Editor's Note:

This issue of the World of Composites will again begin with a review of activities in ASTM's Committee D-30 on High Modulus Fibers and their Composites. This will be followed by an update from the American Society for Composites. Finally, three new composite material publications will be noted.

ASTM Composites Activities

Committee D-30 Installs New Officers

The membership of the committee have elected new officers in a recently completed ballot. Under committee bylaws, the Chairman, Vice-Chairman, Secretary, and Membership Secretary were elected to two-year terms that began on 1 January 1996. The members-at large serve a four-year term. The new roster of committee officers is as follows:

Chairman: John E. Masters
Lockheed Martin Engineering and Science

Vice-Chairman: Eugene T. Camponeschi
Naval Surface Warfare Center

Secretary: Don E. Pettit
Lockheed Martin Aeronautical Systems

Membership Secretary: Steven J. Hooper
Wichita State University

Members-at-Large: Paul A. Lagace
Massachusetts Institute of Technology
Term - 1994 to 1997
Crystal Newton
Material Science Corp.
Term - 1994 to 1997
Peter Sjoblom
University of Dayton Research Institute
Term - 1996 to 2000
Peter Grant
Boeing Helicopters Company
Term - 1996 to 2000

13th Symposium on Composite Materials: Testing and Design

Committee D-30 will hold the 13th Symposium on Composite Materials: Testing and Design on 16 and 17 May 1996 in Orlando, Florida. Steven J. Hooper of Wichita State University, will chair the symposium. The symposium will feature 23 papers. A highlight of the symposium will be the presentation of the first annual Wayne W. Stinchcomb Memorial Award and Lecture. A special technical publication (STP) based on the symposium proceedings is anticipated. A preliminary list of papers and authors is included below.

Design and Testing of Composite Flywheel Rotors—C. E. Bakis and C. W. Gabrys
Probabilistic Composite Design—C. C. Chamis
Impact Damage Characterization of Light Weight Sandwich Structure—J. C. Fish and K. T. Marcucelli
Development of Reliable Data Analysis for Fracture Testing of Fiber-Reinforced Composites—A. J. Brunner, P. Flueler, P. Davies, and J. G. Williams
Mode I, Mode II and Mixed Mode Interlaminar Fracture of Woven Fabric Graphite Epoxy—L. A. Carlson and N. Alif
Accuracy Assessment of the Singular Field-Based Mode Mix Decomposition for the Prediction of Delamination—B. D. Davidson, and K. L. Koudela
A Mixed-Mode Delamination Analysis of a Laminate Subject to Tension-Torsion Loading—S. J. Hooper, J. Knittel, and T. K. O'Brien
Modified Mixed-Mode Fracture Test Apparatus for Measuring Interlaminar Fracture Toughness of Composite Laminates—K. N. Shivakumar, V. S. Ayva, and J. H. Crews
Compression Buckling Behavior of Thick Laminated Composite Panels—B. K. Parida

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A Damage Mechanics Model for Compression Strength of Composites—J. S. Tomblin and E. J. Barbero
Compressive Strength of Unidirectional Composites: Measurement and Prediction—C. Souts; Session V: Metal Matrix and Ceramic Matrix Composites—B. Davidson
Testing and Failure of a Ti Metal Matrix Composite Cylindrical Shell under Cyclic Internal Pressure—E. A. Armanios, D. Hook, D. S. Dancila, A. Thakker, and P. Doorbar
A Comparison of Life Prediction Methodologies for Titanium Matrix Composites Subjected to Thermomechanical Fatigue—J. R. Calcaterra and W. S. Johnson
Ambient and Elevated Temperature Testing Methodology of Ceramic Matrix Composites, Flat and Tubular Specimens—M. Elahi, K. Liao, and K. Reifsnider
Fatigue Behavior of Hybrid Titanium Composite Laminates at Elevated and Room Temperatures—E. Lee and W. S. Johnson
Progressive Fracture of Composites Subjected Jiosipescu Shear Testing—L. Minneyan, C. C. Chamis, and P. K. Gotsis
Modification of the Three Rail Shear Test for Composite Materials under Static and Fatigue Loading—L. B. Lessard, O. P. Eilers, and M. M. Shoakria
Coulomb-Mohr Type Criterion for Matrix Mode Failure in a Lamina—S. N. Chatterjee
Testing and Geometrically Nonlinear Analysis of Pretwisted Laminated Composite Strips with Extension-Twist Coupling—E. A. Armanios, D. Hook, and A. Makeev
Unified Numerical Model for Laminated Composites—T. Nishiwaki, A. Yokoyama, and H. Hamada

Committee D-30 Activities

In addition to the symposium listed previously, Committee D-30 will conduct a full schedule of Subcommittee meetings. A roster of Subcommittee members, their chairs, and task groups are listed here.

