# TABLE OF CONTENTS

**PREFACE**

ix

**TECHNICAL PROGRAM COMMITTEE**

xii

**FEATURED PAPERS**

An Historical View of the MFPT Society
H. C. Pusey 3

A Review of Plant Maintenance Methods and Economics
M. J. Neale 17

The History and Application of the Envelope Detector
J. L. Frarey 25

**GENERAL MONITORING TECHNOLOGY**

Comparison of Vibration and Oil Analysis
T. H. Crum 47

Integrated Machinery Management
J. W. Taylor 55

Expert Systems, A Decade of Use for Used-Oil Data Interpretation
L. A. Toms 65

**MACHINERY DIAGNOSTICS & PROGNOSTICS #1**

Model-Based Sensor Selection for Helicopter Gearbox Monitoring
V. B. Jammu, J. Wang, K. Danai and D. G. Lewicki 75

Electrical Signature Analysis Applications for Non-Intrusive Automotive Alternator Diagnostics
C. W. Ayers 85

Use of the Decision Support Problem Technique for Propulsion Engine Selection Emphasizing Reliability, Maintenance, and Repair Factors: A Limited Example
K. Lynaugh, E. Pogue and B. Friedman 95

In-Line Oil Debris Monitor (ODM) for the Advanced Tactical Fighter Engine
D. E. Muir, B. Howe 111

**MACHINERY DIAGNOSTICS & PROGNOSTICS #2**

Application of an Envelope Technique in the Detection of Ball Bearing Defects in a Laboratory Experiment
H. Toersen 121

Systems Engineering of an On-Line Diagnostic System
J. S. Lin 133

Turbine Engine Diagnostics Using a Parallel Signal Processor
T. A. Bapty, A. Ledeczi, J. R. Davis, B. Abbott, T. Hayes and T. Tibbals 141
Solid-State Active Sensing for In-Situ Health Monitoring
C. A. Rogers and F. Lalande

Artificial Knee Joint Controller Characterisation and Condition Diagnosis
C. K. Mechefske and J. T. Davenport

Comprehensive Machinery Monitoring with FFPI Sensors
R. X. Perez, R. A. Atkins, C. E. Lee and H. F. Taylor

Classification of Composite Defects Using the Signature Classification Development System
J. S. Lin, L. M. Brown and C. A. Lebowitz

MICROELECTROMECHANICAL SYSTEMS (MEMS) OVERVIEW

Liquid Viscosity and Density Measurement with Flexural-Plate-Wave Sensors
S. W. Wenzel, B. J. Costello and R. M. White

MEMS TECHNOLOGIES

Plasma Micromachined MEMS for Intelligent Diagnostic Sensors
G. J. Galvin and T. J. Davis

MEMS Hydrodynamic Bearings: Applications and Implications to Machine-Failure Prevention

A Distributed, Wireless MEMS Technology for Condition Based Maintenance

MEMS-Based Research in Integrated Monitoring and Actuation at Case Western Reserve University
M. A. Huff and M. Mehregany

SIGNAL ANALYSIS

Wavelet Domain Characterization & Localization of Modal Acoustic Emissions in Aircraft Aluminum
G. A. Gordon and R. K. Young

Overview of Wavelet/Neural Network Fault Diagnostic Methods Applied to Rotating Machinery
J. E. Lopez, I. A. Farber Yeldham and K. Oliver

Helicopter Transmission Diagnostics Using Vibration Signature Analysis
B. E. Parker, Jr., M. P. Carley, R. J. Ryan, M. J. Szabo and H. V. Poor

Multiscale Statistical Modeling Approach to Monitoring Mechanical Systems
K. C. Chou

Synchronous Phase Averaging Method for Machinery Diagnostics
J. Jong, M. McBride, J. Jones, T. Fiorucci and T. Zoladz
RUSSIAN TECHNOLOGY INTERCHANGE #1

Principles and Experience of the On-Condition Application of Oils and Working Fluids to Aeronautical Engineering
B. Bedrik, M. Yampolsky, J. Szydywar and Y. Ereomine

Determination of Technical Status, Causes of Wear and Failure of Machine Parts Using the Methods of Metallophysical Analysis
V. Lozovsky

A System of Methods for Identifying the Causes of Failures and Accidents of Aeronautical Engineering
Y. Korovkin

Expert - Examination Computer System for Estimating Operational Status of Technical Equipment with Accounting for the Reliability of Its Life-Critical Parts
V. Lozovsky and M. Yampolsky

RUSSIAN TECHNOLOGY INTERCHANGE #2

Methods for Diagnosing the Fatigue Damage Rate of Materials of Machine Elements and Estimating Their Fatigue Life
A. Koltunov

Hazardous Wear Prevention System for Friction Units of Gas Turbine Engines
V. A. Stepanov and I. F. Touloupov

