

1990 IEEE ANTENNAS & PROPAGATION

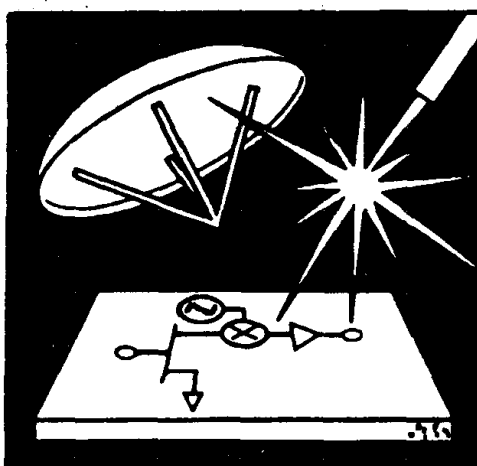
INTERNATIONAL SYMPOSIUM

Vol. 1

**1990 INTERNATIONAL SYMPOSIUM DIGEST
ANTENNAS AND PROPAGATION
VOLUME I**

**INSTITUTE OF ELECTRICAL
AND ELECTRONICS ENGINEERS**

MERGING TECHNOLOGIES



FOR THE 90's

**IEEE CATALOG NO. 90CH2776-3
LIBRARY OF CONGRESS NO. 89-80729**

9250062
**DALLAS, TX
MAY 7-11, 1990**

9250062



Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of U.S. Copyright law for private use of patrons for those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 27 Congress Street, Salem, MA 01970. Instructors are permitted to photocopy isolated articles for non-commercial classroom use without fee. For other copying, reprint, or republication permission, write to Director, Publishing Services, IEEE, 345 East 47th Street, New York, NY 10017. All rights reserved. Copyright 1989 by the Institute of Electrical and Electronics Engineers, Inc.

For information about purchasing this four-volume set, call the IEEE Service Center at (201) 981-1393 or write to its address: 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

IEEE ANTENNAS AND PROPAGATION SOCIETY ADMINISTRATIVE COMMITTEE

D. C. CHANG, President

H. E. SCHRANK, Vice President

J. K. SCHINDLER, Secretary-Treasurer

1990

C. M. BUTLER
F. E. GARDIOL
W. K. KAHN
Y. RAHMAT-SAMII
* A. J. SIMMONS

1991

C. W. BOSTIAN
R. E. KING
R. J. KING
* G. H. KNITTEL
D. M. POZAR

1992

* G. S. BROWN
S. A. LONG
A. C. LUDWIG
L. W. PEARSON
R. J. POGORZELSKI

1993

* L. C. PEDEN

Honorary Life Members: R. C. HANSEN, E. C. JORDAN, L. C. VAN ATTA

1989 Committee Chairmen and Representatives

Antenna Measurements (AMTA): E. S. GILLESPIE
APS-EMC/Nuclear EMP: C. E. BAUM
Awards and Fellows: A. W. LOVE
Candidate Search Committee: A. C. SCHELL
Chapter Activities: Y. RAHMAT-SAMII
Committee on Man and Radiation: F. L. CAIN
Constitution and Bylaws: R. I. WOLFSON
Distinguished Lecturers: G. A. BALANIS
Education: A. T. ADAMS
EAB/TAAC: E. K. MILLER

Energy Committee: R. S. COHEN
J. F. LINDSELY (Alt.)
European Representative:
P. J. B. CLARRICOATS
Finance: J. K. SCHINDLER
Historian: W. F. CROSWELL
Long-Range Planning: A. C. SCHELL
Meetings: W. L. STUTZMAN
Membership: T. G. CAMPBELL
New Technology: R. C. HANSEN

Newsletter Editor: W. R. STONE
Nominations: L. C. PEDEN
Professional Activities (PACE): K. HANFLING
Publications: A. ISHIMARU
R&D Committee - Aerospace: W. A. FLOOD
R&D Committee - Defense: H. E. SCHRANK
R&D Committee - Engineering: D. B. HODGE
Standards - Antennas: D. G. BODNAR
Standards - Propagation: R. J. KING
USNC/URSI: W. R. STONE

