Proceedings of
the First International
Symposium
on
Thermal Stresses
and
Related Topics

THERMAL STRESSES '95

June 5-7, 1995

Shizuoka University
Journal of Thermal Stresses
Thermal Stresses '95 Organizing Committee
# Program

## June 5 (Room A)

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## June 6 (Room A)

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* Key Note Lecture

- V -
Program

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by V. N. Hakobian, S. M. Mkhitarian

Displacement Boundary Value Problem of a Penny-Shaped Crack under General Temperature
by J. V. S. Krishna Rao and N. Hasebe

Transient Thermal Stress in a Plate with an Edge Crack
by Y. Matsunaga and N. Noda

14:50-17:00 Thermal Fracture (Chairman: Norio Hasebe)

* Concept of Thermo-Damage Coupling in Continuum Damage Mechanics
   by A. Ganczarski and J. Skrzypek

The Thermal Shock Resistance of Materials by Induction Heating
   by A. G. Lanin and V. P. Popov

Dependence of Grain Size and Cleanliness on Fracture Behavior of IN718 at Room and Liquid Helium Temperature
   by T. Teramoto, Y. Kayamori and M. Saito

Resistance to Damage of Brittle Solids under Pulse Heating: Thermo-Mechanical Analysis
   by V. N. Gurarie

Experimental and Analytical Study on Thermal Fracture Stress of Carbon-Based Materials
   by T. Arai

Theoretical Evaluation and Its Experimental Verification of Thermal Stress Fracture of Graphite Electrode for Steel-making Arc Furnaces
   by S. Sato, R. Ishida, M. Chida and K. Kawamata

18:30-20:30 Banquet at Meitetsu Hotel

June 7 (Room A)

9:00-11:10 Thermal Stresses and Thermal Fatigue in Ceramics (Chairman: Jacek Skrzypek)

* Thermal Shock and Thermal Fatigue in Ceramics
   by Gerold A. Schneider

Thermomechanical Properties of Superconductive Ceramic Composite with Cylindrically Oriented Crystals around Fiber
   by Yotsugi Shibuya

Thermal Stress in Ceramics under Thermal Shock Test
   by T. Nishikawa and M. Takatsu

Characterization of Thermal Shock and Thermal Fatigue Behaviour of Ceramics by Means of Laser Irradiation

Thermal Shock Stresses of Ceramics at Quenching in Liquid
   by T. Sakuma and U. Iwata

Laser-based Thermal Shock Testing of Ceramics - from Material Characterization to Component Qualification
   by U. Bast, D. Steiner, J. H öpken, H. Balke and G. Kirchhoff

11:20-12:00 Special Lecture III (Chairman: Franz Ziegler)

Some Basic Thermoelastic Problems on Nonhomogeneous Structural Materials
   by Y. Tanigawa

12:00-13:00 Lunch

13:00-15:10 Thermal Cracking (Chairman: Gerold A. Schneider)

* Thermal Crack Growth in Self-Stressed Two- and Three-Dimensional Bimaterials: Numerical Modelling and Experiment
   by K. P. Herrmann and M. Dong

Modelling of Elementary Failure Mechanisms Arising in Thermomechanically Loaded Material Models
   by F. Ferber and K. P. Herrmann

Modelling of the Fracture Process in Alumina Substrates Around Filled and Unfilled Vias
   by T. V. Baughn, P. F. Packman and C. R. McCreary

Pattern Selection in Thermal Cracking

Dynamic Thermal Stress and Crack Growth Behavior due to Repeated Thermal Shock in Cemented Carbides
   by S. Ishihara, T. Goshima, I. Nakayama and T. Yoshimoto

* Key Note Lecture
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Fracture Initiation and Crack Propagation by Thermal Shock in Carbon Anodes
by T. S. Liu, P. S. Cook, C. P. Hughes and B. J. Mason

15:30-15:50 Closing Ceremony

Room B

June 5 (Room B)

10:30-12:00 Dynamic Problems of Thermal Stresses I (Chairman: Michio Kurashige)
*The Determination of Stress Focusing Intensity Factor Due to a Spherical Thermal Inclusions in a Sphere
by T. Hata

The Ray Method for Solving Dynamic Contact Problems of Thermoelasticity
by Yuriy A. Rossikhin and Marina V. Shitikova

The Ray Method in Nonlinear Problems of Thermoelasticity
by Vladimir A. Baskakov, Yuriy A. Rossikhin and Marina V. Shitikova