Subcommittee D30.01 - Editorial
Chair: Crystal Newton
Material Science Corp.
Suite 250
500 Office Center Drive
Fort Washington, PA 19034
(215) 542-8400
● Task Group on Data Reporting

Subcommittee D30.02 - Research and Mechanics
Chair: Roderick H. Martin
Materials Engineering Research Laboratory Ltd.
Tamworth Road
Hertford SG13 7DG, UK
(0992) 500120
● Task Group on International Standards Harmonization
● Task Group on Long-Term Durability

Subcommittee D30.03 - Constituent Properties
Chair: James R. Ferrel
Hercules, Inc.
M. S. 8185
PO Box 98
Magna, UT 84044
(801) 251-5253
● Task Group on NDE

Subcommittee D30.04 - Lamina/Laminate Properties
Chair: Richard E. Fields
Lockheed Martin
PO Box 628007
Mail Point 1404
Orlando, FL 32862-8007
(407) 356-5842
D30.04.01, Tension Test Methods
D30.04.02, Compression Test Methods
D30.04.03, Shear Test Methods
D30.04.04, Fatigue
D30.04.05, Ring/Filament Wound Composites Test Methods
D30.04.06, Guides
D30.04.08, Specimen Preparation

Subcommittee D30.05 - Structural Properties
Chair: Ronald F. Zabora
Boeing Commercial Airplanes
PO Box 3707
Mail Stop 48-02
Seattle, WA 98124-2207
(206) 662-2655

Subcommittee D30.06 - Interlaminar Properties
Chair: T. Kevin O’Brien
U.S. Army Aeronautical Directorate
NASA Langley Research Center
Mail Stop 188E
Hampton, VA 23665-5225
(804) 864-3465
D30.06.01, Mode I Testing
D30.06.02, Mode II Testing
D30.06.03, Mixed Mode Testing
D30.06.04, Fatigue
D30.06.05, Interlaminar Shear Strength
D30.06.06, Interlaminar Tension Strength
Subcommittee D30.07 - Metal Matrix Composites

Chair: W. Steven Johnson
School of Materials Science and Engineering
Georgia Institute of Technology
Atlanta, GA 30332-0245
(404) 894-3013

For further information on Committee activities, please contact the Committee's staff manager, Kathie Morgan at ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959; (610) 832-9721.

AMERICAN SOCIETY FOR COMPOSITES

Society Announces Eleventh Technical Conference on Composites

Call for Papers

11th Technical Conference on Composite Materials
7–9 October, 1996
Omni Hotel at CCN Center
Atlanta, Georgia

The purpose of this conference is to provide an interdisciplinary forum for technical presentations and discussions addressing the critical engineering and scientific disciplines relevant to the advancement of integrated composites technology.

Conference Chairman—Prof. W. Steven Johnson, School of Materials Science and Engineering, Georgia Institute of Technology, Atlanta GA 30332-0245. Tel: 404-894-3013; Fax: 404-894-9140; e-mail: steve.johnson-mse.gatech.edu.

Previously unpublished papers are solicited for these tentative technical sessions:

- NDE of Composites
- Composites for Infrastructures
- Ceramic Matrix Composites
- Textile Composites
- Life Modeling of Titanium Matrix Composites
- Manufacturing Processes for Polymeric Composites: RTM, Low Cost, Advanced Methods
- Advances in Polymers and Fibers
- Aexoeelastic Tailoring with Composite Materials
- Long Term Durability of PMC's and their Joints
- Advanced Computational Methods for Composites
- Damage Mechanics and Damage Tolerance
- Compressive Behavior
- Biomedical Applications
- Automotive Applications
- Structural Design and Analysis Methods
- High Temperature Composites

Prospective authors are questsed to submit three copies of a 300 to 500 word abstract addressed to the Conference Secretariat, Ms. Revonda Dunn, CERC, Georgia Institute of Technology, Atlanta, GA 30332-0245, by January 31, 1996. The abstract should include key figures and/or tables. Indicate the session(s) for which the paper is best suited. Upon acceptance, a 10-page paper will be requested for publication in the conference proceedings and must be received no later than 17 June 1996 on camera-ready mats provided by ASC.