1989 Chapter Chairmen

Albuquerque M. A. DINALLO	Columbus L. HENDERSON	Huntsville T. J. GENTILCORE	Montreal G. L. YIP	Phoenix J. NAIR	South Africa C. W. I. PISTORIUS	Syracuse D. FERGUSON
Atlanta P. G. STEFFES	Dallas E. L. GORDON	Israel A. MADJAR	New Jersey Coast J. VANSAGAR	Princeton P. J. STABILE	Springfield K. M. LAU	Tokyo M. MIZUSAWA
Baltimore D. SALL	Dayton J. E. JONES	Italy (Central & S.) P. LAMARIELLO	New South Wales B. M. THOMAS	Rio de Janeiro J. R. BERGMANN	S. Brevard Indian River	Tucson H. C. KOHLBACHER
Bonnell A. GUSSARD	Denver R. L. SEELEY	Kitchener Y. L. CHOW	North Italy C. NALDI	St. Louis P. L. HUDDLESTON	T. E. DURHAM	Vancouver I. G. CUMMING
Boston R. V. MCGAHAN	Egypt S. F. MAHMOUD	Waterloo S. J. BLANK	North Jersey R. V. SNYDER	San Diego J. J. FRATAMICO JR.	Spain M. P. SIERRA	Virginia, Northern Y. K. WU
Buffalo M. R. GILLETTE	Finland A. V. RAISANEN	Long Island Y. RAHMAT-SAMII	Orlando R. T. COCK	Santa Clara Valley K. SNYDER	Spokane L. I. BYRNE	Utah M. F. ISKANDER
Chicago C. CLARK	Florida W. Coast J. R. SHERMAN	Los Angeles C. J. LIN	Ottawa J. WRIGHT	Seattle R. H. BRUNTON III	Sweden T. LEWIN	West Germany R. H. JANSEN
	Houston S. A. LONG	Michigan, S. E.	Philadelphia N. ENGHETA		Switzerland A. C. BAUDER	Winnipeg L. SHAFAI

IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION

ROBERT E. MCINTOSH, Editor
TAMARA SPEARS, Admin. Asst.

Associate Editors

C. L. BENNETT, Transients
R. E. COLLIN, Numerical Techniques
A. J. FENN, Adaptive Arrays
R. C. HANSEN, Antennas & RCS Measurements
D. R. JACKSON, Microstrip Antennas and EM Theory

I. J. LAHIE, Inverse Scattering
A. C. LUDWIG, Reflector Antennas
R. J. MAILLOUX, Tutorials and Reviews
R. J. MARHEFKA, Diffraction
L. N. MEDGYESI-MITSCHANG, Numerical Techniques

D. P. NYQUIST, Transients
R. H. OTT, Propagation
R. J. PAPA, Geophysical Scattering
D. M. POZAR, Microstrip Antennas
D. H. SCHAUBERT, Arrays
J. L. VOLAKIS, Asymptotic Techniques



WELCOME TO DALLAS

On behalf of the symposium steering committee, I extend a warm welcome to big 'D'. This year, the AP-S and URSI organizations join with the Microwave Theory and Techniques Society (MTT-S) for the AP-S/URSI/MTT-S Joint International Symposium. More than one-third of the AP-S and URSI members are also members of the MTT society and likewise more than one-third of the AP-S chapters

worldwide are joint MTT-S/AP-S chapters. The societies share a common heritage and continue to benefit from the advances occurring in shared technologies. It is therefore natural for the societies to have a "get together" once a decade (last one held at Los Angeles in 1981) to assess the state of common technologies.

A record of 850 papers, evenly split between APS and URSI, were submitted for review by the Technical Program Committee. As in the past, papers will be presented on a wide range of topics with the strongest concentration in EM theory, numerical methods, scattering and diffraction, microstrip antennas, reflectors, antenna theory, and phased arrays.

Special Sessions honor the contributions of Professors Leopold Felsen of the Polytechnic University and Y.T. Lo of the University of Illinois. In addition there are focused Special Sessions on polarimetrics, superconductivity, digital beamforming, scattering from antennas, innovations in EM education, fiber optic applications to phased arrays, millimeter wave components and phased arrays, time domain analysis of planar circuits, the role of analysis in the age of computers, and reducing the operation count in EM modeling.

A highlight of the technical program will be the plenary session held jointly with the MTT Society. Our plenary speakers; Dr. Harold Sobol of the University of Texas at Arlington, Dr. Robert Mailloux of Rome Air Development Center and Mr. Richard Mathison of Jet Propulsion Laboratory will give their views on how different technologies will be merging in the coming decade to influence systems of the next generation. Eight short courses and workshops will be held on Friday. They include, Application of Lightwave Technology to Microwave Antennas, Computer Application in EM Education, EM Modeling Software Validation: Benchmark Solutions, Broadband Low-Profile Antennas, Analysis and Design of Microstrip Antennas, Finite Element Methods, State of the Reflector Antenna Art in the 1990's, and Fundamentals of Microwave Radomes.

The social program is packed with both daytime and evening events. The kick-off event will be the AP-S/URSI reception at the Dallas Convention Center on Sunday evening. On Monday there will be a Horizon House reception at Longhorn Ballroom. The awards banquet will be on Tuesday night. Finally on Wednesday, you will have an opportunity to spend an evening at a Texas Ranch.

This outstanding program is possible only by the contributions of the authors and the dedicated work of several steering committee members. I want to express my thanks to all of them.

Shashi Sanzgiri
Chairman, Steering Committee

**ANTENNAS AND PROPAGATION SOCIETY
1990 MAJOR AWARDS**

DISTINGUISHED ACHIEVEMENT AWARD

James R. Wait

**S. A. SCHELKUNOFF TRANSACTIONS
PRIZE PAPER**

Edward C. DuFort

"Pattern Synthesis Based on Adaptive Array Theory"

August 1989, Vol. 37, No. 8 P. 1011.