Dynamic Thermal Stresses in a Finite Plate with a Crack Subjected to Impulsive Electromagnetic Radiation
by N. Sumi, H. Yoshikawa and H. Monna

12:10-13:30 Welcome Party at Okura Act City Hotel

13:40-15:30 Dynamic Problems of Thermal Stresses II (Chairman: Toshiaki Hata)
*Coupled Thermoelasticity of Shells
by M. R. Eslami, M. Shakeri and A. R. Ohadi

The Coupled Thermoelastic Analysis of Circular Plate in Nonstationary Temperature Field
by Yan Zongda and Li Pengtang

Transient Wave Propagation in Multilayered Thermoelastic Cylindrical Shells
by G. Birlik

Backscatter of Elastic Waves from a Thermally Affected Surface Layer
by T. Ohyoshi and Guang Jun Sui

Simple and Shock Waves in Nonlinear Thermoelastic Solids
by D. V. D. Tran and M. C. Singh

15:50-17:10 Dynamic Problems of Thermal Stresses III (Chairman: Gülil Birlik)
Free Vibrations of a Conical Shell with Temperature Dependent Material Properties
by Z. Mecitoglu

Thermal Flutter
by F. P. J. Rimrott and Jean W. Zu

Tensioning Effect on Thermally Stressed Disk Vibration
by H. Iwata and Y. Yoshida

A Numerical Analysis of the Behavior of a Point Source of Expansion Near the Surface of a Plate
by B. Terluic

June 6 (Room B)

9:00-11:10 Thermoelasticity I (Chairman: Jaroslaw Stefaniak)
*Thermal Stresses in Triangular and Rectangular Inclusion
by T. Mura, T. Y. Lin and S. Qin

A General Treatment of the Elliptical Inclusion Problem in Plane Thermoelasticity
by S. X. Gong

Steady State Thermal Stresses in an Elastic Thick Plate Containing a Prolate Spheroidal Inhomogeneity with Constant Temperature Applied on the Circle Regions of Both Plate Surfaces
by E. Tsuchida, Y. Arai and M. Nishikawa

Effects of Thermal Transient Stresses on Defect Growth in Nozzle-Hemisphere Intersection
by C. K. Lee and H. W. Ng

Analytical Solution of Thermoelastic Problem of an Eccentric Circular Annulus
by Franc Kosel, Tomaz Videnic and T. Videnic

Thermal Stresses in Microstretch Beams
by Ludovico Nappa

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12:00-13:00 lunch

* Key Note Lecture
13:00-15:10  Thermoelasticity II (Chairman: T. Mura)
  *Nonlinear Problems of Thermal Buckling of a Beam  
  by T. Jekot  
  Postbuckling of Reinforced Flat Panels Exposed to a High Temperature Environment  
  by M. A. Souza and L. Librescu  
  Generalized Heat Dipoles on a Semi-Space  
  by K. L. Chowdhury  
  Transient Thermal Stresses in a Rectangular Prism Due to Partial Heat Supplies on the End Faces  
  by I. A. Okumura  
  Thermoelasticity: Material Inhomogeneity and Fracture  
  by C. Dascalu, M. Epstein and G. A. Maugin  
  The Problem of the Plate with Nonstationary Boundary Conditions due to Influence of the Moving Heat Source  
  by R. Cukié and D. Trajkovski

15:30-16:50  Inverse Thermal Stresses Problems (Chairman: Tomasz Jekot)
  *The Method of Concentrated Sources in Heat Conduction  
  by J. Stefaniak  
  An Inverse Thermoelastic Problem in an Isotropic Plate Associated with a Piezoelectric Ceramic Plate  
  by F. Ashida, J. Choi and N. Noda  
  The Inverse Analysis of Two-Dimensional Steady-State Heat Conduction Problem with Many Plane Heat Sources  
  by M. Ohmichi and N. Noda  
  Axisymmetric Thermal Bending Problem of Nonhomogeneous Circular Plate - Inverse Analysis of Material Composition and Coefficients of Heat Transfer in order to Prescribe the Out-of-Plane Deformation  
  by R. Kawamura and Y. Tanigawa

18:30-20:30  Banquet at Meitetsu Hotel

June 7 (Room B)

