

北京国际实验力学会议论文集

ICEM
1985
BEIJING

**PROCEEDINGS OF
THE
INTERNATIONAL
CONFERENCE
ON
EXPERIMENTAL
MECHANICS
(BEIJING, 1985)**

Science Press

BIBLIOTHEQUE DU CERIST

北京国际实验力学会议论文集

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON EXPERIMENTAL MECHANICS

OCTOBER 7-10, 1985, BEIJING

BIBLIOTHEQUE DU CERIST

BIBLIOTHEQUE DU CERIST

157 2559

北京国际实验力学会议论文集

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON EXPERIMENTAL MECHANICS

OCTOBER 7-10, 1985, BEIJING

Co-sponsored by

The Chinese Society of Theoretical and Applied Mechanics

The Japanese Society for Non-Destructive Inspection

Science Press, Beijing, China
1985

BIBLIOTHEQUE DU CERIST

Responsible Editors Li Chengxiang
Yang Ling

7324

Copyright 1985 by Science Press, Beijing.
Published by Science Press.

Printed by C & C Joint Printing Co., (H.K.)
Ltd.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

First published 1985
Science Press Book No. 5026-68

EDITORIAL COMMITTEE*Chairman*

Wu Zongdai (吴宗岱)

Members

Fu Mengchu (傅梦遽)

Li Minhua (李敏华)

Hu Peiquan (胡沛泉)

Zhou Xingeng (周辛庚)

Huang Jiefan (黄杰藩)

EXECUTIVE EDITORS

Li Ruqing (李汝庆)

Shi Guangyi (石光漪)

STEERING COMMITTEE

Co-chairmen

Prof. Jia Youquan (Y.C.Chia)	(贾有权)	Prof. Hideo Kitagawa (北川英夫)
---------------------------------	-------	--------------------------------

Members

Prof. Li Minhua Senior Engr. Fu Mengchu Prof. Wu Zongdai (T.T.Wu)	(李敏华) (傅梦遽) (吴宗岱)	Prof. Heihachi Shimada Prof. Susumu Takahashi Prof. Hajime Nakazawa (中沢一)	(島田平八) (高橋 賞)
----------------------------------------------------------------------------	-------------------------	------------------------------------------------------------------------------------	------------------

CHINESE EXECUTIVE
COMMITTEE*Chairman*

Prof. Jia Youquan (贾有权)

Secretary-general

Prof. Zhou Xingeng (周辛庚)

Deputy Secretary-general

Prof. Song Jinliang (宋锦良)

Members

Prof. Li Minhua Senior Engr. Fu Mengchu Prof. Wu Zongdai Prof. Hu Peiquan Prof. Sun Yanjun Prof. Yang Guitong Prof. Dai Fulong Prof. Zhao Qingcheng Senior Engr. Deng Rihong Senior Engr. Li Boqin	(李敏华) (傅梦遽) (吴宗岱) (胡沛泉) (孙燕君) (杨柱通) (戴福隆) (赵清澄) (邓日红) (李伯芹)
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------

JAPANESE EXECUTIVE
COMMITTEE*Chairman*

Prof. Hideo Kitagawa (北川英夫)

Secretary-general

Mr. Koichi Egawa (江川幸一)

Members

Prof. Heihachi Shimada Prof. Susumu Takahashi Prof. Hajime Nakazawa Prof. Keiji Yoshikawa Prof. Toshimitsu Fujiyoshi Prof. Takashi Koizumi Prof. Akio Yoshinaga Dr. Kazuo Uchino Prof. Koji Shimizu Prof. Haruo Ishikawa Mr. Shinichi Koshide Dr. Hiroshi Kato	(島田平八) (高橋 賞) (中沢一) (吉川敏二) (藤芳利光) (小泉 亮) (吉永昭男) (内野和雄) (清水紘二) (石川晴夫) (越出慎一) (加藤 浩)
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------

前 言

近年来,为借助飞速进步的激光、超声等近代测试技术以及计算机、图象处理和其他信息处理技术以适应断裂力学和其他强度评价问题的需求,实验力学在多种学科和工程领域中得到了日益广泛的运用。在其推广应用于各学科和工程领域(如设计、检测、安全度和可靠性、能源和资源开发、医学、历史、地质和土建工程等)的进程中,实验力学现已构成了一个具有通用性的基础领域,并已成为一个新的科学分支。看来它是可以与使用软件的某些新兴力学分支相辅相成的。

