

## Curriculum Vitae

# Michael L. French, Ph.D.

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## EDUCATION

### **The Ohio State University, Columbus, OH**

#### **Ph.D. Electrical Engineering**

Major Field: Digital Systems

Minor Fields: Communications, Biomedical Engineering, Physiology

Dissertation: A Modular Microprocessor-Based Data Acquisition System for Computerized 3-D Motion Analysis (June 1985)

### **The Ohio State University, Columbus, OH**

#### **M.S. Biomedical Engineering**

Emphasis on Digital Systems and Physiology

Thesis: An Investigation of the Radiation Pressure Technique for the Measurement of Ultrasonic Power Levels (December 1981)

### **The University of Akron, Akron, OH**

Graduate Courses toward M. S. in Electrical Engineering

Attended part time while employed full time at Goodyear Aerospace Corp., Akron, OH (1977 – 1980)

### **Ohio University, Athens, OH**

#### **B.S. Electrical Engineering**

Broad engineering curriculum emphasizing Digital Electronics, Communications, Machinery, and Power

Cum Laude Graduate (June 1977)

## RESEARCH AND DEVELOPMENT

### **The Timken Company, Canton, OH**

**1985 – 2009**

#### **Senior Development Specialist, Power Transmission and Controls:**

**2006 – 2009**

- Developed systems for performance monitoring of high speed aerospace bearings, resulting in new corporate capabilities. Led cross functional team from sensor system conceptualization to implementation. Custom software development for multi-channel, high bandwidth data acquisition. Devised and developed signal processing approaches for transfer function estimation.

**RESEARCH AND DEVELOPMENT continued****The Timken Company, Canton, OH**

- Developed novel and cost effective valve train performance monitoring and analysis system. Selection and implementation of sensors and sensor systems to monitor wide array of system dynamics. Sensors included laser displacement of valve position, eddy current displacement for hydraulic piston actuation, hydraulic pressure monitoring, temperature, and synchronized high-speed video. Resulting system is capable of cam synchronous signal acquisition.

**Senior Development Specialist, Intelligent Products and Systems: 2000 - 2006**

- *Project Leader* - Evaluation of condition monitoring systems both portable and fixed on-line. Of particular interest were systems marketed by The Timken Co. as applied to bearing health monitoring and sensed bearing borne energy. Both parameterized data and broadband sensor responses were evaluated. Particular focus on Shock Pulse method and limitations thereof quantified.
- *Project Leader* - Wireless Self-Powered Sensor Ring. Initial feasibility studies: (1) quantified performance of vibration parameterization algorithms for bearing health monitoring (2) establishment of RF link from within confines of metallic bearing, and (3) power generation from bearing rotary motion. Coordinated development of custom printed circuit with capacity to measure and parameterize vibration signal, rotational speed, and temperature, and transmit via spread spectrum transmitter. **[US Patent 6,535,135]**. A successful product was delivered to Federal Railroad Administration. Success of product was catalyst for corporate Status Check product line.

**Research Specialist, Nondestructive Evaluation & Sensor Technology: 1994 - 2000**

- *Project Leader* - Development and successful field test of Tri-Sensor module for monitoring of rail bearing performance. **[US Patent 6,161,962]**
- *Project Leader* - Rail Bearing Generator development effort **[US Patent 5,440,184]**
- Recipient of Timken "Dedication to Excellence Award", May 1, 1995

**Senior Research Engineer and Principal Research Engineer: 1985– 1994**

- *Project Leader* - Developed factory hardened data acquisition and analysis system for Nondestructive Evaluation Repeatability & Reproducibility studies.
- *Project Leader* - Developed real-time DSP data acquisition & analysis system for acquisition of Electromagnetic-Acoustic Transducer (EMAT) ultrasonic waveform signal.

**RESEARCH AND DEVELOPMENT continued**

### **The Timken Company, Canton, OH**

- *Project Leader* -Developed DSP algorithm for estimation of corporate sound test facilities Frequency Response Function.
- *Project Leader* - Developed electro-mechanical system for use in acquisition & analysis of electromagnetic NDE signals, including control of precision material handling system.

