

INTERNATIONAL JOURNAL OF
SOLIDS and
STRUCTURES

Editor-in-Chief
GEORGE HERRMANN

VOLUME 9
1973

Pergamon Press

NEW YORK · OXFORD · BRAUNSCHWEIG

INTERNATIONAL JOURNAL OF SOLIDS AND STRUCTURES

Editor-in-Chief:

GEORGE HERRMANN *School of Engineering
Stanford University, Stanford, California 94305*

Board of Editors:

J. D. ACHENBACH	<i>Northwestern University</i>
B. A. BOLEY	<i>Cornell University</i>
V. V. BOLOTIN	<i>USSR Academy of Sciences</i>
L. FINZI	<i>Milan Polytechnic Institute</i>
Y. C. FUNG	<i>University of California, San Diego</i>
H. J. GREENBERG	<i>University of Denver</i>
H. LIEBOWITZ	<i>The George Washington University</i>
C. MASSONNET	<i>University of Liège</i>
E. W. PARKES	<i>Cambridge University</i>
K. WASHIZU	<i>University of Tokyo</i>
W. ZERNA	<i>Ruhr-Universität Bochum</i>
O. C. ZIENKIEWICZ	<i>University College of Swansea</i>
H. ZORSKI	<i>Polish Academy of Sciences</i>

Editorial Advisory Board:

J. H. ARGYRIS	<i>London</i>	F. K. G. ODQVIST	<i>Stockholm</i>
C. BENITO	<i>Madrid</i>	H. PARKUS	<i>Vienna</i>
J. L. ERICKSEN	<i>Baltimore</i>	W. PRAGER	<i>Providence</i>
J. FERRY BORGES	<i>Lisbon</i>	Iu. N. RABOTNOV	<i>Moscow</i>
N. J. HOFF	<i>Stanford</i>	F. S. SHAW	<i>Sydney</i>
C. F. KOLLMUNNER	<i>Zurich</i>	J. SINGER	<i>Haifa</i>
J. MANDEL	<i>Paris</i>	I. N. SNEDDON	<i>Glasgow</i>
R. D. MINDLIN	<i>New York</i>	A. YLINEN	<i>Helsinki</i>
F. NEJDRON	<i>Ljungby</i>		

Published monthly. Subscription, post paid (air mail charges extra): \$90.00 (£36) per annum, for libraries, research establishments and all other multiple-reader institutions. Private individuals, whose departmental libraries subscribe, may obtain this Journal for their personal use at a reduced rate of \$17.50 (£7) per annum.

Microform Subscriptions and Back Issues

Current subscriptions on microfiche and microfilm, and back files on microfilm as well as back issues in the regular editions of all previously published volumes are available from our sole distributors, Microforms International Marketing Corporation Inc. (MicroMark) at the most convenient address: Fairview Park, Elmsford, New York 10523, U.S.A. Cowper House, Olney, Bucks, England

Copyright © 1973 Pergamon Press Ltd.

Publishing, Subscription and Advertising Offices:

PERGAMON PRESS

Headington Hill Hall, Oxford OX3 0BW, England
Maxwell House, Fairview Park, Elmsford, New York 10523, U.S.A.

CONTENTS

NO. 1

A. JAHANSIHI: Transient stresses induced by heating a plane boundary	1
ARIS PHILLIPS and HAN-CHIN WU: A theory of viscoplasticity	15
P. W. RANDLES: Cusped wave fronts in anisotropic elastic plates	31
L. M. BROCK and J. D. ACHENBACH: Extension of an interface flaw under the influence of transient waves	53
THOMAS DUFFEY: Transient response of a plastically anisotropic cylinder in plane strain	69
KRZYSZTOF SZUWALSKI and MICHAL ŹYCZKOWSKI: On the phenomenon of decohesion in perfect plasticity	85
Y. IWASHIMIZU and K. KUBOMURA: Stress-induced rotation of polarization directions of elastic waves in slightly anisotropic materials	99
JAMES C. FRAVENTHAL: Initial postbuckling behaviour of optimally designed columns and plates	115
CLIVE L. DYM: Buckling and postbuckling behaviour of steep compressible arches	129
J. L. ERICKSEN: Simpler problems for elastic plates	141
RICHARD M. BEAM and HARVEY P. YAGODA: On the torsional static stability and response of open section tubes subjected to thermal radiation loading ..	151
VIGGO TVERGAARD: Imperfection-sensitivity of a wide integrally stiffened panel under compression	177