不少国家都曾召开过不同形式的实验力学国际会议。为了增进中日两国及其他国家专家学者间的学术交流和友好往来,1982年夏季即已着手研究在中国举行一次实验力学国际学术会议的可能性。经过贾有权教授和北川英夫教授的接触和双方有关人员的多次磋商,最后商定,这次会议由中国力学学会和日本无损检查学会共同主办,于1985年10月7日至10日在北京召开。

征文通知发出后,中国、日本、加拿大、美国、英国、意大利、联邦德国、法国、瑞士、印度和埃及等国学者纷纷响应,寄来了大量的论文。这表明,各国的专家学者们对这一学科具有浓厚的兴趣。

在会议执行委员会的领导下,经过论文编辑委员会的努力,选出了约170篇论文编入本论文集。这些论文涉及到实验力学的各个方面,从而也反映了本次会议内容的深度和广度。

我们衷心地期望,这本文集能促进各国学者在会议期间和会后的学术交流和友好往来,为会议的圆满成功做出贡献。

中国力学学会和日本无损检查学会热烈欢迎中日两国及其他各国学者来参加这次令人愉快的学术会议。

贾 有 权
中国执行委员会主席

北 川 英 夫
日本执行委员会主席

FOREWORD

Reflecting the rapid progress of laser, supersonics, and other recent measurement technology and developments of computer, graphics and other information technology, and combining with fracture mechanics and other strength evaluation technology, the use of EXPERIMENTAL MECHANICS has been developed extensively in science and engineering. On the way of extension of its application to various fields of science and technology, -design, inspection and testings, safety and reliability, energy and source developments, medicine, history, geology, civil engineering and others-, EXPERIMENTAL MECHANICS is now composing a common basic field and becoming a new branch of science, which can possibly cooperate with some new soft-ware-relating branches in mechanics.

A number of international conferences on EXPERIMENTAL MECHANICS in different countries have been held. In order to promote the academic exchange and friendship of the Chinese and Japanese scholars and researchers and those of other countries, in the summer of 1982, investigation of the possibility of an international conference held in the People's Republic of China was started. Through the contact of Professor Jia and Professor Kitagawa, the Problems have been discussed many times between Chinese and Japanese persons, and finally it was agreed that the conference should be organized jointly by the Chinese Society of Theoretical and Applied Mechanics and the Japanese Society for Non-Destructive Inspection and be held in Beijing on the seventh to tenth of October, 1985.

In response to "Call for Papers", numerous contributions came from many countries, including China, Japan, Canada, U.S.A., England, Italy, FRG, France, Switzerland, India, Egypt and other countries, reflecting the keen interest of engineers and researchers in this particular field.

Under the leadership of the executive committee of the conference, the Editorial Committee paid the efforts to decide the contribution papers for presentation at the conference. About 176 selected papers are included in this publication. These papers cover all the fields of experimental mechanics and show the broadness and depth of the scope representative of this conference.

We expect that this publication can contribute to success of the conference by expediting scientific exchanges both during and after the conference.

The Chinese Society of Theoretical and Applied Mechanics and the Japanese Society for Non-Destructive Inspection look forward to welcoming all participants from these two countries and from other countries in the world to an enjoyable meeting in Beijing.

Jia Youquan
*Chairman of Chinese
Executive Committee*

Hideo Kitagawa
*Chairman of Japanese
Executive Committee*

CONTENTS

INVITED PAPERS

On Modern Aspects and the Importance of Experimental Mechanics in Europe <i>Karl-Hans Laermann</i>	1
Recent Development and Future Aspect of Experimental Mechanics of Japan <i>Heihachi Shimada</i>	6
Recent Research Activities in Experimental Mechanics in China <i>Jia Youquan, Fu Mengchu and Wu Zongdai</i>	18
Stress and Stiffness Analysis of Tubular Joints for Offshore Structures <i>H. Fessler</i>	32