Papers authored or co-authored by students only are eligible for Best Student Papers Awards. Please designate submissions for these awards.

RECENT COMPOSITES PUBLICATIONS

Three New Composites Publications Noted

Nondestructive Inspection of Composite Materials


Advanced composite materials are used in many applications, such as military, transportation and civil engineering, where pre-and in-service nondestructive inspection is important. These seminar notes (short course materials) were prepared for those attending a three-day technical seminar on this subject.

389 pages of charts (for overhead projection), diagrams, graphs, tables, and photographs cover NDI methods, equipment, and applications for composite materials. Both established methods, such as ultrasonic and radiographic, and new techniques, such as interferometry and infrared imaging, are presented. How each technique works, how to use it, and its advantages and disadvantages are explained and illustrated.
The course materials also provide a review of composite materials technology, including constituent materials, properties, design, fabrication and applications, as well as failure modes.

These materials were prepared by two leading authorities on NDT. Thomas Jones was with McDonnell Douglas for ten years where his work included teaching NDT courses. He is chairman of the ASTM committee on ultrasonics. Harold Berger was formerly Chief of the Office of Nondestructive Evaluation of the National Bureau of Standards (now NIST) and Leader of the NDI Group at Argonne National Lab. Both have performed NDT work for leading corporations and branches of the military. Their company, Industrial Quality, Inc. specializes in NDI.

This compendium of current information on nondestructive testing of composite materials will provide a useful resource for technical personnel involved in the research, development, testing and applications of materials. A limited supply of these seminar notes is available. To be sure of receiving your copy, please order now. Following is a more detailed description of contents and an order form.

1. Introduction to Composite Materials
   - Relative Material Strengths
   - Types of Composites
   - Materials Forms
   - Fabrication Methods (chart and schematics)
   - Matrix Functions
   - Polyester and Vinyl Ester
   - Epoxies
   - Bismaleimide Resins
   - Thermoplastics
   - Organic Resins
   - Carbon Matrix
   - Metal Matrix
   - Ceramic Matrix
   - Fiber Functions
   - E-Glass Fibers
   - Boron Fibers
   - Carbon Fibers
   - Aramid Fibers
   - Silicon Carbide Fibers
   - Quartz Fibers
   - Fiber Properties
   - Laminate Defects
   - Honeycomb Sandwich Defects
   - Closure Void Foaming Adhesive
   - Blown Core and Node Separation
   - Condensed Core and Inclusion

2. Overview of Nondestructive Inspection
   - Purposes of NDT
   - Selected NDE Methods
   - Flaw Imaging with X-Rays
   - Radioscopic Systems
   - Typical Ultrasonic C-Scan Inspection Equipment
   - Other NDI Methods
   - Some NDT Trends
   - NDT Workstation

3. Visual and Penetrant Methods
   - Visual/Optical Inspection
   - Videoprobe Specifications
   - Penetrant Testing (PT)
   - Penetrant Systems
   - Obstacles to Penetrant Testing
   - Penetrant Application
   - Processing Steps
   - Advantages of Penetrant Inspection
   - Disadvantages of Penetrant Inspection

4. Ultrasonic Methods
   - Ultrasonic Testing
   - CRT Display
   - Sonic Frequencies
   - Longitudinal and Shear Wave Modes
   - Surface Wave Mode
   - Surface Wave Penetration
   - Focused Sound Beams
   - Ultrasonic Data Presentation
   - Straight Beam Test
   - Angle Beam Test
   - Surface Wave Test
   - Ultrasonic Through Transmission
   - Sound Beam Spreading
   - Flaw Orientation
   - Ultrasonic Properties of Materials
   - Conductivity
   - Sound Beam Refraction
   - Wave Modes Generated in Steel with Plastic Wedges
   - Typical Through-Transmission Setup
   - Typical Good Bond Response
   - Typical Flaw Response
   - Reference Standard Setup
   - Acceptable/Unacceptable Thickness Responses
   - Typical Use of Scan Segments
   - Advantages of Ultrasonic Testing
   - Disadvantages of Ultrasonic Testing

