

13-15 February 1991 San Diego, California

(Pages AAC-1 through DCC-19)

August 1991

Final Report for Period February 1989 to February 1991

Approved for public release; distribution is unlimited

Sponsored by:

Wright Laboratory
Flight Dynamics Directorate

AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6553

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

JEROME PEARSON, Chief

Structural Dynamics Branch

LYNN ROGERS, PhD

Principal Engineer

Structural Dynamics Branch

If your address has changed, if you wish to be removed from our mailing list, or if the addressee is no longer employed by your organization please notify WL/FIBG, WPAFB, OH 45433-6553 to help us maintain a current mailing list.

Copies of this report should not be returned unless return is required by security considerations, contractual obligations, or notice on a specific document.

UNCLASSIFIED SECURITY CLASSIFICATION OF THIS PAGE					
REPO	RT DOCUMENTATIO	ON PAGE			orm Approved OMB No. 0704-0188
1a. REPORT SECURITY CLASSIFICATION Unclassified			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY 2b. DECLASSIFICATION / DOWNGRADING SC	SECURITY CLASSIFICATION AUTHORITY DECLASSIFICATION / DOWNGRADING SCHEDULE		3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release;		
4. PERFORMING ORGANIZATION REPORT N WL-TR-91-3078 Volume I			distribution unlimited 5. MONITORING ORGANIZATION REPORT NUMBER(5)		ER(S)
6a. NAME OF PERFORMING ORGANIZATION Flight Dynamics Directoral Wright Laboratory	6b. OFFICE SYMBOL (If applicable) WL/FIBG	7a. NAME OF M	ONITORING ORG	ANIZATION	
6c. ADDRESS (City, State, and ZIP Code) Wright-Patterson AFB, OH 45433-6553		7b. ADDRESS (City, State, and ZIP Code)			
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER		NUMBER	
8c. ADDRESS (City, State, and ZIP Code)		10. SOURCE OF PROGRAM ELEMENT NO. 62201F	PROJECT NO. 2401	TASK NO.	WORK UNIT ACCESSION NO. 23
11. TITLE (Include Security Classification) Proceedings of Damping '9 12. PERSONAL AUTHOR(S)					1
13a. TYPE OF REPORT 13b. TI Final FROM	ME COVERED TO FEB 91	14. DATE OF REPO		h, Day) 15. PA	GE COUNT 514
16. SUPPLEMENTARY NOTATION Pages AAC-1 throug					
17. COSATI CODES FIELD GROUP SUB-GROU		(Continue on revers			
19. ABSTRACT (Continue on reverse if nece	The state of the s		OIS/SCIUCE	ше пистас	etton.

Individual papers of Damping '91 held 13-15 February 1991 in San Diego CA are presented. The subjects included: Viscoelastic Material Testing and Characterization, Passive Damping Concepts, Passive Damping Analysis and Design Techniques, Optimization, Damped Control/Structure Interaction, Viscous Dampers, Friction Damping, Other Vibration Suppression Techniques, Damping Identification and Dynamic Testing, Applications to Aircraft, Space Structures, Marine Structures, Commercial Products, Defense Applications, and Payoffs of Vibration Suppression.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT SUNCLASSIFIED/UNLIMITED SAME AS RPT.	DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified		
22a. NAME OF RESPONSIBLE INDIVIDUAL Dr. Lynn Rogers		22b. TELEPHONE (Include Area Code) (513) 255–6622	22c. OFFICE SYMBOL WIL/FTBG	

DD Form 1473, JUN 86

Previous editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

Workshop Administration

Director

Dr. Lynn C. Rogers Wright Laboratory Flight Dynamics Directorate

Technical Chairman

Dr. Conor D. Johnson CSA Engineering, Inc.

Administrative Chairman

Mrs. Beryl D. Deremigio CSA Engineering, Inc.

Assistant Administrative Chairman

Ms. Bonnie L. Portis CSA Engineering, Inc.

Session Chairmen

Mr. Bradley Allen, CSA Engineering, Inc.

Capt. Walter Andress, Space Systems Division

Dr. Mohan Aswani, Aerospace Corporation

Capt. Mark Arnold, Wright Laboratory, Flight Dynamics Directorate

Mr. Eric Austin, CSA Engineering, Inc.