STRAIN GAGE TECHNIQUE

Calculation of Stresses from Strain-Gage Measurements in the Elasto-Plastic Range <i>Stefan Keil</i>	44
Correction of Errors Due to Wheatstone Bridge Nonlinearity <i>Yang Beinan and Wu Zongdai</i>	50
Development and Application of Reversible Strain Gage <i>Koichi Egawa</i>	56
Development of Temperature-Compensated Resistance Strain Gages for Use to 800°C <i>Ma Liangcheng, Wu Zongdai and Zhao Linbao</i>	62
High Temperature Strain Gage Alloys <i>Stephen P. Wnuk Jr.</i>	69
Measurement of Thermal Stresses of Diesel Locomotive Piston <i>He Silong and Ning Jiaoxian</i>	75
A New Strain Gage for Measuring Stress Intensity Factors of Cracks <i>Haruo Ishikawa and Hideo Kitagawa</i>	82
A New Strain Measuring Device by Using Hall Generator <i>Takashi Koizumi</i>	88
On the Technique of the Stress Measurement under the Severe Environment and Its Application to the Turbo-Machinery <i>Toshimitsu Fujiyoshi</i>	94
On the Time Phase Angle ϕ of Fluctuating Thermal Stress with Respect to Fluctuating Temperature in a Concrete Slab Pavement <i>Du Xiangde</i>	100

Today's Strain Measurement in Japan

Masayasu Kawai 106

PHOTOELASTICITY AND PHOTOPLASTICITY

Dynamic Holophotoelasticity Light Rotation Method of Resolving Transient Stresses <i>Qin Yuwen, Du Changtai and Ye Zhisheng</i>	112
Dynamic Stress Concentration Factor at a Circular Hole with Auxiliary Holes under Impact-Loading <i>Song Jinliang</i>	119
Effect of Freezing Temperature on the Accuracy of Stress Freezing Method <i>Nozomu Aoki and Chikara Minamisawa</i>	126
Experimental Studies on Stress Analysis of Dovetail Joint <i>Yasuo Nakamura and Susumu Takahashi</i>	132
Experimental Studies on the Photo-Plastic Analysis for Polycarbonate in the Plane Strain Field <i>Akira Shimamoto, Susumu Takahashi and Shinji Kumagai</i>	138
Improvement of Measuring Accuracy of Isoclinics in Photoelastic Stress Analysis <i>Shinsuke Sakai</i>	144
Individual Instructional Polariscopes <i>B.W. Cotterman</i>	150
Investigation of Stresses Around Unrotational Symmetric Holes by the Three Dimensional Photoelasticity <i>Hanna A. Hanna</i>	151
Isodynes: New Family of Analytical-Experimental Methods for Advanced Stress Analysis in Presence of High Stress Gradients <i>Jerzy T. Pindera, Bogdan R. Krasnowski and Marek-Jerzy Pindera</i>	157
Isopachic Fringe Multiplication and Its Application in Thermoelasticity <i>Zhang Xi, Li Yaowen, Wu Junyi and Pu Qinan</i>	163
Measuring Method of a Stress Distribution by Using the Stokes Parameters <i>Hayao Kubo, Yuji Yamada, Ryo Nagata and Toshiki Kihara</i>	169
A Method of Relaxation Experiment and Calculation for Judging the Similarity of Photoviscoelastic Experimental Material <i>Ning Peitai, Tang Kunrong, Xu Changhua and Liang Shaoji</i>	175
A New Method for Obtaining $n + \frac{1}{4}$ & $n + \frac{3}{4}$ Order Isochromatics from Full Field in Photoelasticity <i>Wang Hualiang</i>	182
On the Properties of Isotropic Points in a Strip under a Centrally-Concentrated Load <i>Yoshiharu Masuda</i>	187
Photoelastic Coating Method Applied to Large Thin-Walled Structures <i>Wei Songling, Liu Dean and Zhu Shuyun</i>	193
Photoelastic Stress Analysis in Multi-Mitered Bends under In-Plane Bending <i>Yoshiaki Sawa</i>	199