5. Eddy Current and Electrical Methods
   - Eddy Current Testing
   - Uses of Eddy Current NDT
   - Eddy Current Depth of Penetration
   - Impedance Changes of the Eddy Current Test
   - Direction of Surface Cracks on the Impedance Plane
   - Absolute vs. Differential Crack Response
   - Eddy Current/Ultrasonic Scan
   - Representative Automotive Components Tested by Eddy Current Techniques for Various Characteristics
   - Eddy Current Inspection Advantages and Limitations

6. Infrared and Optical Methods
   - Infrared Imaging Methods
   - Block diagram of typical one-sided infrared inspection system
   - Thermal Contrast for Large Flaws in Through-Transmission
   - Quartz Lamp Heating of Composite Repair Area
   - Advantages of Inspection with IR Cameras
   - Borescope Images
   - Typical Borescope Systems
   - Theory of Shearography NDT: How It Works
   - Advanced Shearography Inspection Applications

7. Portable NDI Equipment: Illustrations of Equipment

8. Radiographic/Radiologic Methods
   - Fluor Imaging with X-Rays
   - Primary Mechanism for X-Ray Interaction
   - Transmission of X-Rays through Matter
   - Typical Radiation Sources: Energy, Current, Focal Spot
   - Wire Penetrator Design
   - Comparison of Conventional and Microfocus X-Ray Techniques
   - Radioscopic Systems
   - Real-Time Fluoroscopy Imaging System
   - X-Radioscopy Line Scan
   - Common X-Ray Fluorescent Materials
   - High Density Glass Fiber-Optic Scintillator (FOS) for X-Ray Imaging
   - X-Radioscopy Standards
   - Real-Time Radiography
   - Combination: Microfocus X-Radioscopy
   - Stereo X-Ray Imaging
   - Radiographic Digitization
   - Radiography Applications

9. Other NDI Methods
   - Tap/Impact Testing
   - Acoustic Emission Testing
   - Acoustic Emission Application Areas
   - Accousto-Ultrasonics
   - Holographic Interferogram Showing Impact-Damage in a Composite Tube
   - Lesser-Ultrasonic Inspection for Process Control
   - Vibro thermography
   - Sensitivity Limits of Various Methods of Leak Location
   - Microwave Techniques
   - Common Sensor Arrangements for Microwave NDT
   - Partial List of Reported NDT Applications for Microwaves
   - Neutron Radiography Applications
   - Tomography

10. NDI Systems/Data Handling
    - X-Ray Inspection System
    - Computer Tomography
    - Maneuverable X-Ray Radiography Systems
    - X-Ray System Applications
    - Typical Ultrasonic C-Scan Inspection Equipment
    - Portable Automated Remote Inspection System in Use on Aircraft Wing
    - Infrared Inspection System
    - Intermediate File Exchange Approach
    - File Translation Requirements
    - Types of Information to Be Translated
    - Image and Information Management System

11. Composite Structures/Repair Issues
    - Composite Structures and Designs
    - Material Forms/Fabrication
    - Thermoplastic Filament Winding
    - Laminate Configuration
Cocured and Adhesive Bonded Laminate Joints • Cocured Composite Structure • Complex Structure • Types of Failure • Repair Techniques • Repair Selection • Graphite Epoxy Skin and Aluminum Honeycomb Core: Damage Repair (series) • Composite Laminate Repair

12. Application/Review
• Composite Flaw Types • Summary of Applicability of NDE Methods

High Performance and Engineering Thermoplastic Composites


Thermoplastic composites are currently of special interest to those involved in materials research, development, and engineering. This is the first complete text on this important class of materials. Both high performance and engineering TP composites are examined and compared. All aspects are covered clearly, concisely, and systematically, from resins and reinforcements to the many available manufacturing and finishing methods. Design, testing, quality control, repair and applications are also covered. Numerous schematics illustrate manufacturing methods, design, and testing. Many tables provide reference data in convenient form.

Overview from the Author’s Preface

Chapter 1 is a review of composite principles and serves as a general introduction. Chapter 2 reviews resin properties, and emphasizes the unique position of thermoplastics. In Chapter 3, the interactions of thermoplastic resins with the reinforcements are presented. The methods employed to combine the resins and the reinforcement are discussed in detail as is the resin/fiber interaction zones. ... Some of the special methods of improving the interactions between reinforcements and thermoplastic resins are also discussed. Chapter 4 examines the properties of the composite materials and relates directly to the interactions discussed in Chapter 3. The properties of most interest for thermoplastics composites are emphasized.

