

**Czech Society for Mechanics**

in cooperation with

**Fatigue Analysis RI s.r.o.**

and under auspices of the

**FME CTU in Prague**

announce holding of the

## **Workshop on Computational Fatigue Analysis 2016**

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## **Vibration Fatigue Analysis**



**Karlovo náměstí 13, Prague 2 - Nové Město,  
Czech Republic**

**November 8 - 10, 2016**

### **Introduction**

After 5 successful volumes of WCFA&PUM workshop, and based on well visited specialized Damage Tolerance courses, the organizers decided to bring along another highly specialized fatigue topic. This volume of the WCFA workshop focuses on the fatigue analysis solution under vibration loading.

The lecturer, Dr Neil Bishop, made a slight introduction of himself during a short interesting presentation held in 2012 at the CTU in Prague. Those, who looked for a solution, how to convert PSD signal of the in-service measurement into the fatigue prediction, could note his name, because he was the one, who with Frank Sherratt made the Dirlik solution (the mainstream solution in such cases today) famous. Thanks to his long-term practice with fatigue analysis, including e.g. his support of development of MSC.Fatigue solver, he is well aware of the problems the engineers encounter. And at last, but not least, English is his native language and his pronunciation is clear.

Because no official public fatigue course was held in last 3 years in the Czech Republic (the last one was WCFA'13 & PUM05 workshop), we decided to start with a series of introductory lectures for the first day covered by Darrell Socie, Milan Růžička and Jan Papuga.

### **Lecturers**



**Neil Bishop** got a PhD in 1988 on the subject of "Using Frequency Domain Parameters To Predict Structural Fatigue". He has spent the last 25 years teaching, and doing research, related to CAE based fatigue, especially where dynamic response is important. He wrote the NAFEMS book "Finite Element Based Fatigue Calculations" in 2000. Prior to this he worked as a lecturer, and consultant, in the academic world. He managed research programs for UK, European and US government bodies including

an acoustic fatigue project under the SBIR programme. He has published well over 30 papers in this field. He is a director of 2 SME companies specializing in dynamics and fatigue analysis.



**Darrell Socie:** Since 1978, Dr. Socie has held the position of Professor of Mechanical Engineering at the University of Illinois. Although now retired, Prof. Socie still maintains an active teaching and research program. Current research includes cyclic deformation and fatigue under multiaxial stresses, probabilistic fatigue and fracture design, and design with 3D printed materials. He has authored over 150 technical articles on all aspects of fatigue and durability assessment and was responsible for the development of ASTM Standard E 1049 Cycle Counting in Fatigue Analysis. Prof. Socie is an invited lecturer throughout the United States, Europe, China and Japan and has been teaching industrial fatigue seminars for more than 40 years.



#### **Milan Růžička:**

Employed: FME CTU in Prague (1983-...) - Head of Dept. of Mechanics, Biomechanics and Mechatronics (2015-...)  
Academia: He finished his Ph.D. thesis in 1984 at the FME CTU in Prague, habilitation 1999 (Doc.), 2005 (Prof.).  
Focus: Fatigue in notches, fatigue of welded structures, composite structures, fatigue in composites, use of optical fibres, structural health monitoring  
Other: Secretary of the Czech Society for Mechanics, program director of WCFA&PUM meetings



#### **Jan Papuga:**

Employed: FME CTU in Prague (2007-...); Ekvktor, spol. s r.o. (2006-...); Fatigue Analysis RI s.r.o. (2016-...)  
Academia: He finished his Ph.D. thesis in 2006 at the FME CTU in Prague.  
Focus: Multiaxial fatigue, fatigue in notches, fatigue computation methods  
Other: Developer of PragTic fatigue freeware, chairman of WCFA&PUM meetings, secretary of DTMA 2011 workshop, leader of FADOFF (Fatigue Analysis Documentation Office) project (2011-2014).