Photoelastic Stress Analysis of an Underground Buried Pipe <i>Yang Huaitang, Sun Liecheng and Dong Wei</i>	205
Photoelectric Method and Its Application in the Measurement of Dynamic Properties of Photoelastic Materials <i>Li Hongqi and Yang Naiping</i>	212
Photoplasticity Analyses for Shearing Process of Shears with Parallel Cutting Edges <i>Yun Dazhen, Liu Peie, Wen Daikun and Zhang Shijie</i>	219
A Preliminary Study on Application of Dynamic Photoelasticity <i>Bi Qian, Li Chaoming, Hu Tingwei, Huang Chengwei and Zhang Xianghong</i>	225
A Principle in Scattered Light Photoelasticity for Automatic Measurement of Internal Stress Field in 3-D Models <i>Liu Xianlong, Pan Shaochuan and Ha Liuzhu</i>	234
Shock Response of Curved Beams by Using Stress Pulse <i>Hiroyuku Takeishi and Yoshinasa Yasumoto</i>	241
Solving Structural Test Problems with Photoelastic Coatings <i>T. W. Corby and S. Redner</i>	247
Strain Analysis of CFRP Pin Connector by Birefringent Coating Method <i>Shinichi Koshida</i>	255
Stress Freezing Method Below the Upper Critical Temperature of Epoxy Resin <i>Takeyasu Kishi and Haruo Kawagoe</i>	261
Stress Interference Between Two Spherical Cavities in an Elastic Solid <i>Eiichiro Tsuchida and Ichiro Nakahara</i>	267
Stress-Strain-Optic Laws of Cellulose Acetate under Uniaxial Tension <i>Hiromasa Ishikawa and Shigeru Tadano</i>	273
A Study on Stress Measurement of Steel Structures by Photoelastic Surface Coating Technique <i>Eiji Makitani, Junpei Mase, Atsuo Tanaka and Jun Nakayama</i>	279
A Study on the Reflective Method of Dynamic Holo-Photoelasticity Using Ruby Laser <i>Tong Jingwei and Li Hongqi</i>	285
Transient Thermal Stress of Embankment Wall <i>Eiichi Matsumoto and Chris P. Burger</i>	292

OPTICAL METHODS

An Analysis of Optical Transfer Function in Moire Photography System <i>Shao Yixin and Zhao Qingcheng</i>	298
Application of Conjugate Images in Holographic Interferometry <i>Yu Naixun</i>	302
The Application of Holographic Thermometry in Engineering Thermophysics <i>He Shiping and Wu Xiaoping</i>	307
Application of Holography and Speckle Technique to High Temperature	

Mechanical Behavior Measurement of Composite Materials <i>Jin Guanchang</i>	312
Application of Optical Fiber to Moiré Method <i>Liu Rongxun, Ling Sen and Shui Jingxian</i>	319
Deformation Measurement of Curved Surfaces by Laser Subjective Speckle <i>Zhou Xingeng, D.W. Li and F.P. Chiang</i>	325
Developments in Moiré Interferometry and Applications to Strain Analysis <i>L. Pirodda, Tong Jingwei and G. DiChirico</i>	331
Discussion on Speckle-Shearing Interferometric Method <i>Xu Boqin, Wu Xiaoping and Kou Qingli</i>	340
A First Course in Optical Methods in Experimental Mechanics <i>C.F. Taylor</i>	346
Laser Holographic Interferometry Applied to the Investigation of Earthquake-Resistance for Hydraulic Structures <i>Chen Jishu, He Bosen, Zhang Chongwen, Sang Xuezu and Sheng Dadong</i>	347
The Measurement of Elastoplastic Strain Field by High Sensitivity Moiré Interferometry <i>Zhong Guocheng, Zhou Chuntian and Gou Qiuqing</i>	353
Measurement of Three Components of Displacement Vector Using Heterodyne Holographic Interferometry <i>Satoshi Kakunai, Koichi Iwata, Ryo Nagata and Hisayoshi Sekiguchi</i>	360
Measurements of Plasma Flows Using Quadrature Laser Interferometer <i>Hiromichi Ezumi and Masahiko Kawamura</i>	366
Measuring Instantaneous Deformation by White Light Speckle Method <i>Wang Xianglin and Guo Jinghua</i>	372
The Micro-Connection of the Centre Lines of the Second Order Moiré Fringes and the Determination of the Boundary Strains <i>Fang Cuichang and Jiang Xiaolin</i>	379
Moiré Interferometry for Deformation Studies <i>Daniel Post</i>	386
Multi-Objective-Speckle Technique and Its Application <i>Li Minhua and Tu Meirong</i>	392
Multi-Pulsed Laser for Dynamic Holography and Speckle Interferometry <i>Cao Hungsheng and Wang Zhenlin</i>	399
Objective White Light Speckle Method and Incoherent Data Extraction <i>Tu Meirong, Han Jinhua and Wu Fufu</i>	405
Observation of the Buckling Behavior of Cylindrical Shells Due to Axial Step Loading <i>Megumi Sunakawa and Seishiro Kibe</i>	412
One-Beam Shearing Interferometry for Measuring Slope and Curvature of Bent Plates <i>Dai Fulong</i>	418
On the Interpretation of Shadow-Moiré Fringes with Curved Gratings <i>Tao Zhiqiang and Yun Dazhen</i>	425
Origin and Development of Slip Lines in Al-4wt% Cu Alloys with Solute Segregation <i>Hiroshi Kato, Masahiro Matsuo, Mitsuo Hoshino and Keiji Yoshikawa</i>	432