**H. A. WHEELER APPLICATION
PRIZE PAPER**

Herbert M. Aumann, Alan J. Fenn and Frank G. Willwerth

*"Phased Array Antenna Calibration and Pattern Prediction
Using Mutual Coupling Measurements"*

July 1989, Vol. 37, No. 7, p. 844

R.W.P. KING PRIZE PAPER

Terry L. Krohn (with L. N. Medgyesi-Mitschang)

"Scattering from Composite Materials: A first Order Model"

1990 AP-S/URSI SYMPOSIUM STEERING COMMITTEE



From left to right, back row Dave Townsend (Data Base), Tom Dover (Workshops and Short Courses), Jeff Vann (Local Arrangements), Robert Voges (Vice-Chairman), William Kennedy (Finance), Doug Fowler (Local Arrangements), Sam Buchmeyer (Publications), front row Kurt Hollenbeck (Publicity), Shashi Sanzgiri (Chairman), Eldon Gordon (Secretary), Oren Kesler (Technical Program). Not Pictured Charles Rhoads (Registration), Don Wilton (URSI Liaison), Stuart Long (Member at Large), Lee Allen (Symposium Secretary).

1990 AP-S/URSI SYMPOSIUM STEERING COMMITTEE

General Chairman

Shashi Sanzgiri

Vice Chairman

Robert Voges

Publicity

Kurt Hollenbeck

Registration

Charles Rhoads

Secretary

Eldon Gordon

Publications

Sam Buchmeyer

URSI Liaison

Donald Wilton

Technical Program

Oren Kesler

Local Arrangements

Doug Fowler

Symposium Secretary

Lee Allen

Finance

William Kennedy

Member at Large

Stuart Long

TECHNICAL PROGRAM COMMITTEE

Oren B. Kesler, Chairman

Tom Dover

Don Wilton

Doug Fowler

Robert Voges

Shashi Sanzgiri

Reviewer Subcommittee

Constantine Balanis

David G. Burks

Henry Eilts

W. J. R. Hoefer

Jacob J. Kim

Charles S. Liang

E. K. Miller

Jim Prewitt

John L. Volakis

Joseph R. Zinecker

R. M. Bevensee

Ahay Chakrabarty

Allen Glisson

D. R. Jackson

S. J. Kubina

Stuart A. Long

Pat Montgomery

Charles Rhoads

Don Wilton

Dusan Zrnic

Andrew Blanchard

Kai Chang

K. C. Gupta

W. A. Kennedy

Sharad Laxpati

Paul E. Mayes

Bob Nevels

F. M. Tesche

Hung Yee

Wolfgang M. Boerner

Tom Dover

Jeffrey Herd

Oren Kesler

Randall E. Lehmann

K. K. Mei

L. Wilson Pearson

Robert Voges

Amir L. Zaghloul

Database Subcommittee

Dave Townsend

Lee Allen

Carol Turpin

Jean Costley

Doris Krehmeyer

AP-S Digest **Table of Contents**

Session	Title	Page
---------	-------	------

Volume I **Monday**

2	Time Domain Methods I	1
4	Reducing The Operation Count In EM Modeling	43
5	Frequency Selective Surfaces	83
6	Transients	121
7	Reflectors Antennas I	127
8	Adaptive And Signal Processing Arrays I	169
10	Compact Range And Near Field Measurements	211
11	Wire Antennas	253
12	Microwave Imaging And Holography	291
13	Topics In Electromagnetics	301
15	Electromagnetic Theory I	307
16	Microstrip Antennas: Special Session in Honor of Prof. Y.T. Lo	345
17	Digital Beamforming	379
18	Scattering From Periodic Structures	409
20	Reflector Antennas II	449
21	Antenna Analysis I	491
24	Antenna Elements	521
25	Polarization Radar Theory	557

Volume II **Tuesday**

27	Numerical Methods - General	585
28	Analysis Of Microstrip Antennas	627
29	Phased Array Antenna Design	669
32	Superconductive Material Characterizations And Applications	711
38	Polarimetric Measurements	737
40	Application Of Lightwave Technology To Microwave Antennas	757
41	Microstrip Antenna Configurations	787
42	Array Pattern Analysis And Synthesis	827
43	Numerical Techniques For Scattering Analysis	865
45	A Tribute To Professor L. B. Felsen	907
46	Slot Antennas And Elements	913
47	Feed Horns And Systems	951
49	Electromagnetic Analysis	993
50	Polarimetric Bistatic Inverse Problem	1027