NO. 2

A. J. DURELLI, V. J. PARKS and J. S. NORGARD: Photoelastic solution of stresses in the elastic foundation supporting a plate	193
G. T. S. DONE: Damping configurations that have a stabilizing influence on nonconservative systems	203
JACOB ABOUDI: Stress wave propagation in a laminated plate under impulsive loads	217
R. D. MINDLIN: On the electrostatic potential of a point charge in a dielectric solid	233
C. ATKINSON and M. L. WILLIAMS: A note on the Cherepanov calculation of viscoelastic fracture	237
TAKAHITO GOSHIMA, TAKASHI KOIZUMI and ICHIRO NAKAHARA: Axisymmetric quasi-static thermal stresses in an infinite slab	243
MARCELO EPSTEIN and YAIR TENE: A linear theory of thin elastic shells, based on conservation of a non-normal straight line	257
M. G. SAMUCHIN and J. DUNDURS: Transmission of concentrated forces into prismatic shells-II	269
ZACHARY SHERMAN: Weight minimization of axisymmetric clamped plates subject to constraints	279
T. M. HRUDEY: A creep bending analysis of plates by the finite element method	291

NO. 3

RICHARD B. NELSON: Natural vibrations of laminated orthotropic spheres	305
PIN TONG and THEODORE H. H. PIAN: On the convergence of the finite element method for problems with singularity	313
ISAAC FRIED: Influence of Poisson's ratio on the condition of the finite element stiffness matrix	323
A. J. MORRIS: A deficiency in current finite elements for thin shell applications	331
U. YUCEOGLU and F. ERDOGAN: A cylindrical shell with an axial crack under skew-symmetric loading	347
JACOB ABOUDI and YAKO BENVENISTE: One-dimensional finite amplitude wave propagation in a compressible elastic half-space	363
K. S. HAVNER and R. VARADARAJAN: A quantitative study of a crystalline aggregate model	379
G. A. HEGEMIER, G. A. GURTMAN and ADNAN H. NAYFEH: A continuum mixture theory of wave propagation in laminated and fiber reinforced composites	395
M. P. KAMAT and G. J. SIMITSES: Optimal beam frequencies by the finite element displacement method	415
N. P. GUPTA: Lindemann law for ideal solids	431
OTTO J. SVEC and G. M. L. GLADWELL: A triangular plate bending element for contact problems	435
Erratum	447

NO. 4

ISAAC FRIED: Shear in C^0 and C^1 bending finite elements	449
P. C. Y. LEE and Y. S. WANG: Axially symmetric transient wave propagation in elastic rods with nonuniform section	461
B. S. RAMACHANDRA RAO, G. L. NARASIMHAM and S. GOPALACHARYULU: Eigenfunction analysis for bending of lamped rectangular, orthotropic plates	481
DALE N. LEE: Analysis of multi-beam slabs	495
A. R. S. PONTER: Deformation bounds for a creeping structure approaching rupture	507
A. F. JOHNSON: Bending and torsion of anisotropic beams	527
D. E. BESKOS: Universal solutions for fiber-reinforced incompressible isotropic elastic materials	553

NO. 5

TAJIRO NONAKA: An elastic-plastic analysis of a bar under repeated axial loading	569
L. W. REHFIELD: Nonlinear free vibrations of elastic structures	581
R. W. NAU and J. G. SIMMONDS: Calculation of the low natural frequencies of clamped cylindrical shells by asymptotic methods	591
K. N. SAWYERS and R. S. RIVLIN: Instability of an elastic material	607