Shadow Moire Method with Curved Grating <i>D.Z. Yun, B.H. Dong and X. Yu</i>	438
Shearing Moire Interferometry for Measuring Strain Field <i>Fu Chengsung, Dai Fulong, Chen Yi and Wu Xituyuan</i>	439
Some Improvements of Moire Interferometry <i>Luo Zhishan, Yuan Fuxiang, Liu Wenxiu and Zhang Guiqin</i>	446
A Speckle Shearing Interference Method with Two Gratings of Equal Frequency for the Measurement of Surface Strain <i>Ling Sen, Fang Jing and Liu Rongxun</i>	454
Strain Measurement by Scanning-Moire Method and Its Application <i>Yoshiharu Morimoto and Noriyuki Yamaguchi</i>	461
Study of the Crack Initiation Process in Low Cycle Torsional Fatigue by Grid Method <i>Hironobu Nisitani and Dai-heng Chen</i>	467
Study on One-Way Curved Beam System <i>Gengo Matsui and Seigo Nakamura</i>	473
Time Average Triple-Image Holography for Measuring Vibration <i>Ye Zifeng and Jia Zongliang</i>	479
The Transverse Impact on Orthogonally Stiffened Plates, A Simplified Theory Verified by Optical Methods <i>Reinhard Streubel</i>	485
Visioplasticity Study of Polymer Forming <i>Nobuo Inoue and Toshio Nakayama</i>	491

DYNAMIC MEASUREMENTS

An Approximate Evaluation of Impact Load of a Multi-Stepped Bar or a Multi-Holed Strip <i>Akiyoshi Chatani and Akihiro Hojo</i>	497
Dispersion of Stress Waves in a Laminated Composite <i>Takuo Hayashi, Hiroshi Nakamura, Yuichiro Yamada and Takao Masaharu</i>	503
Dynamic Fracture of a Cryogenic Material Caused by Electromagnetic Force at 4K <i>Yuuji Nakasone and Keisuke Ishikawa</i>	509
The Dynamic Yield Behavior and Plastic Deformation of Metal Bars Subjected to Longitudinal Impact <i>Masashi Daimaruya, Masachika Naitoh and Kaishin Liu</i>	515
An Experimental Study on the Generation of the Electromagnetic Force by a Spiral Coil <i>T. Sano, M. Takahashi, Y. Murakoshi, K. Matsuno and H. Takeishi</i>	521
Inversion Behavior of Circular Tubes by Axial Impact <i>Katsuhiko Murase and Tohru Nishimura</i>	527
Measurement of Shock Wave Produced by Wire Explosion in Water and PMMA <i>Toshiro Suhara, Shigehisa Fukuda and Terutake Matsuhara</i>	533
Measurement of Wind-Induced Vibration in High Voltage Power Cable <i>Ning Jiaoxian, Yang Jinlin and Yang Jinchun</i>	539

Measurements of Dynamic Properties of Materials Subjected to Engineering Stress Levels <i>Calderale, P.M., Regalzi, G. and Vullo, V.</i>	546
Measurement Techniques Applied to Dynamic Testing of Materials <i>C. Albertini, G. Maeder and M. Montagnani</i>	552
A Microcomputer-Based System for the High-Speed Compression Test by the Split Hopkinson Pressure Bar Technique <i>Takushi Yokoyama, Keizo Kishida and Kenji Nakagawa</i>	559
On Self-Induced Vibrations of Tool and Work <i>Kazutoyo Kono and Kazuo Nakamura</i>	565
Optical Fan Blade Vibration Measurement <i>Hirao Aono, Tetsuo Chikata, Yohji Hagiwara and Hideyasu Inuma</i>	571
A Test Facility for Dynamic Properties Measurements <i>T.R. Hsu, G.G. Chen, Z.L. Gong and N.S. Sun</i>	577

