



MFPT News Spring 2021

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VI + MFPT: Diagnostics, Prognostics and Failure Prevention Where Theory Meets Practice

**Combined Conference, Arlington Texas,
July 13-16, In Person**



Live by Loews Conference Center

Machinery Failure Prevention remains one of the top technology use cases in our new digital world, and the laws of physics continue to govern machinery behavior. By attending MFPT 2021, you will increase your knowledge in important concepts including Systems Engineering, Sensors, Signal Processing, Data Management and Analytics, Diagnostics and Prognostics, Failure Analysis, and Human Performance. Each of these disciplines work together to prevent machinery failure.

With in-depth training workshops, technical sessions on emerging industry applications, case studies on challenging problems, and the latest technologies featured in the Exhibit Hall, the combined VIATC and MFPT event is not to be missed for machine failure prevention professionals.

- Four Outstanding Keynotes on July 14 and July 15
- Preconference workshops on July 13
- Over 50 Technical educational sessions
- Network with colleagues and over 20 exhibitors

We look forward to seeing you in July!

Register today at [VIATC / MFPT Annual Meet.](#)

Use "mfpt2021" promo code to get VI member rates.

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Society for Machinery
Failure Prevention
Technology

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Chairman's Letter

It is with great pleasure to announce that MFPT is hosting its annual meeting this July 13-16, in Arlington Texas (near the DFW airport) in conjunction with the Vibration Institute's annual training conference. This joint conference offers significant training and networking opportunities for those in the field of condition monitoring and equipment reliability.

MFPT continues in its mission to provide a mechanism for effective interchange of technical information among segments of the scientific and engineering communities to gain a better understanding of the processes of mechanical failures. Our annual conference and our ongoing webinars are efforts in fulfillment of our mission.

During MFPT 2021, we cover topics in each of our focus groups. Including keynotes in Data Management and AI, and Human Systems. Preconference workshops include Wireless Sensors, Signal Processing, and Diagnostics. There are four keynotes on July 14 and July 15.

- **Vibration Analysis Technology Game-Changer: Past, Present, and Future**
- **Machine Learning and AI for Multi-Physics Sensing and Cyber Physical Condition Monitoring**
- **Reliability Leadership: From Core Values to Metrics, the Mindsets of Leading Reliability**
- **How to "Engineer" Human Performance**
- **Personal View of Failure Prevention and Life Prediction**

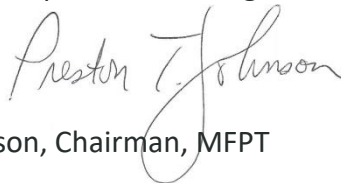
Join us a day early on July 13 for our pre-conference workshops.

- **Introduction to Modal Analysis**
- **Selection of Wireless CBM systems - Review of Technology, Features, and Installation**
- **Optimizing Benefits of Predictive Maintenance, Essential Concepts of Signal Processing, MCSA, and VFD**
- **Motion Amplification for Vibration Diagnostics**

We look forward to seeing you in Arlington beginning July 13!

Register today at: [VI + MFPT: Diagnostics, Prognostics and Failure Prevention, Where Theory Meets Practice](#)

Use "mfpt2021" promo code to get VI member rates.



Preston Johnson, Chairman, MFPT

MFPT 2021 Sessions at-a-glance



Data Management and Artificial Intelligence Sessions

Digitally Enabling Maintenance and Reliability Management for Existing Engineering Systems
Lubrication Monitoring in a Digital Age

Asset Monitoring, Modeling and Analytics Yield Maintenance and Operations Optimization

Leveraging A.I. for Zero-Downtime, Zero-Defect Manufacturing

Failure Analysis

Structural Vibrations in long shaft vertical pumps –Mitigation -Avoiding hot works

Fundamentals of Gas Turbine and Compressor Control

Cold Spray Technology for Repair of Failed Components

Human Performance

Human Performance Training based on Control Theory

Life/Career Cycle Management for Sustained Human Performance

Athlete Engineering: Interdisciplinary Research Focused on Human Performance Baselineing

Closing the Wearable Gap: Using Soft Robotic Stretch Sensors to Capture Data “From the Ground Up”

Comfort and Fit Versus Effectiveness: Human Performance Technology and Reliability

Enhancing Work Execution with Connected Worker

Human Performance Emotional Elements

Sensors

On-line lubrication monitoring

Signal Analysis

Using Creative Synchronous Averaging for Analyzing the Evolution of Bevel Gearbox Defect Signature

