar system. S. N. Milford (SA) 193
A thermal vacuum technique for measuring the solar absorptance of satellite coatings as a function of angle of incidence. Marla G. Hoke. 947
Measurements of albedo and earth radiation from OSO-1. John P. Millard and Carr B. Neel 1317
Studies of shock-layer radiation of bodies entering planetary atmospheres. James O. Arnold, Victor H. Reis, and Henry T. Woodward 2019
Emission and absorption of radiant energy in a model planetary atmosphere. H. G. Myer, J. T. Ohrenberger, and T. R. Thompson 2203
Integrated solar pressure for a transparent balloon satellite. Francis E. Baird (TN) 531
Specular and Lambert reflection problems in radiation dynamics. Stephen N. Falken and Cheng-Ting Hsu (TN) 1356
Comment on "Mass and magnetic dipole shielding against electrons of the artificial radiation belt." R. H. Levy (TC) 988

SPACE SCIENCES

An analytic solution for entry into planetary atmospheres. S. J. Citron and T. C. Meir 470
Optimum estimation of satellite trajectories including random fluctuations in drag. H. E. Rauch 717
Minimum impulse coplanar circle-ellipse transfer. H. Gardner Moyer 723
Optimum power-limited orbit transfer in strong gravity fields. Theodore N. Edelbaum 921
Optimality of intermediate-thrust arcs of rocket trajectories. H. M. Robbins 1094
Combined aerodynamic-propulsive orbital plane change maneuver. Richard W. Bruce 1286
Rendezvous problem for nearly circular orbits. Maurice L. Anthony and Frank T. Sasaki 1666
A comparison of three perturbation methods for earth-moon-spaceship problem. Ali Hasen Nayfeh 1682
Perturbation solutions for low-thrust rocket trajectories. Duane P. Johnson and Luis W. Stumpf 1934
Quasilinearization and orbit determination. Robert S. Long 1937
Numerical investigation of minimum impulse orbital transfer. Gary A. McCue and David F. Bender 2328
Trajectory extrapolation in a central force field. Joseph S. Fiorentino (TN) 144
Influence of tesseral harmonics on nearly circular polar and equatorial orbits. P. T. Guttman 330
Order of a perturbation method. Anthony G. Lubowe (TN) 568
Closed-form Lagrangian multipliers for coast periods of optimum trajectories. Michael W. Eckenwiler (TN) 1149
A regularized approach to universal orbit variables. Edward T. Pitkin (TN) 1508
Indirect speed measurement for planetary entry. M. G. Boobar and B. A. McElhoe (TN) 1527
Approximate inviscid, nonadiabatic stagnation region flow field solution. G. M. Hanley and K. D. Korkan (TN) 1537
Self-contained preliminary orbit determination from angular measurements. Robert H. Gersten and Z. E. Schwarzbein (TN) 1544
Ergodic theory and certain stochastic satellite problems. Charles M. Price (TN) 1760
Low-thrust spiral trajectory of a satellite of variable mass. M. J. Cohen (TN) 1946
Further results on solar influenced libration point motion. B. D. Tapley and B. E. Schutz (TN) 1954
Optimum co-altitude redezvous trajectories with continuous thrust. Daril W. Hahn and Berdien F. Itzen (TN) 2151
Comments on "Elliptic elements in terms of small increments of position and velocity components" and generalization of the solutions for an arbitrary inertial point. Hans K. Karrenberg (TC) ... 381
Comments on "A variational method for optimal staging." Walter F. Denham (TC) 2175

SPACE VEHICLES

Dynamic stability of a flexible missile under constant and pulsating thrust. T. R. Beal 486
Extrapolation in time of fields with stationary increments as applied to the impact point prediction of free rockets. Ferdinand P. Beer and Robert G. Sarubbi 495
Phugoid oscillations at hypersonic speeds. E. V. Laitone and Y. S. Chou 732

Angular motion of a re-entering symmetric missile. Charles H. Murphy ... 1275
Motion of re-entry vehicles during constant altitude glide. H. E. Wang. (TN) ... 1346
Correlation of angle-of-attack envelopes for spinning entry bodies. Murray Tobak and Victor L. Peterson (TN) ... 2166

SPACE VEHICLES (SPACECRAFT)