NONDESTRUCTIVE TESTING

Acoustoelastic Stress Analysis on a Rolled Plate under Plane-Stress State <i>Kenichi Okada</i>	584
AE Monitoring During Indentation Process in Porous Ceramics <i>Kyoji Homma</i>	590
Application of Acoustic Microscopy to Stress Measurement <i>Takuya Semba, Yasuhiro Tani and Hisayoshi Sato</i>	596
The Discrimination of Fracture Mode in CFRP Specimens by Spectral Analysis of Acoustic Emission <i>Yoichi Hayashi, Yoshiaki Kakuta and Masamichi Matsushima</i>	602
The Estimation of Metal Plastic Damage by Ultrasonic Technique <i>Wu Kecheng, Peng Wenzheng and Xue Xuming</i>	608
Fatigue Crack Closure Study by Using Acoustic Emission Technique <i>Lu Guozhi</i>	614
Fatigue Crack Detectability by Ultrasonic Testing—Effects of Fatigue Crack Growth History and Applied Stress Levels <i>Kenji Sakano, Susumu Arai, Takeshi Uemura and Kazuo Uchino</i>	621
Measurement of Fracture Toughness of Steels by Ultrasonic Surface Wave Method at Low Temperature <i>Heihachi Shimada, Kazuhiro Date, Mitsuo Ohata and Toshiaki Moriya</i>	627
Measurement of Surface Motions Due to an Applied Force and a Debonding by the Use of Flat-Frequency Displacement Transducer <i>Shigenori Yuyama, Takuichi Imanaka and Masayasu Ohtsu</i>	633
Stress Measurement by the Electroplating Method <i>Masaichiro Seiku</i>	640

STRUCTURAL ANALYSIS AND TESTING

Bolted Joints in Composites <i>R.E. Rowlands</i>	646
Cyclic Creep Testing of Lead Alloy Beams <i>H. Fessler and T.H. Hyde</i>	647
Buckling of Fiber Reinforced Plastic Tubes under External Pressure <i>S. V. Hoa, P. Ouellette and T. S. Sankar</i>	654
Evolution of Experimental Methodologies in the Car Industry <i>P.M. Calderale and A. Garro</i>	655
Nondestructive Buckling Testing Technique of Panels <i>Yu Weihai, Zhang Yi, Zhang Changli and Ding Hong</i>	661
On the Natural Vibration of the Aircraft Structural Model <i>Taketoshi Hanawa and Keiji Komatsu</i>	668
On the Reconstruction of the Internal Strain and Stress State in Solids from Experimentally Given Boundary Values <i>Karl-Hans Laermann</i>	674
Reliability of Analytical and Experimental Methods of Stress Analysis: Influence of Speculative and Physical Methodologies of Modelling of Real Events in Mechanics <i>Jerzy Tadeusz Pindera</i>	679
Response of an Underwater Shell Structure of Optimum Form to Concentrated Loading <i>J.M. Llamias and R. Royles</i>	687
Some Solutions of Thermal Stress from Mechanical Analogy <i>Wang Yuan Chun, Eiichi Matsumoto, Koji Kamauchi and Tsuyoshi Sekiya</i>	697

RESIDUAL STRESS AND X-RAY ANALYSIS

A Consideration on Residual Stress Measured by X-Ray Diffraction Technique <i>Mitsumasa Iwata and Kinichi Nagai</i>	703
A Discussion on the Interior Distribution of Weld Residual Stress <i>Shigeru Kitagawa</i>	709
Experimental Studies on the Residual Stresses in Injection Molded Plastics by Means of Photoelasticity and Liesegang's Rings <i>Akira Shinohara, Masaru Nakazawa and Tetsuo Nishimura</i>	715
Evaluation of Hardening of Quenched Steels by X-Ray Technique Using Gaussian Curve Method <i>Masanori Kurita, Matsuo Miyagawa and Masashi Shinbo</i>	721
Measurement of the Residual Stress Around the Welded Point by Means of Magnetic Probe <i>Seiichi Abuku</i>	727
Measuring Surface Residual Stresses by Shallow-Hole-Drilling Strain-Gage Method <i>G.F. Chalmers and S.Redner</i>	733

New Developments of the Incremental Hole-Drilling Method and Comparison with Two Other Methods for Measuring Residual Stress Distribution <i>J. Lu, A. Niku-Lari and J.F. Flavenot</i>	741
Non-Destructive Residual Stress Measurement under the Surface by X-Ray Diffractometry <i>P. Coppa and M.M. Gola</i>	747
A Photoelastic Method for Determining Residual Stress in Polymethylmethacrylate (PMMA) <i>Wang Ziming</i>	753
Present Situation of X-Ray Stress Measurement in Japan <i>Kinichi Nagai and Mitsumasa Iwata</i>	760
Quenching Stress of High Frequency Induction Hardening Steel <i>Yukio Sugawara and Hiromasa Ishikawa</i>	766