Lt. Col. Ronald L. Bagley, Air Force Institute of Technology

Dr. Andrew S. Bicos, McDonnell Douglas Space Systems Company

Mr. Daniel Cyphers, W. J. Schafer Associates, Inc.

Mr. Eric Dalton, Teledyne Brown

Mr. Ralph Dornsife, US Army / CERL

Mr. William Driscoll, 3M / Industrial Specialties Division

Mr. Robert Dunning, TRW

Mr. Rod Eddleman, US Army Strategic Defense

Mr. Richard Ely, LTV Aircraft Group

Dr. James Fanson, Jet Propulsion Laboratory

Mr. Bryce Fowler, CSA Engineering, Inc.

Dr. Joseph Garibotti, Ketema, Inc.

Mr. Russell Gehling, Martin Marietta Astronautics Group

Dr. Steven Ginter, Honeywell Satellite Systems

Dr. John Gubser, McDonnel Douglas Missile System Company

Dr. John Henderson, Consultant

Mr. Dennis Hill, GE Astro Space Division

Dr. Philip Hipol, The Aerospace Corporation

Dr. Robert Holman, Hughes Aircraft Company

Mr. J. Warren Hoskins, Lockheed Missiles and Space Company

Dr. Roy Ikegami, Boeing Aerospace

Dr. Conor Johnson, CSA Engineering, Inc.

Mr. Derrick Johnson, Boeing Aerospace

Dr. David I. G. Jones, Wright Laboratory, Flight Dynamics Directorate

Dr. Edward Kerwin, Bolt, Beranek and Newman, Inc.

Mr. John Lassiter, Warner - Robins ALC

Mr. Paul Lindquist, Wright Laboratory, Flight Dynamics Directorate

Lt. John Mackaman, Wright Laboratory, Flight Dynamics Directorate

Dr. Ray Manning, TRW, Space and Technology Group

Mr. Daniel Morgenthaler, Martin Marietta Space Systems

Mr. Ahid Nashif, Anatrol Corporation

Mr. Rory Ninneman, Phillips Laboratory

Mr. Earl Pinson, Lockheed Missiles and Space Company

Mr. Ken Qassim, Phillips Laboratory

Mr. Keith Quinn, Nichols Research Corporation

Dr. Dantam Rao, Mechanical Technology, Inc.

Dr. Wayne Reader, Vector Research Company, Inc.

Dr. Kenneth Richards, Martin Marietta

Mr. Stanley Sattinger, Westinghouse Science and Technology Center

Dr. Daniel Segalman, Sandia National Laboratories

Mr. Leonard Shaw, Wright Laboratory, Flight Dynamics Directorate

Professor Young Shin, Naval Postgraduate School

Dr. Stepan Simonian, TRW, Space and Technology Group

Mr. Kevin Slimak, Phillips Laboratory, Astronautics Directorate

Dr. Jaak Soovere, Lockheed Missiles and Space Company

Mr. Clyde Stahle, GE Astro Space

Mr. Ralph Tate, LTV Aircraft Products Group

Mr. Roger Thaller, Aeronautical Systems Division

Capt. Steven G. Webb, US Air Force Academy

Mr. Kenneth R. Wentz, Wright Laboratory, Flight Dynamics Directorate

Maj. Stephen Whitehouse, Wright Laboratory, Flight Dynamics Directorate

Dr. William Witt, The CORE Group

Dr. Y. C. Yiu, Lockheed Missiles and Space Company

Mr. Wayne Yuen, Wright Laboratory, Flight Dynamics Directorate

Mr. Michael L. Zeigler, Wright Laboratory, Flight Dynamics Directorate

FOREWORD

This publication includes individual papers of Damping '91 held February 13-15, 1991, San Diego, California. The Conference was sponsored by the Wright Laboratory, Flight Dynamics Directorate, Wright-Patterson Air Force Base, Ohio.

It is desired to transfer vibration damping technology in a timely manner within the aerospace community, thereby, stimulating research, development and applications.