**AP-S Digest
Table of Contents
(cont.)**

Session	Title	Page
Volume III Wednesday		
51	Numerical Methods - Hybrid Techniques	1057
52	Electromagnetic Theory II	1059
53	Multilayer Printed Antennas	1099
54	Active Element Arrays & Array Topics	1141
55	Effects Of Materials On Antennas And Radomes	1179
57	Time Domain Analysis Of Planar Circuits	1221
58	Biomedical Applications	1223
59	RF Passive Components	1237
60	Scattering From Objects	1255
61	Antenna Measurements	1297
63	Polarimetric Transient And Broadband Imaging	1337
Volume IV Thursday		
65	Numerical Methods - PDE/MoM	1359
66	Millimeter-Wave Components And Arrays	1401
67	Adaptive & Signal Processing Arrays II	1441
69	The Role Of Analysis In The Age Of Computers	1479
71	Beam Waveguides And Reflector Topics	1497
72	Scattering From Rough Surfaces	1539
73	Scattering And Diffraction	1561
74	Transient Measurements	1583
76	Polarimetric Probing Of Distributed Media	1597
78	Time Domain Methods II	1619
79	Inovations In Engineering Education	1661
80	Adaptive And Signal Processing Arrays III	1691
81	Scattering From Cavities And Arrays	1709
82	Microstrip Arrays	1749
83	Propagation In Naturally Occurring Environments	1791
84	Pattern Analysis	1833
86	Satellite Antennas	1863
87	Millimeter And Submillimeter Wave Antennas	1905

1000654

**AP-S Digest
Author Index**

Author	Page	Author	Page
Abdel-Magid, Y. L.	1700	Balanis, C. A.	14
Abe, Hidehiko	1325	Bansal, Rajeev	1058
Abe, Takao	738	Bar-Ness, Yeheskel	1454
Aberle, James T.	350	Barbero, J.	1782
Acosta, R.	1851	Barbosa, Afonso M.	902
Adachi, S.	898	Barkat, Mourad	1450
Adams, Arlon T.	1684	Barkeshli, Sina	122, 553, 1350
Adatia, N.	1892	Barksdale, H.	1104
Agahi, S.	88	Barnes, M.	1588
Agrawal, Amit P.	558	Barski, M.	1584
Agunao, M.	1820	Barth, M. J.	122
Ahmed, Nasir	860	Bartley, S. W.	1306
Akeyama, Akira	1804	Baudrand, H.	811
Aksun, M. I.	1060	Baum, Carl E.	1338
Alexopoulos, N. G.	370, 1722	Baumer, C.	938
Alford, Neil M.	732	Beaulieu, L.	934
Ali-Ahmad, W. Y.	1429	Bedigian, Oscar J.	1142
Alliot, J. C.	1652	Beheler, Carl M.	462
Alliot, J. C.	337	Bell, D. S.	1306
Allison, Michael J.	122	Benalla, A.	358, 1758
Alvarez, J. M.	1288	Bondett, M.	770
Ali, Mohsen S.	34	Benevello, O.	1222
Anderson, Barbara	602	Bergmann, J. R.	478
Ando, Makoto	926, 930, 1018, 1250	Bernard, J.-M.L.	1087
Antar, Y.M. M.	738	Bernie, Jeffrey A.	302
Antilla, G. E.	1722	Besieris, Ioannis M.	909
Aoki, Hiroshi	1014	Beyer, Adalbert	1918
Aoyagi, Paul	10, 1222	Bhasin, K. B.	770
Appel-Hansen, Jorgen	1068	Bhattacharyya, Arun K.	632
Arai, Hiroyuki	262, 823	Biedlingmaier, Thomas	694
Aresu, A.	1824	Bird, T. S.	1900
Arjavalasingam, G.	117, 1934	Birkner, B. W.	1876
Armao, Michael A.	396	Blanch, S.	1318
Arndt, Dr. G. D.	1437	Blanchard, Andrew J.	742
Arndt, F.	470	Blanis, C. A.	1184
Arnold, J. M.	908	Blasing, R. R.	988
Arockiasamy, M.	113	Boag, Alona	108
Arvas, Ercument	212	Boag, Amir	108
Asano, Yoshikazu	1796	Boccalone, G.	1926
Assal, F. T.	1158	Boerner, Wolfgang-M.	558, 738, 1028, 1032
Auckland, D. T.	1738	Bondyopadhyay, Probir K.	1396
Aumann, Herbert M.	186, 194, 220	Bonitatibus, A. De	1734
Awazu, Charles M.	972	Booyesen, A. J.	302
Bacrtlein, Brian A.	122	Borderies, P.	437
Bahar, Ezekiel	1548	Bornemann, Jens	492
Bailey, M. C.	1868	Bornholdt, J. M.	1738
Baker, J.	1338	Bourne, John	1681
Baklan, M. S.	122	Bowling, Donald R.	732