INSTRUMENTATION

Applying Multipoint Scanning Techniques in Stress Measurement and Analysis Using Special Instrumentation <i>Helmuth Assmann</i>	772
The Measurement of Parasitic Components and the Influence of Load Transfer Systems on a Force Standard Machine <i>C. Ferrero, C. Marinari and Li Qing Zhong</i>	778
Multicomponent Dynamometers for Control of Parasitic Components on Force Standard Machines <i>Giulio Barbato, Anthos Bray and Raffaello Levi</i>	784

IMAGE PROCESSING AND DATA ACQUISITION TECHNIQUE

Application of Computer Picture Processing to Two-Dimensional Strain and Displacement Measurement <i>Genki Yagawa and Shinichi Matsuura</i>	791
Application of Image Processing Technique to the Stress Measurement by Copper Electroplating <i>Akira Kato</i>	797
Automatic Acquisition and Analysis of Photoelastic Fringe Patterns <i>Wei Yinan, Qian Rengji, Qi Feihu and Yu Songyu</i>	803
Automatic Stress Analysis from Photoelastic Fringes Using Personal Computer <i>Eisaku Umezaki, Tamotsu Tamaki and Susumu Takahashi</i>	808
An Image Processing and Data Acquisition Technique for Scattered-Light Photoelasticity <i>Li Bangyi and Liu Chongqing</i>	814
A Method of Electro-Optic Modulation for Photoelastic Data Acquisition <i>Zhang Yuanpeng</i>	822

An Optimized Digital Correlation Method for Displacement Measurement	
<i>Mingqi Cheng, M.A. Sutton, W.H. Peters and W.F. Ranson</i>	828
Photocarrer Method of Fringe Pattern	
<i>Xu Zhu and Y.Y. Hung</i>	834
Processing of Speckle-Fringe with Computer	
<i>Qian Qiaonian and Wang Yiqun</i>	842
A Research into Collection and Processing Automation of Stress Analyzing	
Data of Three-Dimensional Photoelasticity in Full-Fields	
<i>Wang Rupeng and Wei Yanan</i>	848
The Use of Digital Image Processors in Experimental Mechanics	
<i>M.E. Fourney</i>	853

EXPERIMENTAL MECHANICS APPLIED TO FRACTURE MECHANICS

Application of the Caustic Technique to Any Materials by Ficker's Mirror	
Transplantation Method	
<i>Dang Jinbao</i>	854
Assessment of Defects Using Embedded Crack Specimens Produced by Diffusion	
Welding Method	
<i>Yoshiharu Mutoh, Isao Sakamoto and Masahiro Inoue</i>	860
A Bursting Pressure Formula for ϕ 10 Zr-4 Alloy Tubes with Axial Surface Crack	
<i>Ning Jun, Xie Jingyi, Hong Songxian, Yin Donglai and Hong Yunju</i>	866
Determination of SIF K_I for Mode I Cracks and Mixed Mode Plane Cracks	
by Using Scattered Light Technique	
<i>Ma Guang and Tan Dazhou</i>	871
Determination of Stress-Intensity Factors Due to Thermal Stresses	
Using Half-Fringe Photoelasticity	
<i>Peizhong Zhang and Christian P. Burger</i>	878
Dynamic Fracture Toughness Test on Thermite Welded AP ₁ Railroad Rail	
<i>Guan Lingwei, Cheng Yuren and Yan Bingshan</i>	884
Effect of Poisson's Ratio on Photoelastic Stress-Intensity Factor Determination	
<i>Lai Zengmei</i>	890
Effect of Shot-Peening on Surface Crack Propagation in Plane-Bending Fatigue	
<i>Masaaki Misumi, Tsuyoshi Ohhashi and Masafumi Ohkubo</i>	897
Elastic-Plastic Fracture Characteristics of a Cracked Plate under Biaxial Load	
<i>Liu Baochen, Lin Shutian, Huang Qingping and Liu Chunyang</i>	903
Electrical Potential Method Using AC Current for Measuring Crack	
Length and Its Applications	
<i>Mitsuhiko Hasegawa, Shotaro Kodama and Munemori Shinohara</i>	909
The Experimental Calibration of Stress Intensity Factors for	
C-Specimens by the Method of Caustics	
<i>Guan Dachun, Yang Zhongheng and Duan Naiqin</i>	915