TABLE OF CONTENTS

	Paper No.
The F-117 Stealth Aircraft	AAA*
(Keynote Address)	
Mr. Paul Martin	
Use of Passive Damping for Aircraft Cabin Noise Control	AAB*
(Invited Speaker)	
Dr. Leo Butzel	
The Society of Damping Technology in Japan and its Activities	AAC
(Invited Speaker)	
Dr. Yasuo Tokita and Hiroshi Okamura	
SESSION BA - Aircraft Applications	
Integral Damping Treatment for Primary Aircraft Structures	BAA
Sal Liguore, Marty Ferman, and Rudy Yurkovich	
An Investigation of Add-on Damping Treatment for Life Extension of the	BAB
F-15 Upper Outer Wing Skin	
Michael Parin, V. Levraea, Jr., Dr. Lynn Rogers, and A. Pacia	
Damping Treatments for Aircraft Hardmounted Antennae	BAC*
Ralph E. Tate and Carl L. Rupert	
SESSION BB - Plates and Beams	
Examination of Boundary Conditions for Sixth-Order Damped Beam	BBA
Theory Ralph E. Tate	
	P PP
The Effect of Compliant Layering on Damped Beams David John Barrett	BBB
The Damping Property of Laminated Steel Sheet after Deep Drawing	BBC
Hiroshi Okamura	

	Paper No
SESSION BC - Analysis and Design 1	
Practical Design and Analysis of Systems with Fractional Derivative Materials and Active Controls Daniel R. Morgenthaler	ВСА
An Implicit Fourier Transform Method for Nonlinear Dynamic Analysis with Frequency Dependent Damping Prof. F. Venancio-Filho and A. M. Claret	ВСВ
On a Linear Property of Lightly Damped Systems Z. Liang, M. Tong, and G. C. Lee	ВСС
SESSION CA - Control Structure	
Active Vibration Suppression via LQG/LTR: Analytic and Experimental Results for the PACOSS Dynamic Test Article Russell N. Gehling	CAA
H∞ Control for the PACOSS DTA Christopher T. Voth and R. Michael Stoughton	CAB
Active Damping of a Cantilever Beam Dr. Hung V. Vu, Stein Husher, and D. E. Zimmerman	CAC
The Investigation of Large Space Structure Passive Electrodynamic Dampers	CAD
Dr. Roger Stettner and Dr. Paul Mlakar	1
SESSION CB - Damping Material and Measurements	
A Method for the Measurement of the Complex Compressional Modulus of Thin Layers Dr. Jonathan D. Rogers and Dr. Daniel J. Segalman	СВА*

	Paper No.
The Evaluation of Young's Complex Modulus of Viscoelastic	СВВ
Marc Tardif and Prof. Germain Ostiguy	•
Role of Morphology in Damping Efficiency	CBC*
Dr. L. H. Sperling, J. J. Fay, and Dr. D. A. Thomas	,
The Thermorheologically Complex Material Lt. Col. Ronald L. Bagley	CBD*
SESSION CC - Analysis and Design 2	
Methods of Reduction of Wind Induced Dynamic Response in Solar Concentrators and Other Small Lightweight Structures Monte A. McGlaun	CCA
Analysis of a Five-Layer, Viscoelastic, Constrained-Layer Beam Michael A. Falugi	ССВ
Dynamics of a Class of Viscously Damped Struts Dr. Y. C. Yiu and Dr. Steven Ginter	CCC
A Study of a Vibration Absorber to Control the Vibration of a Rectangular Plate	CCD
Akio Sugimoto, Hideo Utsuno, and Toshimitsu Tanaka	
SESSION DA - Analysis and Testing	
Impedance Matched Mass-Dampers: A New Approach for Improving Structural Damping	DAA
Craig Gardner and Prof. Richard H. Lyon	
Analytical and Experimental Modal Analysis of a Two-Tiered Structure Dr. Hung V. Vu, William C. Flynn, and T. K. Vuong	DAB