NO. 5—*continued*

U. LEPIK: Application of Pontryagin's maximum principle for minimum weight design of rigid-plastic circular plates	615
Y. M. TSAI: Propagation of a brittle crack at constant and accelerating speeds	625
MUMTAZ K. KASSIR and GEORGE C. SIH: Application of Papkovich-Neuber potentials to a crack problem	643
P. S. THEOCARIS: Stress-singularities due to uniformly distributed loads along straight boundaries	655
P. TERNDRUP PEDERSEN: Buckling of unstiffened and ring stiffened cylindrical shells under axial compression	671
MARK LEVINSON: Comments on the paper: Adjoint variational methods in non-conservative stability problems	693
SHYAM N. PRASAD and GEORGE HERRMANN: Reply to the comments by M. Levinson concerning the paper: Adjoint variational methods in nonconservative stability problems	694

NO. 6

R. D. MINDLIN: Electromagnetic radiation from a vibrating quartz plate	697
ERIC N. K. LIAO and P. G. KESSEL: On dynamic response of prestressed cylindrical shells—Green's tensor technique	703
J. MANDEL: Equations constitutives et directeurs dans les milieux plastiques et visco-plastiques	725
N. T. ICH and NORMAN JONES: The dynamic plastic behavior of simply supported spherical shells	741

NO. 7

V. N. GAVDZINSKI and E. F. HENAIN: The mixed boundary value problem for the elastic half space	761
W. N. HUANG and F. A. COZZARELLI: Damped lateral vibration in an axially creeping beam with random material parameters	765
FREDERICK REYES NORWOOD: Similarity solutions in plane elastodynamics ..	789
NÉSTOR DISTÉFANO and RICARDO TODESCHINI: Modeling, identification and prediction of a class of nonlinear viscoelastic materials (I)	805
M. ROBINSON: The effect of transverse shear stresses on the yield surface for thin shells	819
T. Y. YANG: Matrix displacement solution to elastica problems of beams and frames	829
PAUL G. RICHARDS: The dynamic field of a growing plane elliptical shear crack	843
J. KIUSALAAS: Optimal design of structures with buckling constraints	863
JACOBO BIELAK: Comments on the paper: Vertical vibration of a rigid circular body and harmonic rocking of a rigid rectangular body on an elastic stratum	879

NO. 7—Continued

A. O. AWOJOBI: Reply to the comments of Jacobo Bielak concerning the paper: Vertical vibration of a rigid circular body and harmonic rocking of a rigid rectangular body on an elastic stratum	881
W. E. CARROLL and R. M. BARKER: A theorem for optimum finite-element idealizations	883
E. P. CHEN and G. C. SIIH: Running crack in an incident wave field	897

NO. 8

M. RATWANI and F. ERDOGAN: On the plane contact problem for a frictionless elastic layer	921
C. SVE: Elastic wave propagation in a porous laminated composite	937
P. V. McLAUGHLIN, JR., S. MAJUMDAR and J. W. PHILLIPS: Elastic behavior, brittle failure and plastic flow of filamentary materials	951
W. LAKIN: Refraction of an elastic-plastic shock	967
A. NEEDLEMAN: A numerical study of uniaxial compression in circular elastic-plastic columns	981
A. VAN DER NEUT: The sensitivity of thin-walled compression members to column axis imperfection	999
Announcement	1012

NO. 9

ISAAC FRIED: Bounds on the spectral and maximum norms of the finite element stiffness, flexibility and mass matrices	1013
T. L. CHEN and A. J. DURELLI: Stress field in a sphere subjected to large deformations	1035
R. C. KOELLER: On a formulation of the bending of elastic plates	1053
S. K. BOSE and A. K. MAL: Longitudinal shear waves in a fiber-reinforced composite	1075
HARRY H. WEST and DANIEL L. CARAMANICO: Initial-value discrete suspension bridge analysis	1087
FRED NILSSON: A path-independent integral for transient crack problems	1107
JØRGEN JUNCHER JENSEN: Harmonic vibrations of pretwisted plates	1117
A. K. NIYOGI: Nonlinear bending of rectangular orthotropic plates	1133

NO. 10

G. D. GUPTA: A layered composite with a broken laminate	1141
W. T. TSAI: On the problem of flexure of anisotropic cylindrical shells	1155
SATYANADHAM ATLURI: On the hybrid stress finite element model for incremental analysis of large deflection problems	1177