Cepstrum Pre-whitening Technique for Enhancing Bearing Fault Diagnosis

Gearbox Signal Analysis in Dynamic Operating State Conditions

Development of Subscale Turbine Tests and Techniques

Topic on the Rotor Optical Strain System Application and Digital Image Correlation Technique in Spin Tests

Systems Engineering

Using Finite Element Models as Digital Twin in the Development of Vibration Corrective Action Plans

Turbomachinery Laboratories Research and Improving Performance and Reliability



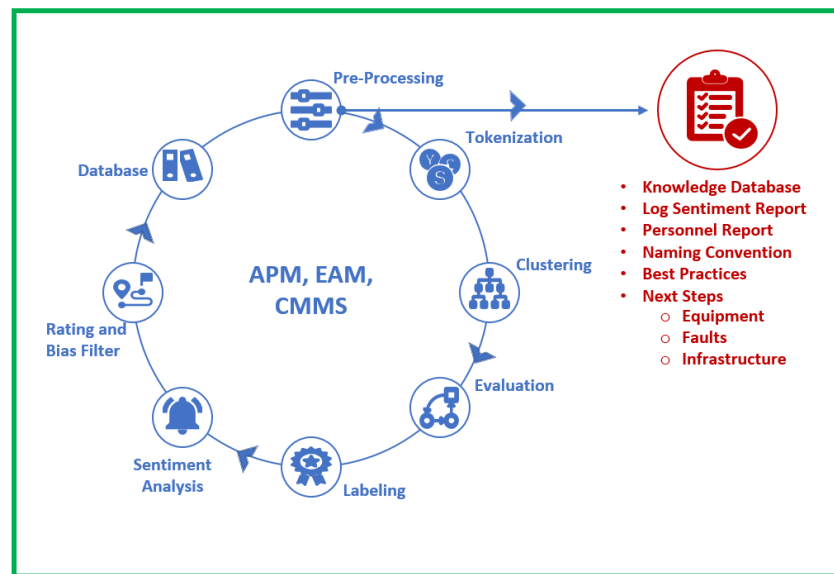
Articles

Intelligent Knowledge Extraction and Analysis

Two key elements of a successful Predictive Maintenance project are having good infrastructure and knowing what to look for. Most industrial plants are already telling us what to look for. The challenge is that much of the data is siloed in a Maintenance Management Systems where it is:

- Separated from the Historian and Control Systems
- Unstructured: Text documents with domain specific technical terms, abbreviations, etc.

MFPT.org and D2Ktech.com are investigating whether knowledge can be automatically extracted from this data and used to help improve maintenance and operations.



We are looking for industry participants who can work with MFPT members and D2Ktech, sharing some Maintenance Management Systems Data for testing and evaluation.

What the participants get:

- Free Consulting
- Data Security Assurance
- Vendor Agnostic Insights
- An automated review of maintenance log data and output into a usable Database
- Data Entry proposed Best Practices. Naming Convention etc.
- Event Report and Analysis
- Proposed Next Steps

If interested in learning more, please contact D2K Tech at:

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281-546-2944

MFPT Focus Group Areas: <https://www.mfpt.org/focus-groups/>

The Society's mission (of providing an interchange of technical information for the benefit of owners and operators of mechanical machinery) is facilitated within our focus groups. The focus groups include:



All the focus area disciplines interact with each other. For example, systems engineering identifies functional requirements of equipment and their likely failure modes in the application. This engineering work drives human inspection tasks as well as automated inspections. Sensors give us quantifiable data about the physical world, and signal analysis transforms that data into condition and performance indicators about our equipment. Exploring and interpreting these indicators are diagnostic, prognostic, multivariate data analytics, and analysis of failures. In each of these areas, the performance of the human is always an element of success and efficiency.

Thru discussions in our focus groups, participants gain knowledge that helps drive towards failure prevention within the participant's organization. Our discussion forum (see link above) makes it easy to post a question, comment, article, etc., for all the MFPT community to see.

Each year, we host sessions in each of these areas at our annual conference and our webinars. Join our [mailing list](#) to stay informed.

Systems Engineering

FG Chair: John Lucero, NASA, Glenn Research Center

The Systems Engineering Focus Group (SEFG) provides a forum to foster the development and application of a systems approach to complex technical problems. Due to the interdisciplinary technical structure of MFPT, technical processes representing System Design, Technical Management and Product Realization are instrumental in the development and integration of new technologies into mainstream applications. The SEFG will encourage the application of these Systems Engineering tools to problems posed by the MFPT community.