	Paper No.
Development of a Magnetic Suspension System for Reliable Vibration Damping Measurement Dr. Dantam K. Rao	DAC*
SESSION DB - Viscoelastic Material	
VEM Characterization Program Bryce L. Fowler	DBA
Data Base of the Dynamic Properties of Materials Ahid D. Nashif and Thomas M. Lewis	DBB
Establishing the Validity of the Master Curve Technique for Complex Modulus Data Reduction Dr. S. O. Oyadiji and Prof. G. R. Tomlinson	DBC
SESSION DC - Optimization	
Integrated Optimization of Composite Structures for Advanced Damped Dynamic Characteristics Dr. Dimitris A. Saravanos and Christos C. Chamis	DCA
An Optimum Design Methodology for Passively Damped Truss Structures Dr. Ray Manning	DCB
On An Application of Complex Damping Coefficients Z. Liang, M. Tong and G. C. Lee	DCC
SESSION EA - DAMMPS 1	
Statistcal and Worst Case Evaluation of Orbital Jitter Reduction Using Passive Damping J. Molnar, Dennis Hill, and Clyde Stahle	EAA

Taking a second of the second	Paper No.
LMSC DAMMPS Program Status J. Warren Hoskins and Dr. Y. C. Yiu	EAB
Damping of Precision Metal Matrix Trusses Dr. Stepan S. Simonian	EAC
Development of Low Modulus Damping Material for Precision Mounting Platforms	EAD
Steven Kirshenbaum, Dennis Hill, and Clyde Stahle	
Complex Stiffness Test Data for Three Viscoelastic Materials by the Direct Complex Stiffness Method Bradley R. Allen and Earl Pinson	EAE
SESSION EB - Viscoelastic Material Measurements	
Direct Measurement of the Dynamic Material Properties of Polymers for Low Frequencies Ahid D. Nashif, Thomas M. Lewis, and Paul J. Macioce	ЕВА
Correlation of Complex Modulus Data by Direct Stiffness and Indirect Resonant Beam Test Techniques T. Lewis, Mona P. Khoury, and Dr. David I. G. Jones	EBB
Constitutive Modeling of Nonlinear Damping Materials Dr. Jerome Sackman, Prof. J. M. Kelly, and A. E. Javid	EBC
Results of a Round Robin Test Series to Evaluate Complex Moduli of a Selected Damping Material Dr. David I. G. Jones	EBD
SESSION EC- Analysis and Design 3	
A Mathematical Framework for the Study of Indirect Damping Mechanisms David L. Russell	ECA*

	Paper No.
Techniques of Design and Using Viscoelastic Dampers Z. Liang, M. Tong, and G. C. Lee	ECB
Modeling of Constrained Layer Damping in Trusses Dr. Daniel J. Inman, Joseph C. Slater, and W. Keith Belvin	ECC
A Strong Criterion for Testing Proportionally Damped Systems Z. Liang, M. Tong, and G. C. Lee	ECD
SESSION ED - Applications Abbreviated Papers	
The PACOSS Dynamic Test Article Russell N. Gehling	EDA
Retrofitted Damping Treatment for a Three Stage Booster System Dr. Daniel J. Segalman and E. L. Marek	EDB*
Damping Design for a Disk Drive Head Flexure Eric M. Austin, James C. Goodding, and William A. Driscoll	EDC
Damping Jet Engine Front Frame Struts Capt. Vance Johnson, Kurt Nichol, and Dennis Murphy	EDD*
Isolation Joint for Flexural and Compressional Isolation Al Wignall and J. Aron	EDE
Characterization of Viscoelastic Damping in an Antenna Structure Dr. Ephrahim Garcia, James M. Argento, and Robert Alan Carlin	EDF.
Laminar Blade Damper Michael Koleda	EDG
Experimental Study on Noise Reduction due to Damping Treatments Ken Okada and Junichi Kanazawa	EDH*