Chapters 5 to 8 are discussions of the methods used to manufacture thermoplastic composites. Chapter 5 is a general overview of manufacturing methods originally developed for thermoset composites and the modifications required to use those processes for thermoplastics. The processes discussed in Chapter 6 are the traditional processes used to manufacture nonreinforced thermoplastics and the changes made to run reinforced materials. In each case, the modifications are the major focus, but a general discussion of the process is also given. Chapters 7 and 8 examine composite manufacturing processes that are unique for thermoplastics. ... Because of the many potential uses for molding of consolidated thermoplastic composite sheet, all of Chapter 7 examines the various methods used to form this sheet. Chapter 8 focuses on the forming of thermoplastics that are not sheets.

Chapters 7 through 11 examine the important auxiliary and support functions associated with the manufacture and use of composites ... molds and tooling, joining and repair, design, testing (including quality control), and costs.

1. Introduction
• Basic Concepts of Composites • Uses • Basic Resin Concepts • Thermoplastic and Thermoset Resin Comparisons • High Performance versus Engineering Resins • Summary

2. Thermoplastic Resin Properties
• Chemical Structures • Mechanical Properties • Thermal Properties • Environmental Resistance

3. Fiber/Matrix Interactions
• Fiber/Matrix Adhesion • Characterization of the Matrix and Fiber Interphase • Resin Properties Affecting Fiber-Matrix Bond Strengths • Methods of Coating Fibers with Thermoplastic Resins

4. Composite Properties
• Composite Mechanical Properties • Effects of Fiber Length, Orientation and Content • Fatigue • Environmental Resistance

5. Manufacturing by Traditional Thermoset Methods
• Manufacturing Overview • Layup • Filament Winding and Fiber Replacement • Pultrusion • Matched-Die Molding • Liquid Composite Molding (RTM/RIM) • Consolidation or “Curing”

6. Injection Molding and Extrusion
• Extrusion of Reinforced Thermoplastics • Injection Molding of Reinforce Thermoplastics • Emerging Manufacturing Processes • Properties of Parts Made by Short and Long Fiber Processes

7. Forming of Thermoplastic Sheets
• Nonreinforced Thermoplastic Sheet Processing (Thermoforming) • Processing Reinforced Thermoplastic Sheets • Sheet Formation and Composition • Process Auxiliary Equipment • Properties and Modeling • Formable and Modeling • Formable Sandwich Materials • Summary

8. Molding/Forming Preshaped Thermoplastics
• Roll Forming • Die Forming • Unconstrained Forming • Continuous Sheet Forming

9. Molds and Tooling
• Selection • Mold Design • Materials • Fabrication • Mold/Tool Use

10. Finishing and Repair
• Joining and Assembly • Machining and Cutting • Repair • Annealing • Crosslinking
Damage Tolerance in Advanced Composites


Advanced composite materials, particularly continuous fiber-reinforced polymers, are currently being used in a wide variety of structural applications. These materials are used not only in the aircraft industry, but in civil, mechanical, and other disciplines in which they are subjected to a wide spectrum of loading during in-service use. Dynamic loadings (impact type events) represent a serious design concern.

However, when using advanced composites, there is an overall lack of an established knowledge base on how to assess and characterize damage, as well as how to identify the progression of damage and subsequently design against it. All of these issues are related to the structural integrity of the overall system and represent a significant challenge to advanced composite material designers. Accepted design measures for the structural integrity of structural systems using advanced composites include design for strength, stiffness, durability and safety. The latter measure involves the important issue of this monograph.

An important challenge in design is that the performance of advanced composite material structures will be equal to or superior to the damage tolerance requirements of metallic structures. Thus, an understanding of what damage tolerance is and the role it plays in the use of and design with advanced composite materials for structural applications is the focus of this monograph.

In summary, the purpose of this monograph is to present a current information base on the subject of damage tolerance, its importance, and its role in the design process.