**AP-S Digest
Author Index
(cont.)**

Author	Page	Author	Page
Brachet, P.	1128	Chen, K. M.	1338, 1342, 1640
Brandia, M.	1346	Chen, K. S.	308
Brodow, J. W.	749	Chen, M. H.	1526
Brian, D. J.	1892	Chen, Mike	1938
Bridges, E.	2	Chen, Qinglun	590
Bridges, G. E.	332	Chen, Yih-Min	1474
Brochat, S. L.	1228	Cheon, Changyul	618
Brown, Brian S.	1446	Cherrettic, Alan R.	1514
Brown, R. C.	1864	Cherry, Paul	1229
Bucca, S. E.	1009	Chew, R.	358, 1758
Bucceri, A.	670	Chew, W. C.	22, 52, 346, 602
Bucci, O. M.	856	Chiba, Isamu	852
Bull, Jeffrey F.	396	Chikaoaka, Shigeru	852
Burgess, Lawrence R.	396	Cho, Sung H.	1700
Burkholder, Robert J.	908	Choi, Seungwon	1700
Butler, Chalmers M.	72	Choi, Y. K.	1900
Cable, V.	38, 68, 994	Chou, C.-K.	1228
Cable, V. P.	1678	Chow, Y. L.	312, 622, 1079
Campbell, T. G.	1855, 1868	Christodoulou, C. G.	413, 1314
Cangelaris, A. C.	1675	Chu, Tah-Hsiung	1028
Canning, Francis X.	60, 1364	Chujo, Wataru	262, 400, 774
Cao, C.	244	Ciric, I. R.	122, 1256
Cardillo, Gerard P.	1032	Citome, J.	644, 946
Carney, Michael	1188	Claesson, I.	202, 1462
Caroglmanian, Armen	112	Clarke, B.	1108
Castillo, Steven	1058	Clarricoots, P. J.	1864
Cha, Alan G.	1506	Clampy, Paul C.	770
Chadwick, M.	160	Clerc, F.	1624
Chakrabarti, S.	1689	Cloete, J. H.	248, 549, 1212
Chamberlin, Kent	1552	Cole, R. W.	1671, 1689
Chamma, W. A.	122	Collin, R. E.	1480
Chan, C. H.	425	Collins, J. D.	1058
Chan, Chi H.	104	Combes, P. F.	437
Chan, Kwok K.	960, 988	Compton, R. C.	1146
Chandler, Charles	1938	Compton, Jr., R. T.	182, 828, 1692
Chang, Byong Kun	860	Constantinides, E. D.	866
Chang, Chun-Yen	1470	Cook, Crit J.	236, 1196
Chang, Dau-Chyrh	706	Corey, L. E.	836
Chang, David C.	1120	Cornfeld, A.	1409
Chang, Hung-Chun	1376	Corona, P.	1734
Chang, J.	1150	Correia, Luis M.	902
Chang, Kai	922	Corum, James F.	832
Chang, Nion S.	1812	Corum, K. L.	832
Chang, Shun-Hsyung	1470	Costache, George I.	18
Chang, Yuch-Chi	450	Craig, William P.	148
Changsheng, Si	517	Crampagne, R.	811
Chaudhuri, Sujeet K.	1032	Crone, G. A.	1864
Chen, J. C.	1417	Croq, F.	1128

**AP-S Digest
Author Index
(cont.)**

Author	Page	Author	Page
Cruellas, J. C.	1288	Eswarappa	6
Cruz, J. L.	504	Fache', N.	324
Cucci, Alessandro	1170	Fang, D. G.	622
Cuevas, J. G.	302	Fang, Guang-You	1648
Cuhaci, M.	1108	Fang, Jinyuan	1368
Curtis, David D.	766	Farr, Everett G.	1588
Cwik, T.	1058, 1360	Fazarinc, Zvonko	1663
Da Costa, J.C.W.	478	Fellinger, P.	1346
Da Silva, L. C.	976	Felsen, L. B.	909, 1497
Dahlstrom, R. K.	968	Feng, Chen	547
Daijavad, Shahrokh	1071	Feng, W. L.	1742
Das, Nirod K.	1100, 1433	Fenn, Alan J.	186, 194, 220
Davidson, David B.	614	Fernandez, N. S.	1778
Davis, W. A.	302, 1009	Ferrando, Miguel	1280, 1288
Dawoud, M. M.	1700	Ferrara, G.	1734
De Zutler, D.	324	Ferraro, R. D.	1360
Degauque, P.	337, 1820	Ferriere, X.	1652
Delecki, Z. A.	336	Fessenden, D. E.	1859
Demarest, Kenneth R.	64	Fisher, S. W.	1678
Deng, S. H.	1745	Floc'h, J. M.	644
Deveze, T.	1624	Floch, J. M.	946
DiLeo, J. C.	742	Florence, James M.	782
Dinger, Robert J.	724, 732	Fok, Fredric Y. S.	122
Dinham, G.	960	Fonseca, Sergio B.	508
Do-Nhat, T.	270, 1839	Foo, Bing-Yuen	1028
Dominek, A.	302	Forti, R. Lo	1896
Drissi, M.	946	Foster, John D.	104
Du Toit, C. F.	248	Fournier, M.-A. B.	934
Du Toit, L. J.	1212	Fralich, Russ	815, 1112, 1154, 1762
Duan, Dah-Wei	1578	Frank, Steven J.	1540
Dubost, G.	660	Friedlander, Gershon	913
Dudley, D. G.	909, 1684	Fujii, Satoshi	1458
Dunsmore, M.R. B.	392	Fukai, Ichiro	1222, 1656
Dusseux, T.	811	Fung, A. K.	749, 1544
Dybdal, R. B.	1588, 1880	Galindo-Israel, Victor	140, 454, 1502
Eastham, Gary B.	922	Garcia, A. C.	504
Ebine, Yoshio	1800	Garrett, James E.	1906
Edrich, Jochen	1224	Gatti, Mark S.	254, 1329
Egashira, Shigeru	1132	Gauthier, S. R.	960
El-Shenawee, M.	1548	Gearhart, S. S.	1914
Elliott, Robert S.	918	Gedney, Stephen D.	1058, 1730
Elsherbeni, Atef Z.	894	Gee, Walter	346
Encinar, J.	1922	Gennarelli, C.	1734
Engert, Gerald W.	1075	Gera, Amos E.	282
Epp, Larry	104, 117	Ghosh, S.	976, 1888
Erbil, A.	716	Giarola, Attilio J.	508, 1930
Eriksson, P.	202, 1462	Gieger, R.	1222
Esselle, Karu P.	1584	Gilbert, M. P.	44