NO. 10—*continued*

SHYAM N. PRASAD and SAILENDRA N. CHATTERJEE: Some mixed boundary value problems of elasticity in a rectangular domain	1195
NENG-MING WANG: Finite element analysis of cut-growth in sheets of highly elastic materials	1211
N. S. KHOT, V. B. VENKAYYA, C. D. JOHNSON and V.A. TISCHLER: Optimization of fiber reinforced composite structures	1225
KARL W. SCHULER, JACE W. NUNZIATO and EDWARD K. WALSH: Recent results in nonlinear viscoelastic wave propagation	1237
W. F. CHEN and T. ATSUTA: Strength of eccentrically loaded walls	1283
SUBRATA MUKHERJEE: Variational principles in dynamic thermoviscoelasticity ..	1301
Erratum	569

NO. 11

J. KIUSALAAS, W. JAUNZEMIS and J. C. CONWAY: A strain-gradient theory for prestrained laminates	1317
W. KREHER and H.-G. SCHÖPF: Effective elastic-plastic compressibility of porous bodies	1331
G. T. EMBLEY and G. C. SIH: Sudden appearance of a crack in a bent plate ..	1349
MEHDI FARSHAD: On general conservative end loading of pretwisted rods ..	1361
JACE W. NUNZIATO and EDWARD K. WALSH: Amplitude behavior of shock waves in a thermoviscoelastic solid	1373
A. K. NAGHDI: On the convergence of the series solution for a cylindrical shell subject to a segmental line load	1385
K. ADEROGBA: The thermal bending of composite plates	1389
HARRY H. WEST and ANIL K. KAR: Discretized initial-value analysis of cable nets	1403

NO. 12

M. GRIGORIAN and S. YAGHMAI: A theorem for the plastic design of regular twistless grids under continuous transverse loading	1421
NÉSTOR DISTÉFANO and RICARDO TODESCHINI: Modeling, identification and prediction of a class of nonlinear viscoelastic materials (II)	1431
PH. BOULANGER, G. MAYNE and R. VAN GEEN: Magneto-optical, electro-optical and photoelastic effects in an elastic polarizable and magnetizable isotropic continuum	1439
J. C. NAGTEGAAL: A superposition principle in optimal plastic design for alternative loads	1465
PETER W. LIKINS: Dynamic analysis of a system of hinge-connected rigid bodies with nonrigid appendages	1473
J. D. RENTON: Buckling of long, regular trusses	1489
L. W. MORLAND: A plane theory of inextensible transversely isotropic elastic composites	1501

NO. 12—*continued*

VIGGO TVERGAARD: Influence of post-buckling behaviour on optimum design of stiffened panels	1519
ZENON MROZ and J. E. TAYLOR: Prestress for maximum strength	1535
J. A. WALKER: A note on stabilizing damping configurations for linear nonconservative systems	1543
THOMAS A. McMAHON: Elastic beams of greatest lateral extent	1547
Y. M. KUO and H. D. CONWAY: The torsion of composite tubes and cylinders ..	1553
ANNOUNCEMENT:	1567