Overview of Contents

• Key Elements in Damage Tolerance Concept • Analytical Methodology • Damage Tolerance Evaluation (Techniques and Tests)

1. Damage Tolerance of Composites
   1. Introduction
   2. Advanced Structural Composites

3. Damage Tolerance as an Issue
4. Damage Tolerance Definitions
5. Key Elements in Damage Tolerance Concept: • Measures of Damage: Metal versus Composites • Role of Failure Mode in Damage Tolerance Criteria • Level of Design Complexity: Material versus Structural • Damage Tolerance versus Durability • Materials, Sources of Damage, and Key Considerations for Damage Tolerance • Damage Tolerance Approaches • Overview of the Damage Tolerant Design Approach

6. References

2. Analytical Methodology

1. Introduction
2. Analysis—Model I: Isotropic Materials • Composite Materials • Summary
3. Analysis—Model II Energy-Balance Model • Spring-Mass Model • Model Development • Solution to Equations • Summary
4. Analysis—Model III: • Kinematic Relations • Constitutive Equations • Governing Equations of Equilibrium • Summary
5. Analysis—Model IV: • Case 1 • Case 2 • Summary
6. Analysis—Model V: • Displacement Components • Strain-Displacement Relations • Strain Energy • Summary
7. Analysis—Model VI: • Summary
8. Analysis—Model VII: • Summary
9. Analysis—Model VIII: • Summary
10. Concluding Remarks
11. References

3. Damage Tolerance Evaluation

1. Introduction: • Typical Defects in Composites • Sources of Damage
2. Nondestructive Evaluation (NDE) Techniques: • Initial Plan View Inspections • Detailed Plan View Identification • Through-Thickness Identification • Evaluation Plan • Ultrasonic Methods • X-ray Radiography • Eddy Current • Edge Replication
3. Damage Assessment: Optical/SEM Application: • Optical Microscopy • Scanning Electron Microscopy (SEM)
4. Damage Tolerance Tests: Compression after Impact Test • Open-Hole Tension Test • In-Plane Open-Hole Compression Test
5. References
Calendar on Composites

The following meetings may be of interest to researchers in the field of composite materials.

18–21 February 1996
19th Annual Meeting of the Adhesion Society
Myrtle Beach, South Carolina
Contact: Kim Mills, 2 Davidson Hall, Virginia Tech, Blacksburg, VA 24061-0201; Telephone: 540-231-7257

17–18 February 1996
Adhesion Society Short Course: Adhesion Theory and Practice (being held in conjunction with the 19th Annual Adhesion Society Meeting, 18–21 Feb. 1996)
Myrtle Beach, South Carolina
Contact: Dr. Gary Hamed, Polymer Science Department, The University of Akron, Akron, OH 44325-3909; Telephone: 216-972-6831

19–21 March 1996
First International Conference of Computational Methods and Testing for Engineering Integrity (CMT ’96)
Kuala Lumpur, MALAYSIA
Contact: Liz Kerr, CMT 96, Wessex Institute of Technology, Ashurst Lodge, Ashurst Southampton, SO40 7AA, UK; Telephone: 44-(0)-1703-293223; FAX: 44-(0)-1703-292853; e-mail: CMI@uk.ac.ri.ib; intl e-mail: CMI@ib.ri.ac.uk

19–21 March 1996
Sixth International Conference on Marine Applications of Composites Materials (MACM ’96)
Cocoa Beach, Florida
Contact: MACM ’96 Conference, Composites Education Association, 7705 Technology Drive, West Melbourne, Florida 32904; Telephone: 407-951-9464; FAX: 407-728-9071

14–16 April 1996
Eighteenth Southeastern Conference on Theoretical and Applied Mechanics
Tuscaloosa, Alabama
Contacts: H. B. Wilson or James L. Hill, SECTAM XVIII, Department of Engineering Science and Mechanics, University of Engineering Science and Mechanics, University of Alabama, Box 870278, Tuscaloosa, Alabama 35487-0278; Telephone: 205-348-1628; FAX: 205-348-7240; e-mail: jhill@coe.eng.ua.edu

7–9 May 1996
Mechanics in Design
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Hamilton, Ontario, Canada
Contact: Professor S. A. Meguid, Department of Mechanical Engineering, University of Toronto, 5 King's College Road, Toronto, Ontario, Canada M5S 1A4; Telephone: 416-978-5741; FAX: 416-978-7753; e-mail: meguid@me.utoronto.ca