**AP-S Digest
Author Index
(cont.)**

Author	Page	Author	Page
Gilbert, Roland	346	Haupt, Randy L.	156, 429
Giles, Sammie	1584	Haus, Hermann A.	1667
Gimeno, B.	504	Hay, S. G.	1900
Gimonet, E.	437	Hazelwood, J. D.	956
Giri, S.	113	Hegazi, G.	1409
Gobin, V.	337	Helaly, A.	1166
Goffar, Amit	844	Herczfeld, Peter R.	778, 844, 1178
Gogineni, S.	1689	Herd, Jeffrey	384
Goorian, Peter M.	878	Herdeg, W. F.	292
Gordon, R. K.	1264	Herman, M. I.	1417
Goto, Naohisa	823, 926, 930, 1250	Hermann, Philip R.	1314
Gould, D. M.	392	Hernanz, Ma L.	1782
Grabow, Wilhelm	198	Herper, J. C.	670
Graglia, R. D.	302, 1064	Herrmann, Gabriel F.	882, 1384
Graham, Robert	1510	Hese, J. Van	1636
Grando, J.	1652	Hess, D. F.	640
Grannemann, Richard S.	874	Heston, J. G.	788
Griffin, D. W.	795	Heyman, Ehud	909, 913
Gruener, K.	742	Hidaka, Kazutaka	277
Gruener, R. W.	956	Hilderbrand, Glen D.	302
Guglielmi, Marco	1922, 1926	Hinman, Karl	388
Guo, Yanchang	206, 1704	Hinshilwood, Don J.	190
Guo, Yong B.	1425	Hirokawa, Jiro	926, 1250
Guoding, Li	517	Hirose, K.	1774
Gupta, Inder J.	178	Hoefler, Wolfgang J. R.	6, 1222, 1620
Gupta, K. C.	358, 1758		1644
Gurke, T.	1346	Hofer, Dean A.	522
Habashy, T. M.	1346	Hofstra, Joseph S.	1588
Hadwin, L. J.	968	Holzman, Eric L.	918
Hadzer, C. M.	1216	Hongbin, Zhang	1292
Haihua, Mao	517	Honma, T.	702
Haibout, J. M.	1934	Hoppe, Dan	320
Hall, R. C.	302	Houshmand, Bijan	1851
Hall, W. F.	997, 1632	How, H.	1208
Hallidy, William	1058	Howard, G. E.	1079
Hallock, G. A.	1876	Hsia, Irene	370
Hamid, A. K.	1256	Huang, J.	1150, 1750
Hamid, M.	1256	Huang, Kuang-Chih	1470
Hamilton, P. R.	1306	Huang, Wei-Ko	706
Hancock, Gary D.	1770	Huang, Yi	513
Handwerker, J.	535	Huang, Yung-Dar	1450
Hanfling, Jerome D.	1142	Huber, D. A.	312
Hanna, Victor Fouad	946	Hummer, Kenneth A.	922
Hansen, Robert C.	720	Hung, Chia-I	706
Hanson, George W.	652	Hung, H-L	1409
Harackiewicz, France J.	417	Hunsberger, F.	38, 994
Harrah, Steven D.	292	Hunter, John H.	404
Hassan, M. A.	286	Huret, F.	732