Experimental Investigation on Ductile Instability <i>Kotoji Ando, Shinpei Fujibayashi, Masaya Horino and Nobukazu Ogura</i>	919
Experimental Investigations in Fracture Mechanics Problems <i>L.S. Srinath and K.S.S. Aradhya</i>	925
Fatigue Crack Closure in Polymers <i>Shunji Nagasaka</i>	932
Fatigue Crack Growth under Biaxial Stresses <i>Ryoji Yuuki and Hideo Kitagawa</i>	938
Fracture Behavior and Loading Capacity of Ductile Thinner Materials with a Crack <i>Hiroyuki Kisu, Hideo Kitagawa and Ryoji Yuuki</i>	944
The Mix-Mode Stress Intensity Factor Evaluated by a Filter Caustic Method <i>Cao Hong and Jia Youquan</i>	950
A New Engineering Method for the Measurement of Stress Intensity Factors of I-II Combined Mode Cracks <i>Tong Jiaxian and Wang Junyang</i>	957
On Observation of Crack Initiation and Growth in the Field of Contact Without Macro Slip <i>Hiroyuki Kisu and Akira Ura</i>	963
A Photoelastic Determination of Mixed-Mode Stress-Intensity Factors(K_I , K_{II}) <i>Fumio Nogata, Jun-ichi Masaki, Kenji Seo and Susumu Takahashi</i>	969
Plastic Zones for a Pair of Coplanar Line Cracks: Theory and Experiment <i>Y.M. Tsai and Peizhong Zhang</i>	975
A Strain Gage Technique for the Determination of Stress Intensity Factors <i>Zhao Jianhua</i>	981
Studies on the Three Dimensional Elastic-Plastic Cracks by Using the Recrystallization Technique <i>Yang Bingxian</i>	987
The Study of Fatigue Crack Propagation Process on Crad Materials by Monte-Carlo Simulation <i>Yuji Ishida, Nozomu Aoki and Chikara Minamisawa</i>	993
A Study of Mixed-Mode Crack Stress Field and Determination of Stress-Intensity Factors Using Holographic Photoelasticity <i>Chen Shujian and Li Jiabao</i>	999
The Study of Plane Elastic Contact Problems with the Method of Caustics and Pseudocaustics <i>Lin Xing and Chu Kunliang</i>	1007

EXPERIMENTAL MECHANICS APPLIED TO BIOMECHANICS

Analysis of Load Transfer Between Removable Partial Dentures and Mandible by Reflection Photoelastic Technique <i>P.M. Calderale and M. Rossetto</i>	1015
Basic Mechanical Properties of Retina in Simple Elongation <i>Wu Wenzhou, Walter H. Peters and Mark L. Hammer</i>	1021

Could Spondylolysis Be Initiated by the Action of Mechanical Forces? <i>H.A.C. Jacob and Y. Suezawa</i>	1027
The Determination of the Loads of the Metatarsal Bones of Human's Forefoot Sole and Its Clinical Application <i>Hong Shuizong, Wu Zhenkun and Gu Xiangjie</i>	1033
3 D Stress Distribution Measurement in Varus-Loaded Human Ankle Joint Model by Scattered-Light Polarizer Photoelasticity <i>Toshiki Kihara, Masato Unno, Hayao Kubo and Ryo Nagata</i>	1039
Evaluation of Mechanical Behaviour of Bovine Pericardium in Relation to Tissue Fixation and Sterilizing Treatments <i>P.M. Calderale, F.De Bona, P. Arru and M. Galloni</i>	1045
Experimental Research of Dynamic Properties of Compact Dry Bones under High Strain Rate Conditions <i>Yang Guitong and Zhang Hongmin</i>	1051
Hip Prosthesis Design Based on Experimental Stress Analysis of the Human Pelvis and Femur <i>Hilaire A.C. Jacob</i>	1059
An Improved Experimental Device for Simplified Gait Analysis <i>M.M. Gola and A.Gugliotta</i>	1068
Inference Method of Estimating Elastic Modulus of Cancellous Bone from Image Analysis <i>N. Inoue, K. Sakakida, F. Yamashita, T. Hirai and T. Katayama</i>	1074
Measuring Technique of Contact Pressure Distribution Between Feet and Ground by Means of Photoelasticity <i>H. Nakagawa and S. Takahashi</i>	1080
A New Optical Mismatch Method in Modern Photo-Mechanics and a Study on Efficacies of Internal Fixers Used in Treatments of Femoral Neck Fractures <i>Zhu Hongmao and Zhao Qingcheng</i>	1086
Theoretical Analysis of the Coupling Between Hip Prosthesis Stem and Femur <i>P.M. Calderale and A. Garro</i>	1091
Author Index	1097