MFPT

The Society for Machinery Failure Prevention Technology

Q3 2020 Newsletter

Letter from the Chairman

I pray this newsletter finds you, your colleagues, and your family keeping healthy and safe. Despite the working environment challenges of 2020, MFPT and its members pulled off a successful MFPT 2020 virtual conference on August 6th. ("Advancing Analytics for Failure Prevention")

From 250+ registrants, we had peak attendance of 120 persons during our amazing keynote, "Machine Learning based on 25 years of Collecting Big Data in the Vibration World". If you missed the conference, you will find all the sessions here:
https://www.mfpt.org/mfpt-2020-keynote-session-and-workshop-listing/
- 3 Workshops, 23 sessions, 4 infomercials, 1 panel discussion

Please do join our discussion forum, where all questions and answers are posted:
https://www.linkedin.com/groups/8920840/
You can find the group "MFPT: Society for Machinery Failure Prevention Technology" at LinkedIn.com.

At the conference, 9 formal papers were presented. The best paper award went to Eric Bechhoefer, for his paper "Signal Processing to Reduce the Effect of Gear Dynamics"

Perhaps most importantly, we awarded Paul Howard, a decades long contributor to MFPT, the MFPT Jack Frarey Award for his continued contribution to the field of machinery failure prevention.

We all continue our exciting role in our society: to promote machinery failure prevention technology and practice its use all around us. Our skills and practice apply not only to big industrial machines, manufacturing, but also to pharmaceuticals, medical facility buildings, and all other equipment. We all must continue to create value for machinery users around us.   Collaboration is ever more important as technology evolves at a rapid pace.

We look forward to your participation in our unique LinkedIn group.

Stay Safe and Healthy,

Preston T. Johnson

Chairman Preston Johnson

MFPT Award Winners Henry and Sallie Pusey Best Paper Award

Congratulations to the following award winners at MFPT 2020:

Henry and Sallie Pusey Best Paper Award

Eric Bechhoefer, GPMS Inc, and his co-author, **Yalin Ozturk**, Turkish Aerospace, received the Henry and Sallie Pusey Best Paper Award for the paper, "**Signal Processing to Improve Gear Fault Diagnostics in the presence of Gear Dynamics**".   Each year one paper is selected from all papers written for the MFPT Annual Meeting Proceedings. Papers are reviewed by a minimum of three Board members familiar with the subject area and other MFPT affiliated subject matter experts. Papers are scored based on (A) Technical Contribution to the Subject Field, i.e. the paper is scientific rather than commercial in nature; (B) Originality of the Work; and (C) Clarity and Accuracy of Subject Coverage in the Paper.

Jack Frarey Award – Paul L Howard

Paul L. Howard, MFPT Board Member Emeritus, was selected to receive the Jack Frarey Award. The Jack Frarey Award is given annually to a candidate who has demonstrated a commitment to promoting and working to achieve Excellence in the Field of Machinery Failure Prevention Technology. Award winners are recognized for innovation of lasting significance and for their contributions to the field.

Paul is president of Paul L. Howard Enterprises, a small business that provides technology and business development support to Government and Industry clients internationally. He is a Degreed Physicist, with more than fifty years of experience in all aspects of product development and technology transition in the fields of diagnostic and prognostic technology. Paul has developed analytical techniques and designed sensors and signal analyzers for shock pulse analysis and acoustic emission sensing systems, ultrasonic systems, vibration monitoring systems, hydraulic contamination detectors, and lubricating oil debris monitoring systems. He holds five patents in Ultrasonic Technology, Real Time Particle Monitoring, and Fluid Sampling Methods in addition to invention disclosures on diagnostic technologies in the acoustic emission, ultrasonic technology, vibration analysis, and lubricating oil debris particle monitoring fields. He has co-authored a book and taught courses on diagnostic and prognostic technology and economic analysis methods for Condition Based Maintenance Program Implementation. He has led studies for NDIA and OSD on Electronics Prognostics, CBM Plus Enabling Technology, and Mechanical Systems Condition Monitoring Technology, presented numerous technical papers at national and international technology conferences on subjects including Oil Debris Technology, Helicopter Gearbox Diagnostic Technology, and Current Approaches to Structural Flaw Detection.

Paul is held in high esteem by his colleagues in the field of failure prevention. As demonstrated by his passion and lifetime commitment, he unequivocally emulates the spirit and personal dedication that Jack Frarey brought to the field of machinery failure prevention.

Society Fellow Award – Preston T Johnson

Preston T Johnson, the current MFPT Board Chairman, was elected **Fellow of the Society** by his colleagues. Fellows are recognized for their outstanding and devoted long-term service to the MFPT Society.

Preston has served the MFPT as a member of the Board of Directors since 2013. Prior to being elected MFPT Chairman, he was the Data Management Focus Group Chair. He provided much needed guidance and direction in this area for the society. Preston has delivered over 35 papers and presentations, many of them at MFPT meetings. He has served as conference session chair on numerous occasions and has helped to organize the past six MFPT annual meetings. As Chair of the MFPT, Preston has continued to promote and grow the Society. He has developed innovative ways to deliver technical content to the membership which were especially important this year. Preston holds a Bachelor's of Science in Electrical Engineering and Computer Science from Vanderbilt University and a Master's of Business Administration in Information Management Systems from the University of Texas at Austin. He is a certified Category III Vibration Analyst and holds the Certified Maintenance and Reliability Professional (CMRP) designation.

His colleagues in the MFPT hold Preston in high regard. He has made many significant contributions to the MFPT of his time and talent and has served the Society with distinction. For that the Society has unanimously chosen him for the rank of Society Fellow.

MFPT Focus Group Areas

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.

At MFPT 2020, we had sessions from each of our focus Groups.

Systems Engineering
FG Chair: John Lucero

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
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 at MFPT 2019 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

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 accurately and reliably assess the condition of components, subsystems, systems 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.

Data Management and AI
FG Chair: Preston Johnson

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

You will find these in our MFPT 2020 conference proceedings.

Diagnostics and Prognostics
FG Chair: Hoffy Hoffmeister

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 and 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.

Failure Analysis
FG Chair: Mantosh Bhattacharya

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

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. Look for this title this fall from Springer.

    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.org, https://www.mfpt.org/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, in Arlington Texas at "Live at Loews". Save the "date" and stay tuned for more details.

Please also follow MFPT
at https://mfpt.org
and on our LinkedIn discussion forum at MFPT: Society for Machinery Failure Prevention Technology (https://www.linkedin.com/groups/8920840/).
And Twitter
https://twitter.com/MFPTSociety