MFPT 2020 included 2 sessions in the Systems Engineering track:

- Additively Manufactured Metal Powder Gas Atomized in a Mobile Foundry from Recycled Scrap for Lightweight Protection Applications
- Resonance Effect, Critical and Resonance Velocities Applied to Diagnostics, Stability and Balancing Methods of Turbine and Generator Rotors over 40 MVA

You will find these in our [MFPT 2020 conference proceedings](#).

Sensors

FG Chair: Ed Spence, Machine Instrumentation Group

The Sensors Focus Group (SFG) facilitates the discussion of sensors for Machinery Failure Prevention. Discussions include new sensor technologies and the means to connect them, data driven approaches to data analysis, and developments under the Industrial IoT umbrella.

Ed Spence, our Sensors Focus Group Chair, hosted a tutorial:

- Accelerometers for Machine Health Monitoring and Diagnostics

And we hosted several sessions with sensors as the focus:

- Complimenting acceleration measurements with advanced strain gauge technology
- Miniature Solid-State Batteries for High Temperature Industrial Sensors
- Combining Wear Debris and Vibration for a More Complete Understanding of Machinery Health

You will find these in our [MFPT 2020 conference proceedings](#).

On Oil Condition Monitoring

By Christopher Nemarich and Paul Howard

The SFG and the MFPT community are looking to build on the progress we made to establish the foundation for the development of a standard for Online Oil Condition Monitoring. It is our goal to hold additional technical sessions on Oil Condition Monitoring. If you have research, applied experience or products that support online oil condition measurements we would welcome your input.

Signal Analysis

FG Chair: Suri Ganeriwala, SpectraQuest

The Signal Analysis Focus Group (SAFG) facilitates the discussion of data acquisition, signal analysis, diagnostics, artificial intelligence, logicians, etc. A core focus is signal processing (of all sensor type data) to assess the condition of components, subsystems, systems accurately and reliably in enough time to maximize reliability and minimize costs.

MFPT 2020 offered several sessions from our Signal Analysis group:

- Signal Processing to Reduce the Effect of Gear Dynamics (1st place paper)
- Improved Spectral Estimation of Signals using Quadratic Interpolation
- Synthetic Signal Modeling – Parts 1, 2, and 3
- Three-dimensional spectral analysis of large data sets

You will find these in our [MFPT 2020 conference proceedings](#).

Also, MFPT hosted a motor current analysis webinar, “Induction Motor Diagnostics Using Motor Current Signature Analysis” which you can review here: [Induction Motor MCSA](#)

Data Management and AI

FG Chair: Preston Johnson, CBT

The Data Management and AI Focus Group (DM&AIFG) supports the discussion of data management tools, capabilities and standards that facilitate the detection and measurement of failure modes; that facilitate monitoring machinery and structural health; and that facilitate maintenance decision making. Participate in discussion of best practices and options for collection, advanced analysis, and dissemination of technical information for all sensed parameters.

MFPT 2020 offered several sessions from our Data Management and AI focus group:

- Data Driven Method for Detection of Malfunctions of Large Turbomachinery During Transient States
- A Journey from Reactive to Proactive Maintenance using Industrial IoT Technologies in a Chemical Processing Plant
- A Method of Fusing Acoustic Emission and Vibration Data for Gearbox Fault Diagnosis

Also, MFPT hosted a Data Management and AI webinar, “Asset Modeling, Monitoring, and Analytics for Maintenance and Operations Optimization”. You can find the replay here: [Model Model Analyze](#).

You will find these in our [MFPT 2020 conference proceedings](#).

Diagnostics and Prognostics

FG Chair: HOFFY HOFFMEISTER, Ridge Top Group

The Diagnostics and Prognostics Focus Group (D&PFG) provides a forum to foster professional collaboration in the practice and technology of Prognostics and Health Management (PHM). The D&PFG provides an entry point for members new to the field of PHM and a forum for experienced professionals to collaborate on the most pressing problems. D&PFG encourages the use of standards and the application of PHM techniques across multiple domains.

The MFPT D&PFG is a group of professionals working to advance the field of PHM by collaborating on technical issues and sharing relevant industry information. Sample discussion areas include: Mechanical and electronic PHM, Prognostic methods and technology, PHM Standards, PHM case studies.