Instability of spinning space stations due to crew motion. W. T. Thomson and Y. C. Fung ... 1082
Minimum fuel closed-loop translation. D. A. Conrad (TN) ... 952
Reply to A. P. Cappelli. Robert E. Lavender (TC) ... 573

STRESSES AND LOADS

Flutter of flat plates with partially clamped edges in the low supersonic region. E. F. E. Zeydel and D. R. Kobett ... 17
Extensional vibration of axisymmetrical shells. Chintsun Hwang ... 23
Dynamic response of a cylinder to a side pressure pulse. John S. Humphreys and Robert Winter ... 27
Experiments on dynamic buckling of shallow spherical shells under shock loading. J. S. Humphreys, R. S. Roth, and J. Zatlers ... 33
Free vibrations of a thin-walled cylindrical shell subjected to a bending moment. V. I. Weingarten ... 40
Matrix analysis of three-dimensional elastic media small and large displacements. J. H. Argyris ... 45
Breathing vibrations of pressurized partially filled tanks. Ernesto Saleme and Theodore Liber ... 132
Influence of cushion stiffness on the stability of cushion-loaded cylindrical shells. D. O. Brush and E. V. Pittner ... 308
Plastic buckling of axially compressed cylindrical shells. S. C. Batterman ... 316
A generalization of Macaulay's method with applications in structural mechanics. W. H. Wittrick ... 326
Elastic stability of thin-walled cylindrical and conical shells under axial compression. V. I. Weingarten, E. J. Morgan, and Paul Seide ... 500
Finite asymmetric deformation of shallow spherical shells. J. Famili and R. R. Archer ... 506
Dynamic response of a long case-bonded viscoelastic cylinder. J. D. Achenbach ... 673
Dynamic analysis of structural systems using component modes. Walter C. Hurty ... 678
Liquid surface oscillations in longitudinally excited rigid cylindrical containers. Franklin T. Dodge, Daniel D. Kana, and H. Norman Abramson ... 685
The response of a thin cylindrical shell to transient surface loading. James Sheng ... 701
Stiffness of thin pressurized shells of revolution. Peter F. Jordan ... 899
Elastic stability of thin-walled cylindrical and conical shells under combined external pressure and axial compression. V. I. Weingarten and Paul Seide ... 913
An integrated approach to structural synthesis and analysis. Lucien A. Schmit Jr. and Richard L. Fox ... 1104
Elastic stability of thin-walled cylindrical and conical shells under combined internal pressure and axial compression. V. I. Weingarten, E. J. Morgan, and Paul Seide ... 1118
Pure bending flutter of a swept wing in a high-density, low-speed flow. John Dugundji and Nancy Ghareeb ... 1126
Creep analysis of circular cylindrical shells. F. A. Cozzarelli, Sharad A. Patel, and B. Venkatraman ... 1298
Some properties of the energy load. C. P. Rubin and E. F. Masur ... 1302
Nonlinear numerical analysis of axisymmetrically loaded arbitrary shells of revolution. Philip Mason, Robert Rung, Jacob Rosenbaum, and Rein Ebrus ... 1307
Uniform-stress spinning filamentary disk. A. C. Kyser ... 1313
Response to pressurization of a viscoelastic cylinder with an eroding internal boundary. R. M. Christensen and R. N. Schreiner ... 1451
Asymmetric buckling of finitely deformed conical shells. J. Famili ... 1456
Axial buckling of pressurized imperfect cylindrical shells. John Hutchinson ... 1461
Vibration of cylindrical gridwork shells. Thein Wah ... 1467
Free vibrations of ring-stiffened conical shells. V. I. Weingarten ... 1475
Flutter of two-bay flat panels of infinite span at supersonic Mach numbers. Malcolm H. Lock and Edith F. Farkas ... 1692
Dynamic response of two-layered cylindrical shells to time-dependent loads. David Bushnell ... 1698
Buckling of segments of toroidal shells. Manuel Stein and John A. McElman ... 1704
Buckling of a long cylindrical shell containing an elastic core. G. Herrmann and M. J. Forrestal ... 1710
Numerical analysis of large exisymmetric deformations of thin spherical shells. Paul E. Wilson and Edward E. Spier ... 1716
Annular plate under a transverse line impulse. Alexander L. Florence ... 1726
Stresses about a circular hole in a cylindrical shell. Peter Van Dyke ... 1733
Elasticity equations for incompressible and nearly incompressible materials by a variational theorem. Leonard R. Herrmann ... 1896
Toroidal shells under internal pressure in the transition range. John N. Rossettos and J. Lyell Sanders Jr. ... 1901
Consistent matrix formulations for structural analysis using finite-element techniques. John S. Archer ... 1910
Flutter of a flat panel subjected to a nonlinear temperature distribution. Harry G. Schaeffer and Walter L. Heard Jr. ... 1918
Free vibrations of prestressed toroidal membrane. Atis A. Liepins ... 1924
Stress analysis of finite length cylinders by station function. H. Kaehler ... 2132
Application of matrix displacement method to linear elastic analysis of shells of revolution. John H. Percy, Theodore H. H. Pian, Stanley Klein, and Dhirendra R. Navaratna ... 2138
General static aeroelastic analysis for a body of revolution. David Allen O'Keefe ... 2256
Structural analysis of axisymmetric solids. Edward L. Wilson ... 2269