AUTHOR INDEX

- ABOUDI JACOB, 217, 363
ACHENBACH J. D., 53
ADEROGBA K., 1389
ATKINSON C., 237
ATLURI S., 1177
ATSUTA T., 1283
AWOJOBI A. O., 881
BARKER R. M., 883
BEAM RICHARD M., 151
BENVENISTE YAKO, 363
BESKOS D. E., 553
BIELAK J., 879
BOSE S. K., 1075
BOULANGER PH., 1439
BROCK L. M., 53
CARAMANICO D. L., 1087
CARROLL W. E., 883
CHATTERJEE S. N., 1193
CHEN E. P., 7, 897
CHEN T. L., 1035
CHEN W. F., 1283
CONWAY H. D., 1553
CONWAY J. C., 1317
COZZARELLI F. A., 765
DISTÉFANO N., 805, 1431
DONE G. T. S., 203
DUFFEY THOMAS, 69
DUNDURS J., 269
DURELLI A. J., 193, 1035
DYM CLIVE L., 129
EMBLEY G. T., 1349
EPSTEIN MARCELO, 257
ERDOGAN F., 347, 921
ERICKSEN J. L., 141
FARSHAD M., 1361
FRAVENTHAL JAMES C., 115
FRIED I., 323, 449, 1013
GAVDZINSKI V. N., 761
GLADWELL G. M. L., 435
GOPALACHARYULU S., 481
GOSHIMA TAKAHITO, 243
GRIGORIAN M., 1421
GUPTA N. P., 431, 1141
GURTMAN G. A., 395
HAVNER K. S., 379
HEGEMIER G. A., 395
HENAIN E. F., 761
HERRMANN GEORGE, 694
HRUDEY T. M., 291
HUANG W. N., 765
ICH N. T., 741
IWASHIMIZU Y., 99
JAHANSHAHI A., 1
JAUNZEMIS W., 1317
JENSEN J. J., 9, 1117
JOHNSON A. F., 527
JOHNSON C. D., 1225
JONES N., 741
KEMAT M. P., 415
KAR A. K., 1403
KASSIR MUMTAZ K., 643
KESSEL P. G., 703
KHOT N. S., 1225
KIUSSALAAS J., 863, 1317
KOELLER R. C., 1053
KOIZUMI TAKASHI, 243
KREHER W., 1331
KUBOMURA K., 99
KUO Y. M., 1553
LAKIN W., 967
LEE DALE N., 495
LEE P. C. Y., 461
LEPIK Ü., 615
LEVINSON MARK, 693
LIAO E. N. K., 6, 703
LIKINS P. W., 1473
MC LAUGHLIN S., 951
McMAHON T. A., 1547
MAJUMDAR S., 951
MAL A. K., 1075
MANDEL J., 725
MAYNE B. G., 1439
MINDLIN R. D., 233, 697
MORLAND L. W., 1501
MORRIS A. J., 331
MROZ Z., 1535
MUKHERJEE S., 1301
NAGHDI A. K., 1385
NAGTEGAAL J. C., 1465
NAKAHARA ICHIRO, 243
NARASIMHAM G. L., 481
NAU R. W., 591
NAYFEH ADNAN H., 395
NEEDLEMAN A., 981
NELSON RICHARD B., 305
NILSSON F., 1107
NIYOGI A. K., 1133
NONAKA TAIJIRO, 569
NORGARD J. S., 193
NORWOOD F. R., 789
NUNZIATO J. W., 1237, 1373
PARKS V. J., 193
PEDERSEN P. TERNDRUP, 671
PHILLIPS ARIS, 15
PHILLIPS J. W., 951
PIAN THEODORE H. H., 313
PONTER A. R. S., 507
PRASAD SHYAM N., 694, 1193
RAMACHANDRA RAO B. S., 481
RANDLES P. W., 31
RATWANI M., 921
REHFIELD L. W., 581
RENTON J. D., 1489
RICHARDS P. G., 843
RIVLIN R. S., 607
ROBINSON M., 819
SAMUCHIN M. G., 269
SAWYERS K. N., 607
SCHÖPF H.-G., 1331
SCHULER KARL W., 1237
SHERMAN ZACHARY, 279
SIH G. C., 643, 897, 1349
SIMITSES G. J., 415
SIMMONDS J. G., 591
SVE C., 937
SVEC OTTO J., 435
SUWALSKI KRYSZTOF, 85
TAYLOR J. E., 1535
TENE YAIR, 257
THEOCARIS P. S., 655
TISCHLER V. A., 1225
TODESCHINI R., 805, 1431
TONG PIN, 313
TSAI Y. M., 625, 1155
TVERGAARD VIGGO, 177, 1519
VAN DER NEUT A., 999
VAN GEEN R., 1439
VARADARAJAN R., 379
VENKAYYA V. B., 1225
WALKER J. A., 1543
WALSH E. K., 1237, 1373
WANG N.-M., 1211
WANG Y. S., 461
WEST H. H., 1087, 1403
WILLIAMS M. L., 237
WU MAN-CHIN, 15
YAGHMAI S., 1421
YAGODA HARVEY P., 151
YANG T. Y., 829
YUCEOGLU U., 347
ŻYCZKOWSKI MICHAL, 85