	Paper No.
SESSION FA - DAMMPS 2	
Evaluation of Damping Concepts for Precision Mounting Platforms Dennis Hill, Clyde Stahle, and James Staley	FAA
Synergistic Design of Passive Damping and Metal Matrix Composites Earl D. Pinson, Eric M. Austin, and Michael L. Zeigler	FAB
A Three Element Viscoelastic Isolator Dr. Stepan S. Simonian	FAC
SESSION FB - Noise and Acoustics	
Integrally Damped Honeycomb Structural Concepts to Increase Noise Transmission Loss Jefferson F. Newton, Dr. Roy Ikegami, and D. J. Carbery	FBA
Reduction of Acoustic Responses Using Viscoelastic Damping Materials Dr. David Chu, C. Stahle, J. Staley, J. Peir, and M. McMeekin	FBB
Design Method of Damping Treatment for Structure-Borne Noise Reduction Iwao Honda, Tadao Nakamura, Yoshihiko Irie, and Kazuo Yamamoto	FBC*
SESSION FC - Civil Structures	
Earthquake Simulator Testing of Two Damping Systems for Multistory Structures Ian D. Aiken and James M. Kelly	FCA
Correlation of Experimental Results with Predictions of Viscoelastic Damping for a Model Structure T. T. Soong and Dr. Ming Lai	FCB

	Paper No.
Damping Capacity of Reinforced Concrete External Beam Column Connections Dr. Alexander G. Tsonos, Ioannis A. Tegos, and Prof. Georgios G. Penelis	FCC*
SESSION FD - Analysis and Damping Mechanisms	_
Abbreviated Papers	
Eddy Current-based Vibration Damping for Aerospace Structures James Goldie	FDA
The Absolute Value Modal Strain Energy Method Daniel R. Morgenthaler	FDB
An Analytical Model for the Vibration of Viscoelastically Damped Curved Sandwich Beams Dr. Mohan D. Rao and Shulin He	FDC
Bibliography of Environmental Data Measured In-Flight Lt. Col. Raymond F. Hain, III	FDD
General Motion of an Inclined Impact Damper with Friction C. N. Bapat	FDE
The Shock and Vibration Information Analysis Center (SAVIAC) Harold D. Kohn	FDF
SESSION GA - Electro-Rheological Fluids and Fluids	
The Vibration Damping Effect of an Electrorheological Fluid Stephen A. Austin	GAB
Modelling of Nonlinear Dilatation Response of Fluids Containing Columns Plastic and Shear Relaxation Considered Dr. Bernd Wendlandt	GAC

^{*}Not available for publication

	Paper No.
Electro-Rheological Fluids Characterization by Dynamic Mechanical Thermal Analysis under Applied Fields Dr. R. E. Wetton and Dr. J. C. Duncan	GAD*
SESSION GB - Control Structure Interaction 2	
On Piezoelectric Energy Conversion for Electronic Passive Damping Enhancement Dr. Donald L. Edberg, Dr. Andrew S. Bicos, and J. S. Fechter	GBA
The Need for Passive Damping in Feedback Controlled Flexible Structures	GBB
Dr. Andreas von Flotow and D. W. Vos	
Passive Control of a Flexible Planar Truss Using A Reaction Mass Actuator	GBC
Capt. Steven G. Webb and Lt. David R. Lee	,
SESSION GC - Damping Indentification	
A Identification Technique for Damped Distributed Structural Systems Using the Method of Collocation R. Chander, M. Meyyappa, and S. V. Hanagud	GCA
Correlation Techniques to Determine Model Form in Robust Nonlinear System Realization/Identification Greselda Stry and D. Joseph Mook	GCB
System Level Design and Analysis of Truss Structures Damped by Viscous Struts Dr. Y. C. Yiu	GCC
Damping Ratio Estimates from Autocorrelation Functions Prof. Luigi Balis-Crema and Prof. A. Agneni	GCD

	Paper No
SESSION GD - Damping Materials	
Dynamic Moduli of Fluorocarbon Compounds Dr. Wayne T. Reader and Robert W. Megill	GDA*
Passive Vibration Damping with Noncohesive Granular Materials Dr. Monen Abdel-Gawad	GDB
VEM Database Program Bryce L. Fowler	GDC
Measurement of the Mechanical Properties of Viscoelastics by the Direct Complex Stiffness Method Bradley R. Allen and Dr. David A. Kienholz	GDD
The Effect of Porosity on the Microstructural Damping Response of a 6061 Aluminum Alloy Jinmin Zhang, M. N. Gungor, and E. J. Lavernia	GDE
Damping Properties of Aliphatic Polyurethanes from 4, 4' - Dicyclohexylmethane Diisocyanate John D. Lee, Gilbert F. Lee, and Bruce Hartmann	GDF
An Apparatus for Measuring the Low Frequency Dynamic Characteristics of Materials Mona P. Khoury and Francis Olivier	GDG
SESSION HA - Composite and Metal Matrix	
Controlling the Damping Behavior of Pitch-based Carbon Fibers Andrew J. Eckel and Steven P. Jones	НАА
Internal Damping of Metal Matrix Composites: A Technical Assessment Jacques E. Schoutens	НАВ
Vibration Suppression of Thin-Walled Composite Tubes Using Embeded Viscoelastic Layers F. M. Belknap and Professor J. B. Kosmatka	НАС
*Not available for publication xvi	