Stability of stiffened cylinders. John M. Hedgepeth and David B. Hall ... 2275
Use of cross correlation in studying the response of lightly damped structures to random forces. B. L. Clarkson and C. A. Mercer ... 2287
Theoretical and experimental panel flutter studies in the Mach number range 1.0 to 5.0. E. H. Dowell and H. M. Voss ... 2292
Computer analysis of asymmetric free vibrations of ring-stiffened orthotropic shells of revolution. Gerald A. Cohen ... 2305
Nonlinear dynamic behavior of shallow spherical shells. Robert R. Archer and Charles G. Lange ... 2313
Calculation of natural modes of vibration for free-free structures in three-dimensional space. Julian H. Berman and Jerome Sklerov (TN) 158
Buckling of axially compressed cylindrical shells reinforced by circumferential fiber windings. H. L. Langhaar, A. P. Boresi, G. Love, and L. Marcus (TN) ... 175
Thin cylindrical shells under surface torques. S. W. Yuan (TN) ... 178
Natural frequency curves of simply supported cylindrical shells. J. R. Yamane (TN) ... 180
Torsion of an elastic cylinder of unsymmetrical aerofoil cross section. K. Y. Narasimhan (TN) ... 347
Large displacement analysis of axially compressed circular cylindrical shells. C. H. Tsao (TN) ... 351
Influence of geometry on the number of buckles in cylinders. Richard L. De Neufville (TN) ... 364
An extension of Hetényi's method through the use of Macaulay brackets. Leon Y. Bahar (TN) ... 369
Reduction of stiffness and mass matrices. Robert J. Guyan (TN) ... 380
Dynamic loading of structural models by electrostatic forces. J. P. O'Neill (TN) ... 518
Equilibrium equation for radially loaded thin circular rings. Anatol Zagustin and Donovan H. Young (TN) ... 533
Dynamic response of a nonlinear membrane in supersonic flow. Harry G. Schaeffer and John A. McElman (TN) ... 543
Uniformly located plates of regular polygonal shape. A. W. Leissa, C. C. Lo, and F. W. Niedenfuhr (TN) ... 566
Distributed mass matrix for plate element bending. Robert J. Guyan (TN) ... 567
Influence of boundary conditions on stability of thin-walled cylindrical shells under axial load and internal pressure. Günter Ficher (TN) ... 736
Natural frequencies of orthotropic circular plates. K. A. V. Pandalai and Sharad A. Patel (TN) ... 780
Inadequacy of nodal connections in a stiffness solution for plate bending. Bruce M. R. Irons and Keith J. Draper (TN) ... 961
Structural eigenvalue problems: elimination of unwanted variables. Bruce Irons (TN) ... 961
Deflection of a uniformly loaded rectangular plate with one pair of parallel edges rigidly connected to two identical beams. W. W. Smith and H. H. Pian (TN) ... 964
Buckling of circular conical shells under uniform axial compression. Josef Singer (TN) ... 985
Characteristic roots for Donnell's equations with torsion. T. C. Fan (TN) ... 1134
Dynamic response of an encased elastic cylinder with ablating inner surface. J. D. Achenbach (TN) ... 1142
Circular sandwich plate under radial compression and thermal gradient. Ju-Chin Huang and Ibrahim K. Ebcioglu (TN) ... 1146
Generalized matrix force and displacement method of linear structural analysis. Alan L. Yettram and Husain M. Husain (TN) ... 1154
Deflections and bending moments of rectangular sandwich panels with clamped edges under combined biaxial compressions and pressure. T. H. Lin and L. T. Yokota (TN) ... 1162
Lagrange multiplier techniques in structural analysis. Bruce M. Irons and Keith J. Draper (TN) ... 1172
A solution of the partial differential equation governing vibration of a rod. Sing-Chih Tang (TN) ... 1174
Vibration of hub-pin plates. R. R. Craig and H. J. Plass (TN) ... 1177
Approximate solutions of the membrane flutter problem. C. H. Ellen (TN) ... 1186
Forced vibrations of a burning rocket. J. D. Achenbach (TN) ... 1333
Torsion of an aeolotropic cylinder having a speroidal inclusion on its axis. S. C. Bose (TN) ... 1352
Effect of pulse shape on final deformation of spherical shells under impulsive loading. R. Sankaranarayanan (TN) ... 1513
Constraint surface normals for structural synthesis techniques. Richard L. Fox (TN) ... 1517
In-plane vibration of spinning disks. Ronald L. Huston (TN) ... 1519
Very-large-deflection behavior of corrugated strips. David L. Platus and Shoichi Uchiyama (TN) ... 1549
Creep under random loading. M. P. Bieniek (TN) ... 1559
Comments on "Stability of damped mechanical systems" and a further extension. E. E. Zajac (TN) ... 1749
Stepped circular Kirchhoff plate. Walter D. Pilkey (TN) ... 1768
Stability of finite-difference equation for the transient response of a flat plate. John W. Leech (TN) ... 1772
Some experimental observations on the nonlinear vibration of cylindrical shells. Mervyn D. Olson (TN) ... 1775
Electromagnetic generation of high dynamic buckling pressures. Wolfgang A. Kapp and Donald G. Lemke (TN) ... 1777
Large deflections of thin rods under nonsymmetric distributed loads. Teh Hwei Lee (TN) ... 1779
Large amplitude-free oscillations of beams and plates. A. V. Srinivasan (TN) ... 1951