## Workshop Location

The meeting will be held at the building of the Czech Technical University in Prague on Karlovo náměstí. It can be conveniently accessed by a subway, and one of its exits on Karlovo náměstí station is directly on the edge of this building.

## Course Options

The course is built in such a way, that no prior knowledge on fatigue analysis is needed. The basic principles of the common fatigue damage estimation are described in the first day, while the content related to fatigue analysis under vibration loading is extensively discussed in next two days. In order to better suit the needs of participants and to fit it better to the level of their knowledge, three variants of the course are provided as shown in the table below.

Tuesday November 8, 2016	Introduction to Fatigue (D. Socie, M. Růžička, J. Papuga)	Complete Course
Wednesday November 9, 2016	Vibration Fatigue (N. Bishop)	
Thursday November 10, 2016		

More detailed information about the programme will be subsequently published during September 2016 on the workshop website.

## Content of Lectures

**Introduction to Fatigue:** History of Fatigue and Fatigue Methods; Materials Considerations; Loading Considerations; Stress-Life Based Fatigue; Strain-Life Based Fatigue; Factors Affecting Fatigue Life; Processing of Load Records; Fracture Mechanics and Crack Propagation

(Brief Treatment Only); Composite Materials; An Introduction to Weld Analysis; Multiaxial Fatigue; The Concept of FE Based Fatigue Analysis; Commercial Applications; Available Data Sources.

**Vibration Fatigue:** Recap of Fatigue Methods in Relation to Random Vibration Fatigue; History of Fatigue Methods Integration into the CAE Environment; Background to Dynamics For Fatigue Analysis, Introduction to MBS; Accelerated Testing Techniques; Surrogate Loads - Process for Enveloping (Reducing and Simplifying) Loads; Step By Step Process For Static and Dynamic Models (Both Time and Frequency Domains); Some Frequency Domain Dynamic (Vibration Fatigue) Examples; Vibration Environments – Random v Deterministic; Random Response Estimates - Especially for Collision Detection; Frequency v Time Domain; System Transfer Functions (Frequency Domain); Choosing points on the transfer function; How transfer functions work; FFT's and PSD's; Buffers and window averaging; Calculating PSD's From Time Signals; Classifying Time Signals and PSD's; Statistics, probability and reliability; Loads & "Cross PSD's"; Gaussian, random and stationary data; Zero and peak crossing rates; Irregularity factor; Root mean square (rms) value; Moments; Hand calculations from a PSD; Working Directly With PSD's; Options For Calculating Fatigue Life From PSD's; Vibration Fatigue Solvers – Narrow Band, Wirsching, Steinberg, Dirlik; Random Fatigue Response Embedded in FE Solvers; Time Based Methods – Static, Transient, Modal Participation Factor method

## Attendance Fee

The attendance fee includes access to the lectures, printouts of the presentations, meals during lunches plus drinks and meals during coffee breaks. The price for the accommodation is not included in it.

The attendance fee is set in several versions related to the course content (3 variants for 1, 2 or 3 days) and also to the speed the application and payment were processed.

The Early Bird rate is available to those who will pay before September 23, 2016. The Regular rate is applicable to all participants who settle their payment after September 23, 2016. The complete list of variants can be found in this table:

Course Content	Early Bird Rate	Regular Rate
Introduction to Fatigue	110 EUR or 3000 CZK	120 EUR or 3200 CZK
Vibration Fatigue	250 EUR or 6700 CZK	280 EUR or 7500 CZK
Complete Course	330 EUR or 8900 CZK	370 EUR or 9900 CZK

Members of the Czech Society for Mechanics pay 10% less from any of the aforementioned prices.

More details about the payment can be found on the workshop website.

## Used Language

English language is the official language of the lectures.

## Organizing Committee

Chairman: Jan Papuga, [papuga@pragtic.com](mailto:papuga@pragtic.com)

Finances: Jitka Havlínová, [csm@it.cas.cz](mailto:csm@it.cas.cz)

## Conference Contacts

Webpage: <http://www.pragtic.com/VFA.php>.

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