9:00-11:10  Generalized Thermal Stresses Problems (Chairman: Gaetano Fichera)
  *Nonclassical Dynamical Problems of Thermoelasticity  
  by R. B. Hetnarski and J. Ignaczak  
  On Wave Propagation in Random Generalized Magneto-Thermo-Visco-Elastic Medium  
  by R. K. Bera  
  Waves in Heat-Flux Dependent Micropolar Thermoelastic Thin Plate  
  by T. K. Chadha and Swaranjii Kaur  
  Generalized Thermoelasticity in One Dimensional Plate under Some Support Conditions  
  by T. Furukawa, M. Konishi, D. X. Ding and H. Nakanishi  
  Dynamic Thermal Strain and Stress in Films under Quick Laser Heating  
  by D. W. Tang, N. Araki, N. Noda and B. L. Zhou  
  Conservation Laws for Thermoelasticity  
  by Xu Li

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13:00-14:50  Heat Conduction Problems (Chairman: Jozef Ignaczak)
  *Is the Fourier Theory of Heat Propagation Paradoxical?  
  by G. Fichera  
  The Coupled Heat Transfer Problem with Pool Subcooling Boiling, Radiation and Phase Transformation  
  by J. R. Chen, H. G. Wang, J. Q. Yu and Z. W. Qin  
  The Research on the Coupled Effect with Inner Dissipation of Metallic Materials in Thermal Shock  
  by He-Ming Cheng, Hong-Gang Wang and Yongjing Chen  
  The Microscopic Research on the Heat Conduction Laws of Thermal Shock Problems  
  by Y. H. Guan, H. G. Wang, T. L. Chen and Z. W. Qin  
  On Fourier's Law of Heat Conduction in Granular Material  
  by Z. Golubovic, D. Kuzmanovic and P. Cvetkovic

* Key Note Lecture

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Thermal Stresses ’95

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  by Y. Ootao and Y. Tanigawa
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  by M. Nakagaki, S. Hagihara, R. Kuranari and Y. Shibata
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Optimal Design of Thick Laminated Composite Plates for Maximum Thermal Buckling Load
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Response of Doubly-Curved Metal Matrix Laminated Panels to Combined Thermal and Mechanical Loadings
by E. Feldman

Bonding Residual Stresses in Symmetric Cross-Ply High-Temperature Composites
by P. Dadras and G. H. K. Reddy

Thermal Stress at an Off-Angled Interface Separating Two Dissimilar Anisotropic Half Spaces
by Kazumi Watanabe

15:10-17:00 Thermal Stresses in Porous Materials (Chairman: Daudeville Laurent)

*On Specific Properties of an Elasto-Viscoelasto-Porous Material Architecture
by B. Maruszewski, R. Starosta and L. Restuccia

Fundamental Solutions for an Infinite Thermo-Poro-Elastic Solid with Zero Conductivity and Permeability in One Direction
by Michio Kurashige

High Temperature Behaviour of Concrete as an Unsaturated Porous Material
by C. E. Majorana and B. A. Schrefler

Thermal Stressing for Thermal Stress Analysis of a Concrete Slab Pavement
by Tu Hsiang-Te

Tesabik Behavior: A Further Study on the Mechanism of Thermal Stress in Concrete Pavement
by Tu Hsiang-Te

18:30-20:30 Banquet at Meitetsu Hotel

June 7 (Room C)

9:00-11:10 Electronic Problems in Thermal Stresses I (Chairman: Theodore R. Tauchert)

*Thermal Stress in Microelectronics and Fiber Optics
by E. Suhir

A Model for Calculating Dislocation Generation due to Thermal Stress in Semiconductor Crystals Grown from the Melt
by K. Imai, K. Kikuchi, K. Sumino and M. Kurashige

Thermal Stress Analysis of Bonding Wire in IC Packages
by Jihong Liu and Tohru Hirano

Micro-step on Cleavage Surface of Semiconductor Heterostructure Induced by Thermal Deformation
by Y. Arimitsu, M. Izawa, M. Yoshimura and T. Yao

Does the Cooling of Electronics Increase Reliability?
by A. Dasgupta and M. Pecht

The Role of Thermal Effects in the Production of Parts and Units by Means of Pulse Magnetic Field
by V. A. Glouschenkov and V. I. Pesotsky

11:20-12:00 Special Lecture III (in Room A)

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*Cylindrical Bending of Hybrid Laminates Under Thermo-Electro-Mechanical Loading
by T. R. Tauchert

An Intelligent Composite Material without Thermal Bending Deformation
by J. Qiu and J. Tani