**AP-S Digest
Author Index
(cont.)**

Author	Page	Author	Page
Hwu, Shian-Uei	594	Jouny, Ismail	1596
Hyodo, Manabu	1233	Jull, E. V.	1588
Ito, Jun	1556	Kagoshima, Kenichi	496, 543
Idris, S. H.	1216	Kahny, D.	738
Ikegami, Tetsushi	1808	Kalbasi, K.	64
Ikuno, Hiroyoshi	909	Kam, Moshe	844
Imbriale, W.	140, 454, 1502, 1506	Kamiya, Yoshiaki	774
Ingham, David R.	1574	Kanareikin, D. B.	1598
Inoue, Masao	1014	Karam, Mostafa A.	1544
Ishimaru, Akira	292, 1614	Kasai, Haruo	1233
Iskander, Magdy F.	302, 1229, 1490	Kashiwa, Tatsuya	1656
Ismail, A. N.	1700	Kashyap, S.	1388
Issac, F.	1652	Katagi, Takashi	1014
Iitanami, Takao	1325	Kates, R. M.	1306
Ito, Koichi	1233	Katz, Daniel S.	122
Itoh, Kiyohiko	1592	Kawabata, Kazuaki	807
Itoh, Tatsuo	788, 799, 1242	Kawakami, Haruo	539
Ittipiboon, A.	648, 1108	Kawamura, Kazuhiko	1681
Iversen, Per O.	1498	Kennis, P.	732, 1237
Ivrissimtzis, L. P.	1562	Kesler, Oren B.	522
Iwasaki, Hisao	807	Khan, S.	1058
Iwashita, Hideki	823	Khebir, A.	1260
Izutsu, Masayuki	774	Kheibir, A.	366
Jackson, David R.	374, 712	Kiang, Yean-Woci	1346
Jacobi, N.	1058, 1360	Kiener, S. J.	610
James, G. C.	292	Kildal, Per-Simon	474, 1510
Jamnejad, V.	526, 1150, 1838	Kim, Chang S.	952
Jarem, John M.	240	Kim, Chang S.	132
Jaska, Esko A.	836	Kim, H.	1876
Jassal, B. S.	1828	Kim, Ihn S.	1620, 1644
Jeng, Shyh-Kang	1376	Kim, Moonil	1174
Jenn, David C.	152	Kim, Se-Yum	1346
Jespersen, N. V.	778	Kim, Y. S.	1696
Jian, Qian	547	King, Adrian S.	1770
Jidong, Xie	482	King, H. E.	266
Jin, Jian-Ming	1058, 1726	Kinoshita, T.	1018
Jofre, L.	1318	Kinowski, D.	732
Johansson, Stefan F.	1518	Kinzel, Joseph A.	1402
Johnson, Eric G.	413	Kirtley Jr., James L.	1685
Johnson, J. R.	186, 194	Kishk, Ahmed A.	738
Johnson, John C.	170	Kitamura, Shinzo	292
Johnson, L.	1437	Klein, Michael J.	1329
Jones, T.	1896	Klooster, K. Van't	160
Jones, Trevor	698	Ko, Wai Lee	84
Jose, K. A.	1284	Kobayashi, Kazuya	441
Josefsson, L.	942, 1162	Kojima, Toshitaka	1556
Joseph, J.	1264	Kokotoff, D. M.	1738
Joseph, R.	292	Kolbchdari, Mohammed	886

**AP-S Digest
Author Index
(cont.)**

Author	Page	Author	Page
Kondo, Akira	1325	Lee, Teh-Hong	1333
Kongyu, Feag	1036, 1095, 1292	Legay, H.	644
Kosanovich, S.	1222	Lehto, A.	1298, 1302, 1310
Kosma, M. N.	1678	Lepkier, Ph.	644, 811, 980
Kouki, A. B.	366, 1260, 1392	Leviatan, Yehuda	108
Kovitz, J. K.	1437	Li, Hsueh-Jyh	749
Kozlov, A. I.	569, 573, 580, 584, 1598	Li, J. M.	610
	1614	Li, Jiang	1048
Krank, W.	1792	Li, Jianxin	206, 1704
Kriegsmann, Gregory A.	1058	Li, Mingyi	922
Krull, David	1671	Li, Shi-Zhi	292
Kuga, Yasuo	1606	Liang, Guo-Chun	728
Kuhnle, Jacob	1510	Libelo, L. F.	968
Kuiper, Thomas B.	1329	Liepa, Valdis V.	618
Kumar, A.	1834	Lier, Erik	690, 964, 1530
Kumazawa, Hiroyuki	1325	Liewer, P. C.	1360
Kunz, K.	38, 994	Lin, Ding-Bing	1028
Kwak, B. S.	716	Lin, Feng-Li	749
Kwon, Young S.	972	Lin, Min-Chin	1346
Labane, G.	1652	Lin, Shi-Ming	558, 562, 566
Labane, G.	337	Lin, Weigan	1048
Labourdette, C.	811	Lin, Yiyu	354
Lagerlof, R.	1162	Lin, Yu-De	799
Lai, Larry	1816	Lind, T. S.	302
Lam, Chi-Ming	292	Lindell, Ismo V.	1192
Lam, Wayne W.	791	Ling, C. C.	1429, 1914
Lambert, Kevin M.	1333	Ling, Hao	1242, 1714, 1876
Lampe, Ross W.	1322	Litva, John	628, 686, 815, 1112, 1154
Lan, G. L.	1417		1238, 1754, 1762, 1816
Lande, Boris S.	1614	Liu, Frank	1938
Landstorfer, F. M.	1380	Liu, Kefeng	1184
Langenberg, K. J.	1346	Liu, Q. H.	346, 602
Langston, Leland	388	Liu, Y. W.	728
Lanstorfer, F.	938	Lixin, Wen	1095
Law, C. L.	281	Liyang, Zhang	1010
Law, P. H.	1710	Lo, Titus	1816
Layden, R. G.	1718	Lo, Y. T.	346
Lebherz, M.	1792	LoVetri, Joe	18
Lee, Choon S.	458	Lockhart, T. G.	1360
Lee, David O.	1040, 1276	Logvin, A. I.	569, 573, 580, 584, 1598
Lee, J. J.	682, 758		1614
Lee, Ju-Hong	1474	Lomaglio, F. S.	164
Lee, K. F.	1124, 1766	Long, Stuart A.	712
Lee, Karen	1425	Loyet, Lowell L.	522
Lee, R. Q.	1124, 1766, 1778	Lu, Z. M.	1922
Lee, S. W.	346, 458, 1851	Ludwig, A. C.	48
Lee, T.	1409	Laebbers, Raymond	38, 994
Lee, Taek-Kyung	1346	Luk, K. H.	1228