MFPT 2020 offered several sessions from our Diagnostics and Prognostics focus group. Our FG Chair provided an excellent tutorial on **Prognostic Health Monitoring**. Other sessions included:

- Unlocking the Mysteries of the Load Zone in Rolling Element Bearings
- A Two-Plane Balancing Method for Detection and Correction of Shaft Unbalance
- Induction Motor Diagnostics Using Vibration and Motor Current Signature Analysis (MCSA)
- New Motion Amplification Developments
- Using Accelerometers to Detect and Determine the Severity of Pump Cavitation
- Cases of Motion Magnified Video (AKA Video Vibration Amplification) Applied to Machinery Diagnosis
- Combining Wear Debris and Vibration for a More Complete Understanding of Machinery Health

You will find these in our MFPT [2020 conference proceedings](#).

We also hosted our first Webinar, “Motion Magnification and Other Approaches to Machinery Diagnosis” which you can review here: [Motion Magnification](#)

Failure Analysis

FG Chair: Mantosh Bhattacharya, Petrofac

The Failure Analysis Focus Group (FAFG) fosters the development, utilization, and enhancement of failure analysis techniques and methodologies. Lessons learned are conveyed to the MFPT Community, to prevent recurrence of failures, saving precious resources. The FAFG engages with other MFPT Focus Groups to show why failure analysis is an integral part of the product life cycle.

MFPT2020 offered several sessions from our Failure Analysis focus group:

- Tutorial: **Root Cause Analysis: It's a Money Maker, Not a Money Taker!!**
- Right Sizing of Gear Box for a Centrifugal Compressor with Synchronous Motor as Driver
- Cases of Vibrations in High-Speed Pinion in Low Load Condition in API 613 Turbo-gears.

You will find these in our [MFPT 2020 conference proceedings](#).

Human Systems Monitoring

FG Chair: Mark Derriso, US Airforce

The mission of the Human Systems Monitoring Focus Group (HSMFG) is to create an international forum where academia, industry and government agencies can discuss the state of the art in the area of human monitoring systems technologies. Topics of interest include but are not limited to wearable sensor technologies, data acquisition and management architectures, data analytics and assessment methodologies and health, fitness, and human performance monitoring techniques for industrial and military applications.

The MFPT HSMFG is a group of professionals working to advance the field of human systems monitoring by collaborating on technical issues and sharing relevant methodologies and approaches from academia, industry, and government to advance the state of the art.

MFPT 2020 offered several sessions from our Human Systems Monitoring focus group:

- Connected Worker for Work Execution Performance Enhancements
- Management of Stress– A Mechanical System Simulation Approach

You will find these in our [MFPT 2020 conference proceedings](#).

Publications:

MFPT members have published several books on failure prevention technology subjects. These include:

- [“Prognostics and Health Management: A Practical Approach to Improving System Reliability Using Conditioned-Based Data”](#), co-authored by James P. Hofmeister

Prognostics and Health Management provides an authoritative guide for an understanding of the rationale and methodologies of a practical approach for improving system reliability using conditioned-based data (CBD) to the monitoring and management of health of systems. This proven approach uses electronic signatures extracted from conditioned-based electrical signals, including those representing physical components, and employs processing methods that include data fusion and transformation, domain transformation, and normalization, canonicalization and signal-level translation to support the determination of predictive diagnostics and prognostics. Written by noted experts in the field, Prognostics and Health Management clearly describes how to extract signatures from conditioned-based data using conditioning methods such as data fusion and transformation, domain transformation, data type transformation and indirect and differential comparison.
- [“Condition Monitoring Algorithms in MATLAB®”](#): Offering the first comprehensive and practice-oriented guide to condition monitoring algorithms in MATLAB®, by Adam Jablonski. This book is available from Springer at the above link.

This book offers the first comprehensive and practice-oriented guide to condition monitoring algorithms in MATLAB®. After a concise introduction to vibration theory and signal processing techniques, the attention is moved to the algorithms. Each signal processing algorithms is presented in depth, from their basics to the applications, including extensive explanations on how to use the corresponding toolbox in MATLAB®. In turn, the book describes several techniques for synthetic signals generation, as well as vibration-based analysis techniques of large data sets. Finally, it shows readers how to directly access data from industrial condition monitoring systems (CMS) using MATLAB® .NET Libraries. Bridging between research and practice, this book offers an extensive guide on condition monitoring algorithms to both scholars and professionals.

Other Publications

You will find many of our conference publications at [MFPT Publications](#) We are working to improve the listing and indexing, yet feel free to search today for your key words.



Going Forward

The Society for Machinery Failure Prevention Technology (MFPT) continues its mission of providing a technical interchange of MFPT topics. We look forward to our conversations, and our in person meeting the week of July 12, 2021 in Arlington Texas at “Live at Loews”. Register today at [VIATC / MFPT Annual Meet](#). Use “mfpt2021” promo code to get VI member rates.

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