Laser Absorption in Thermonuclear Fusion Plasma
by O. P. Niraula

Predicting a Life of SLC/FCA Assembly by Performing the Accelerated Stress of Temperature, Humidity, and Voltage Bias
by K. Imahara

Numerical Green's Function Solution for Thermoelasticity
by Deok Kee Choi

* Key Note Lecture
June 5 (Room D)

10:30-12:00 Thermal Fatigue I (Chairman: Lars-Erik Lindgren)
- The Fatigue Behavior and Residual Stress of a Carbonitrided Cr-Mo Steel
  by Sam-Hong Song and Sang-Hoon Lee
- Thermal Fatigue in an Axi-symmetric Structure
  by Jung-Ho Lee
- High Temperature Multiaxial Low Cycle Fatigue of Ni-Base Single Crystal Superalloy
  by M. Kanda, M. Sakane, M. Ohnami and T. Hasebe
- Thermal-Mechanical Fatigue Crack Propagation Behaviors of a Turbine Casing Bolt
  by Sam-Hong Song and Myung-Soo Kang

12:10-13:30 Welcome Party at Okura Act City Hotel

13:40-15:00 Thermal Fatigue II (Chairman: Gerard A. Maugin)
- Evaluation of Cyclic Thermal Load Effects on Concrete Around Containment Pipe Penetrations
  by C. H. Shih, E. Odar and M. Hsu
- Effects of Recrystallized Grain Structure on High-Temperature Low-Cycle Fatigue Strength
  by H. Iizuka
- Thermal Fatigue Life Evaluation of Ligaments of High-Temperature Boiler Headers
  by Y. Tanaka, T. Tokiyoshi, M. Fujita, H. Nakatani and S. Maehara
- Fatigue Characteristic Stress Intensity Factors at Low Temperature
  by Y. Sawaki, H. Yoshida, Diao Dong Dongfevg and A. Inoue

15:20-16:50 Thermal Stresses in Materials with Phase Transformation I (Chairman: Sam-Hong Song)
- Irreversible Progress of Phase-Transition Fronts in Thermoelastic Conductors
  by G. A. Maugin and C. Trimarco
- Recovery Stress due to Phase Transformation in TiNi Shape Memory Alloy
  by H. Tobushi, A. Ikai, S. Yamada, P. H. Lin and K. Tanaka
- Recovery Strain and Recovery Stress in Shape Memory Polymers of Polyurethane Series
  by H. Tobushi, S. Hayashi, A. Ikai and H. Hara
- Toolbox for Computing Phase Transformations and Material Properties of Hypoeutectoid Steels in Satoh Test
  by L.-E. Lindgren and A. Oddy

June 6 (Room D)

9:00-11:10 Thermal Stresses in Materials with Phase Transformation II (Chairman: J.-L. Bobet)
- *Metallo-Thermo-Mechanics in Welding Process
  by T. Inoue and A. Sakuma
- The Constitutive Equations of Thermal Viscoelastoplasticity with the Transformations of Probabilistic Certainty of Metallic Materials in Solid State
  by Y. J. Chen, B. J. Duggan, H. G. Wang
- A Study of the Transient Temperature Fields and Phase Transformation Process During Laser Surface Hardening
  by Tieli Chen, Yihong Guan, Yongjin Chen, Zhiwu Qin and Honggang Wang
- The Thermal Stresses and Residual Stresses During Laser Phase Transformation Process
- Simulation of Thermomechanical Behavior of Polymer Materials in the Process of Crystallization
  by V. P. Begishev, V. P. Matveyenko, N. V. Pitsiov and I. N. Sardakov
- Self-Stabilization of a Composite Shaft Via Thermally Adaptive SMA Plies
  by W. Kurnik

11:20-12:00 Special Lecture II (in Room A)
12:00-13:00 lunch
13:00-14:30 Thermoplasticity I (Chairman: Tatsuo Inoue)
- *The Theoretical Estimate of the Temperature Effect on Yield Stress Based on Dislocation Theory
  by H. G. Wang, H. M. Cheng and Z. W. Qin
- Thermoplastic Behaviour of Tunnels for a Cohesive - Frictional Material
  by H. Wong and O. Simionescu

* Key Note Lecture
Program

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18:30-20:30 Banquet at Meitetsu Hotel

June 7 (Room D)

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Effects of Substrate Temperature and Successive Annealing on Residual Stress in AIN films Deposited by Sputtering
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12:00-13:00 lunch
13:00-15:00 Lecture for Citizens

* Key Note Lecture- XII -