14–15 May 1996
Seventh European Conference on Composite Materials
London, United Kingdom
Contact: Ms. Cathy Pearcey, Conference Department (C609), Institute of Materials, 1 Carlton House Terrace, London SW1Y 5DB, United Kingdom; Telephone: 44-0171-839-4071; FAX: 44-0171-823-1638

15–17 May 1996
Symposium of Interfacial Materials Science on Composites (SIMS-CV)
Fukuoka, Japan
Contact: Dr. Hiroyuki Hamada, Faculty of Textile Science, Kyoto Institute of Technology, Matsugasaki, Sakyo-ku, Kyoto 606, Japan; Telephone: +81-75-724-7844; FAX: +81-75-724-7800; e-mail: hhamada@ipc.kit.ac.jp

19–21 May 1996
ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting
Orlando, Florida
Contact: Katharine Morgan, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959, Telephone: 610-832-9721.

19–22 May 1996
11th ASCE Engineering Mechanics Conference
Ft. Lauderdale, Florida
Contact: Prof. Y. K. Lin or Prof. T. C. Su, Center for Applied Stochastics Research, College of Engineering, Florida Atlantic University, 777 Glades Road, Boca Raton, FL 33431-0991; Telephone: 407-367-3449; FAX: 407-367-2868

20–21 May 1996
ASTM Committee D-30 13th Symposium on Composite Materials: Testing and Design
Orlando, Florida
Contact: Katharine Morgan, ASTM; 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959; Telephone: 610-832-9721
3–5 June 1996
Fourth International Conference on Localised Damage 96 Computer Aided Assessment and Control
Fukuoka, Japan
Contact: Jane Evans, Conference Secretariat LD96, Wessex Institute of Technology, Ashurst Lodge, Ashurst Southampton, SO40 7AA, UK; Telephone: 44-(0)-703-293223; FAX: 44-(0)-703-292853; e-mail CMI@uk.ac.rl.ib; intl. e-mail: CMI@ib.ac.uk

10–13 June 1996
VIII International Congress on Experimental Mechanics
Nashville, Tennessee
Contact: Katherine M. Ramsay, SEM, 7 School Street, Bethel, CT 06801; Telephone: 203-790-6373; FAX: 203-790-4472; e-mail: sem@transit.nyser.net

12–14 June 1996
ASME Mechanics & Materials Conference
The Johns Hopkins University
Contact: Prof. K. T. Ramesh, 1996 ASME Mechanics & Materials Conference, Department of Mechanical Engineering, The Johns Hopkins University, Baltimore, MD 21218; Telephone: 410-516-7132; FAX: 410-516-7254; e-mail: ramesh@polaris.me.jhu.edu; http://www.jhu.edu/mechmat/

18–20 June 1996
First International Conference on Composite Science and Technology
Durban, South Africa
Contact: Professor S. Adali, Department of Mechanical Engineering, University of Natal, Private Bag X10, Dallbridge 4014, South Africa; Telephone: 27-31-260-3203; FAX: 27-31-260-3217; e-mail: adali@mech.und.ac.za

1–3 July 1996
Fifth International Conference on Computer Aided Design in Composite Material Technology (CADCOMP ’96)
Udine, Italy
Contact: Rebecca Garrett, Conference Secretariat, CADCOMP ’96, Wessex Institute of Technology, Ashurst Lodge, Ashurst Southampton, SO40 7AA, UK; Telephone: 44-(0)-1703-293223; FAX: 44-(0)-1703-292853; e-mail: CMI@uk.ac.rl.ib; intl. e-mail: CMI@ib.ac.uk

3–5 July 1996
Computer Aided Design in Composite Material Technology (CADCOMP ’96)
Southampton, United Kingdom
Contact: Susi King, Conference Secretariat, CADCOMP ’96, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, SO40 7AA, United Kingdom; Telephone: 44-0-703-293223; FAX: 44-0-703-292853; e-mail: cmi@uk.ac.rl.ib; intl. e-mail: cmi@ib.fr.ac.uk

21–27 July 1996
Third International Conference on Composites Engineering (ICCE)
New Orleans, Louisiana

12–15 August 1996
International Conference on Advanced Materials (ICAM)
Beijing, China
Contact: Professor Tian-Xiang Mao, Institute of Mechanics, Chinese Academy of Science, Beijing 100080, China; FAX: 86-10-2561284; e-mail: cstam@sun.ihep.ac.cn