	Paper No.
SESSION HB - Tubes and Shells	
Directional Damping of the Global Vibration Modes of Tubular Struc- tures by Constrained-Layer Treatments Stanley S. Sattinger	НВА
Damped Response of Viscoelastic Thick Cylinders of Infinite Extent Dr. Hamid Hamidzadeh, D. J. Nunez, and D. E. Chandler	нвв
SESSION HC - Circular Plates	
Dynamic Analysis of Finite, Three Dimensional, Linear, Elastic Solids with Kelvin Viscoelastic Inclusions: Theory with Applications to Asymmetrically Damped Circular Plates Prof. C. D. Mote, Jr. and I. Y. Shen	НСА
Modal Analysis of Kelvin Viscoelastic Solids Under Arbitrary Excitation: Circular Plates Under Moving Loads I. Y. Shen and Prof. C. D. Mote, Jr.	НСВ
Response of a Circular Plate with Patch Damping Prof. Douglas Muster, Mahmoud Mezache, and G. H. Koopmann	нсс
SESSION IA - Viscous	
Development of the PACOSS D-Strut David Cunningham	IAA
Design, Analysis, and Testing of the PACOSS D-Strut Truss Daniel R. Morgenthaler	IAB
An Advanced D-Strut L. Porter Davis and Dr. Steve Ginter	IAC

	Paper No.
Testing of a Viscous Damped Isolator Bradley R. Allen and David Cunningham	IAD
SESSION IB - Experimental Measurements	
The Effect of Source Impedance on Damping Measurements Using Resonance Dwell Testing Ralph E. Tate	IBA
The Dependency of Vibration Energy Dissipation on the Amplitude of Structural Motion Dale L. Jensen	IBB*
Low-deflection Loss and Hysteresis Measurements on a Spacecraft Test Joint Eric M. Austin, James C. Goodding, and Timothy L. Flora	IBC
Damping Ratio Measurements in Kevlar Sandwich Samples Prof. Luigi Balis-Crema, Prof. A. Castellani, and Prof. A. Agneni	IBD
SESSION IC - Metals	
Characterization of the Damping Properties of High Damping Alloys Dr. Iain G. Ritchie and Z-L. Pan	ICA
Viscoelastic and Structural Damping Analysis Prof. Harry H. Hilton	ICB
Analysis of Strain Dependent Damping in Metals via Modeling of Material Point Hysteresis Dr. E. J. Graesser and C. R. Wong	ICC
Non-Obstructive Particle Damping Tests on Aluminum Beams Dr. Hagop V. Panossian	ICD

	Paper No.		
SESSION JA - Experimental Measurements of Damping			
Complex Dynamic Modulus of Nitinal-reinforced Composites Dr. Amr M. Baz, R. Deigan, and Dr. J. Gilheany Estimation of Nonproportional Damping from Experimental Measurements Dr. T. K. Hasselman and Jon D. Chrostowski Load Unit Deflection Correction for Forced Vibration Test System Kirk R. Biegler	JAA* JAB*		
		SESSION JB - Friction	-
		An Analytical Approach to Designing Friction Dampers in Turbomachinery Blading Joe Panovsky, D. Hendley, and R. MacKay	ЈВА
Micro Slip Damping Mechanism in Bolted Joints Prof. M. Groper	JBB*		
SESSION JC - Analysis and Design 4			
On a Theory of Complex Damping Z. Liang, M. Tong, and G. C. Lee	JCA		
An Iterative Method in Dynamic Structural Analyses with Nonproportional Damping Dr. Wan T. Tsai and J.T. Leang	JCB		