### **The Ohio State University, Columbus, OH**

**1980 - 1985**

#### **Graduate Research Associate, Department of Physical Medicine:**

**1982 - 1985**

- Development of camera/computer interface for use in human gait analysis--new system capable of multi-camera, multi-frame rate capabilities. Implemented all aspects of design, development and testing, both hardware and software.

#### **Graduate Research Associate, Department of Electrical Engineering:** 1980 - 1982

- Investigated the radiation pressure technique for measurement of ultrasonic power levels. Research involved study of radiation pressure physics and piezoelectric transducer models. Compared predicted power levels from transducer models with measured power levels using a radiation pressure balance.

### **Goodyear Aerospace Corporation, Akron, OH**

**1977 – 1980**

#### **Development Engineer, Guidance Systems:**

- Responsible for testing, analysis, and quantification of guidance systems' performance. Primary focus in area of hardware design (both digital and analog), with some software development. Extensive work with real-time signal/image processing utilizing high-speed bit slice microprocessors. Analysis and maintenance of guidance system while performing in the field.

### **PATENTS**

French, Michael L., Iftekharruddin, K. M., Leeper, D. R., Samy, R. P., Hwang, W. R., "Bearing with Wireless Self-Powered Sensor Unit", US Patent 6,535,135, March, 2003

French, M. L., Melvin, J. W., Talafous, J. A., "Bearing With Sensor Module", US Patent 6,161,962, December 2000

Samy, R.P., Varonis, O. J., French, M. L., "Antifriction Bearing Capable of Generating Electrical Energy", US Patent 5,440,184 August 1995

**PUBLICATIONS**

French, M. L., Williams, S. R., “*Development of a Self-Contained Sensor Bearing for Rail Applications*”, 2002 ASME International Mechanical Engineering Congress and Exposition, November 2002

Samy, R. P., Fuquen, R., French, M. L., Varonis, O. J., Vuksta, R. J., “*Development of a Generator Within a Bearing To Provide On-Board Power for Freight Cars*”, ASME Winter Annual Meeting, November 1996

**INTERNAL CORPORATE PUBLICATIONS**

French, M. L., Evaluation of Condition Monitoring Technologies, Intelligent Products and Systems Summary Report Project No. 0001040, April 2006

French, M. L., Gas Turbine Inter-Shaft Roller Bearing Health Monitoring, Advanced Product Technology Final Report Project Number PROP21, August 2004

French, M. L., Fabrication, Field Test, and Data Analysis of AP Bearing Tri-Sensor Module, NDE and Sensor Technology – Research Final Report Project No. 0010131, April 1998

French, M. L., Jackson, K. E., Leeper, D. R., Performance Evaluation of NDE Stations at Gambrinus Steel Plant, “Bay 6”, NDE & Sensor Technology – Research Project No. 0000562, Interim Report-4, February 1995

French, M. L., Early Detection of Rolling Contact Fatigue in Timken Disk-On-Disk RCF Test Facilities, NDE / Sensor Technology Investigation Summary Report Project No. 0001038, October 1993

French, M. L., On-Line Approximation of Sound Test Facility Frequency Response Function, NDE / Sensor Technology Interim Report No. 1 Project No. 86032, August 1991.

French, M. L., Curran, M. N., Electromagnetic NDE Data Acquisition and Analysis System, NDE / Sensor Technology – Research Final Report Project No. 85894, December 1989.

**INSTRUCTIONAL EXPERIENCE**

- Graduate and Undergraduate Student Interns  
Selected by management of The Timken Company to serve as mentor to students from The University of Akron, The Ohio State University, and Massachusetts Institute of Technology in the areas of digital signal processing, data acquisition, application of sensors, and machinery condition monitoring.  
1990 – 2008 as selected

**INSTRUCTIONAL EXPERIENCE (continued)**

- Initiated a Timken Grant, creating an internship program to support Graduate Students from The University of Akron's College of Engineering. Mentored engineering interns in areas of data acquisition, signal processing, and electromagnetic non-destructive testing.  
1987 – 1990

**AREAS OF PROFICIENCY / INTEREST**

Signal Analysis  
Digital Signal Processing  
Electronics, Analog and Digital  
Wireless Communication  
Diagnostics of Circuits

Application of Sensors & Sensor Systems  
National Instruments LabVIEW  
Machinery Monitoring  
Systems Integration  
Rotor Dynamics