Photoelastic analysis of prebuckling deformations of cylindrical shells. D. Gorman and R. M. Evan-Iwanowski (TN) 1956
Buckling of imperfect cylindrical shells under axial compression and external pressure. John Hutchinson (TN) 1968
Criterion for selecting stiffness matrices. Jitendra Khanna (TN) 1976
Coupled panel/cavity vibrations. D. J. Ketter (TN) 2162
Stability of a finite-difference method for solving matrix equations. John W. Leech, Pao-Tan Hsu, and Evelyn W. Mack (TN) 2172
Buckling of cantilever cylindrical shell with a transverse end load. S. Y. Lu (TN) 2350
Comments on "Derivation of element stiffness matrices by assumed stress distributions." Richard H. Gallagher (TC) 186
Reply by author to R. H. Gallagher. Theodore H. H. Pian (TC) 187
Comments on "Some energy and momentum considerations in the perforation of plates." William J. Stronge (TC) 570
Comments on "Vibrational characteristics of thin-wall conical frustum shells." William C. L. Hu (TC) 1213
Reply by authors to W. C. L. Hu. J. D. Watkins and R. R. Clary (TC) 1213
Comment on "Basis for derivation of matrices for the direct stiffness method." J. L. Tocher and K. K. Kapur (TC) 1215
Reply by author to J. L. Tocher and K. K. Kapur. R. J. Melosh (TC) 1216
Errata: "The response of a thin cylindrical shell to transient surface loading." James Sheng (TC) 1568
Comment on "Buckling of a cylindrical shell loaded by a pre-tensioned filament winding." T. C. Fan (TC) 1791
Errata: "Plastic buckling of axially compressed cylindrical shells." Steven C. Batterman (TC) 1792
Comments on "Uniformly loaded plates of regular polygonal shape." H. D. Conway (TC) 2175
Comments on "Strain-displacement relations in large displacement theory of shells." Harvey M. Berkowitz (TC) 2176

STRUCTURAL DESIGN

General instability and optimum design of grid-stiffened spherical domes. Robert F. Crawford and David B. Schwartz 511
Behavior of fully stressed design of structures and its relationship to minimum-weight design. Reza Razani 560
Buckling of a cylindrical shell loaded by pre-tensioned filament winding. Martin M. Mikulas Jr. and Manuel Stein (TN) 560
Design of rectangular panels with biaxial stresses. Harold Switzky (TN) 776