Equipment for Carrying Out Technical Monitoring of Gas Pumping Units by Lubrication Oil Analysis
B. R. Matveyevsky and V. A. Petrosyanz

Basic Trends of Frictional Interaction and Tribodiagnostics
M. A. Bronovets, S. P. Zaritski and A. S. Lopatin

Effective Magnetic Method for Detecting Longitudinal Cracks in the Pipes of Pipe-Line Transport
G. Shelihov, V. Usoshin, V. Lozovsky and V. Rozov

LUBRICANT CONDITION MONITORING #3

A New Orbital Ball Type of Viscometer
A. Abnett and R. Garvey

Estimating Water Content in Oils: Moisture in Solution, Emulsified Water, and Free Water
R. Garvey and G. Fogel

Rapid, Portable Voltammetric Techniques for Performing Antioxidant, Total Acid Number (TAN) and Total Base Number (TBN) Measurements
R. E. Kauffman

A New Electronic Viscometer Based on Rayleigh Wave Mechanics
J. J. Kauzlarich, R. A. Ross and D. S. Abdallah

PARTICULATE/WEAR DEBRIS ANALYSIS #2

A Phenomenological Approach to Wear Debris Analysis
U. Cho and J. A. Tichy
Monitoring Fluid System Debris Via Diagnostic Filters  
*P. Madhavan*  
579

Developing an Integrated Condition Monitoring System  
*J. Tranter*  
587

**VIBRATION ANALYSIS/MONITORING**

A Fuzzy-Neuro Scheme for Fault Diagnosis and Life Consumption of Rotordynamic Systems  
*M. J. Roemer*  
601

Sync-Period Frequency Analysis and Its Application to the Diagnosis of Multiple Element Defects of Rolling Bearings  
*W-Y Wang and M. J. Harrap*  
611

Coherent Phase Wide Band Demodulation Technique for Turbomachinery Cavitation Detection and Monitoring  
*J. Jong, T. Nesman, W. Bordelon, J. Jones and T. Zoladz*  
621

Self-aligning Roller Bearings Fault Detection Using Asynchronous Adaptive Noise Cancelling  
*K. Nezu and Y. Shao*  
633

**NON-DESTRUCTIVE INSPECTION**

Eddy-Current Examination of Large-Diameter Insulated Pipes  
*J. C. Griffith*  
643

Off-Line and On-Line Motor Electrical Monitoring and Condition Analysis: Payoffs and Problems  
*J. R. Nicholas, Jr.*  
651

The Use of the Motor as a Transducer to Monitor System Conditions  
*D. A. Casada and S. L. Bunch*  
661

Subsurface Defect Detection in Ceramic Materials Using Low Coherence Optical Scatter Reflectometer  
*M. Bashkansky, M. D. Duncan, M. Kahn, D. Lewis, Ill and J. F. Reintjes*  
673

Poor Surfaces and Intersections of Surfaces Still Cause Trouble Just Like They Used To Do  
*D. Krashes and J. J. Scutti*  
681

**FAILURE ANALYSIS #1**

Gear Crack Propagation Investigations  
*D. G. Lewicki and R. Ballarini*  
693

Detecting Gear Tooth Fatigue Cracks in Advance of Complete Fracture  
*J. J. Zakrajsek and D. G. Lewicki*  
703

Metallurgical Examination of a Failed Spiral Bevel Gear  
*M. Pepi*  
715

The Development of a Cost Benefit Analysis Method for Monitoring the Condition of Batch Process Plant Machinery  
*B. S. Rajan and B. J. Roylance*  
725
Failure Analysis of a Pitch Link Self-Locking Nut MS 17825-10 737
S. Grendahl

FAILURE ANALYSIS #2

Failure Analysis of Modular Lift Link, Lug Mounting, Self-Locking Nuts 751
S. Grendahl

Multisensor Monitoring of Gear Tooth Fatigue for Predictive Diagnostics 763
G. A. Gordon, A. K. Garga and C. Moose

Prevention of Crankcase Explosions in Reciprocating Compressors 775
V. A. Cox

Experimental and Numerical Study of Vibration Monitoring Applied on Gear 785
Transmission Systems
J. Mahfoudh, C. Bard and D. Play

EQUIPMENT MONITORING AND CONDITION DIAGNOSIS

Low-Speed Mini-Motor Failure Recognition Using Fuzzy Theory 797
K. C. Siong and K. Nezu

Automatic Machinery Fault Detection and Diagnosis Using Fuzzy Logic 803
C. K. Mechefske, J. Del Mar and D. Prendergast

Technology Overview: Shock Pulse Method 811
L. E. Morando

Reliability-Based Maintenance as a Breakthrough Strategy in Maintenance 821
Improvement
G. Fogel and D. Petersen

APPENDIX: MFPG /MFPT Publications 833