AP-S Digest
Author Index
(cont.)

Author	Page	Author	Page
Ly, H. C.	1566	Michalski, K. A.	908
Lynch, Daniel R.	1001	Michielssen, Eric	1268
Lyzenga, G. A.	1360	Migliorini, P.	1824
Ma, Jinxi	122	Miller, Edmund K.	44, 1493, 1689
MacDonald, Alan D.	712	Miller, Thomas W.	404
MacDonald, Alan D.	1180	Mills, Duncan	1250
MacDonald, Anita	1204	Mimaki, H.	702
MacKnight, D. J.	1196	Min, Xiaoyi	1640, 1938
MacPhie, R. H.	270, 1839	Mishra, S. R.	738
Madia, Francesco	1170	Mitra, R.	10, 88, 92, 104, 117, 366 454, 870, 1058, 1060, 1222, 1260, 1264 1268, 1372, 1488, 1730
Madjar, Asher	1178	Miyazaki, Akira	1812
Mackawa, Yasuyuki	1812	Mizusawa, Motoo	341
Magnusson, R.	421	Moffatt, David L.	122
Mahon, John P.	1578	Moghaddam, M.	22
Maloney, James G.	1628	Moghaddar, A.	228
Manabe, Takeshi	1458	Mohammadian, A. H.	997, 1632
Mandt, Charles E.	1614	Mohanani, P.	984, 1284, 1847
Mano, Seiji	852, 1014, 1136	Moheb, H.	598, 1843
Manry, Jr., Charles W.	1228	Monakov, A. A.	1610
Marhefka, R. J.	866, 1562	Mongrand, P.	980
Mariage, P.	1820	Moore, Dr. Rick L.	716, 1188, 1204
Marks II, Robert J.	292	Morgan, Michael A.	1588
Martellucci, A.	1824	Morin, G. A.	100
Marun, C.	1782	Moroz, R.	716
Maruyama, Masahiko	898	Mostafavi, Masoud	1354
Marx, Egon	1083	Mott, R. C.	1158
Marzougui, Adel M.	1392, 1540	Nagasawa, Koji	527
Matrosov, S. Y.	1598	Nagurney, Ladimer S.	492
Matsumoto, Keisuke	774	Nair, K. G.	984, 1284, 1847
Matsunaga, M.	1136	Nair, R. A.	1522, 1534
Matsuzuka, Isamu	527	Nakano, Hisamatsu	702, 1774
Matthewson, P.	392	Nance, E. C.	749
Mayes, Paul E.	362, 656, 1392	Naqvi, S. Sohail H.	410
Mazzarella, G.	856	Narayanan, K. K.	1847
McDougall, J. A.	1228	Nashashibi, Adib	1606
McKaughan, M. E.	1859	Nauwelaers, B.	1091
McKay, Jim P.	232	Nazar, James B.	1104
McLean, James	1242	Neelakanta, P. S.	113
McLeod, R. R.	122	Neikirk, D. P.	788
McLeod, Robert R.	122	Newman, T.	1910
Medeiros, F.	160	Ng, K. T.	425
Mei, Kenneth K.	728, 1368	Ng, K. T.	1910
Melcher, James R.	1667	Ngan, Y. C.	791
Mellema, G. R.	1588	Nghiem, David	716
Melnik, A.	1598	Nie, Z.	346, 602
Mendonca, J.	742	Nimmagadda, Sainath	76
Messum, R.	1892		
Metze, G.	1409		