25–31 August 1996
19th International Congress of Theoretical and Applied Mechanics
Kyoto, Japan
Contact: Prof. Iiichi Watanabe, Secretary General, ICTAM 1996, Dept. of Civil Engineering, Kyoto University, Sakyo-ku, Kyoto 606-01, Japan; Telephone: 81-75-753-5079; FAX: 81-75-752-5296

26–29 August 1996
11th DOD/NASA/FAA Conference on Fibrous Composites in Structural Design
Forth Worth, Texas
Contact: Richard Holzwurth, Conference Chairman: Telephone: 513-255-6639 or Larry Kelly, Conference Technical Coordinator, Telephone: 513-255-5664

24–26 September 1996
Life Assessment and Life Extension of Engineering Plant, Structures and Components
Cambridge, UK
Contact: Cheryl Gleave, AEA Technology, Risley, Warrington, Cheshire, WA3 6AT, United Kingdom; Telephone: +44(0) 1925 252322; FAX: +44 (0) 1925 252376; e-mail: brian.tomkins@aeat.co.uk

7–9 October 1996
The 11th Technical Conference of the American Society of Composites
Atlanta, Georgia
Contact: Professor Steven Johnson, Composites Education and Research Center, Georgia Tech, Atlanta, GA 30332-0245; Telephone: 404 894-3013, e-mail: steve.johnson@mse.gatech.edu

17–22 November 1996
ASME Winter Annual Meeting
Atlanta, Georgia
Contact: ASME, 345 East 47th St., New York, NY 10017; Telephone: 212-705-7722
17–22 November 1996
*International Mechanical Engineering Congress and Exposition*
Atlanta, Georgia
Contact: ASME, United Engineering Center, 345 East 47th St., New York, NY 10017; Telephone: 212-705-7722

19–21 November 1996
*ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting*
New Orleans, Louisiana
Contact: Katharine Morgan, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959; Telephone: 610-832-9721

6–8 May 1997
*ASTM Committee D-30 Seventh Symposium on Composite Materials—Fatigue and Fracture*
St. Louis, Missouri
Contact: Katharine Morgan, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959; Telephone: 610-832-9721

7–9 May 1997
*ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting*
St. Louis, Missouri
Contact: Katharine Morgan, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959; Telephone: 610-832-9721

23–24 June 1997
*Symposium on Mesostructures and Mesomechanics in fibre Composites*
Toronto, Ontario, Canada
Contact: Michael Piggott, Department of Chemical Engineering, University of Toronto, Toronto, Canada M5S 1A4; Telephone: (416) 978-4645; FAX: (416) 977-7836; e-mail: michael.piggott@utoronto.ca

29 June–2 July 1997
*The 1997 Joint ASME AMD/ASCE EMD Summer Meeting (McNU ’97)*
Northwestern University
Contact: Wing Kam Liu, Northwestern University, Department of Mechanical Engineering, 2145 Sheridan Road, Evanston, Illinois 60208-3111; Telephone: 708-491-7094; FAX: 708-491-3915; e-mail: McNU97@nwu.edu

Fall 1997
*American Society for Composites, 12th Technical Conference on Composite Materials*
Detroit, MI
Contact: R. Gibson, Wayne State University, Dept. of Mechanical Engineering, Dearborn, MI 48202; Telephone: 313-577-3702; FAX: 313-577-8789; e-mail: ronald_gibson@eng.wayne.edu

10–11 November 1997
*ASTM Committee D-30 Symposium on Time-Dependent Effects*
San Diego, California
Contact: Katherine Morgan, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959, Telephone: 610-832-9721

11–13 November 1997
*ASTM Committee D-30 on High Modulus Fibers and Their Composites Meeting*
San Diego, California
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Fall 1996
*American Society for Composites, 13th Technical Conference on Composite Materials*
Contact: A Vizzini, University of Maryland, Dept. of Aerospace Engineering, College Park, MD 20742; Telephone: 301-405-1123; FAX: 301-314-9775; e-mail: vizzini@eng.umd.edu

Send items for this calendar to:
Prof. M. W. Hyer, Department of Engineering Science and Mechanics
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061-0219
Telephone: 703-231-5372
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e-mail: hyerm@vt.edu
Additional Information for Contributors

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*Composites Contents*—A listing of current literature of interest to the composite community as a service to our readers. Please send items of interest to Dr. Ronald F. Gibson.

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