

Czech Society for Mechanics

under auspices of the
FME CTU in Prague

announce holding of the

Workshop on Computational Fatigue Analysis 2022

Vibration Fatigue Analysis



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

November 14 - 16, 2022

Introduction

The break of WCFA tradition by COVID stopped the preparation of the volume focused on vibration fatigue. This topic was chosen because of the enormous interest of attendants of previous WCFA volumes, and the successful lectures by Neil Bishop in 2016.

We finally managed to bring it to life this year. We are proud some of the most renowned vibration fatigue researchers in Europe accepted our call and will deliver the lectures at the workshop. The lectures are intended to allow the practicing engineers to understand the topic and its analysis. They should provide hints to implement this type of the solution into the portfolio of routine analyses in their companies.

Lecturers



Denis Benasciutti: PhD at University of Ferrara in 2005. Master in Welding Engineering (2006), diploma of European/International Welding Engineer (EWE/IWE). Assistant Professor at the University of Udine (2006-2015), Associate Professor at the University of Ferrara. Editorial Board member of journals: Metals, Shock and Vibration, Mathematical Problems in Engineering. Focus on the structural integrity assessment of structures subjected to stochastic uniaxial and multiaxial loadings and on the cyclic plasticity and low-cycle fatigue behavior of traditional and additive manufactured materials.



Filippo Cianetti: Full Professor of Machine Design at Department of Engineering and the Head of the School of Mechanical Engineering at University of Perugia. He teaches “Machine Design” and “Dynamics in Machine Design”. His research activity from early 90’s is aimed to solve mechanical design problems with particular attention to systems dynamics. He develops techniques for simulation of mechanical systems. His activity is oriented on durability analysis of systems and mechanical components in virtual simulation (FEA and MBS) environment with particular attention to fatigue analysis, in time and frequency domain.



Martin Nesládek: Works at the FME CTU in Prague (2010). He finished his Ph.D. thesis in 2016 at the FME CTU in Prague. In this research he focuses on various fatigue topics including low- and high-cycle fatigue, multiaxial fatigue, fretting, fatigue in contacts or thermo-mechanical fatigue.



Adam Niestony: researcher at the Opole University of Technology. He cooperates with the Science and Technology Park in Opole, where he participated in establishing the Engineering Design Center. Scholarship of Alexander von Humboldt at the Fraunhofer LBF in Darmstadt (2006-07). His specialty is material fatigue and experimental verification of durability, with the focus on spectral methods of fatigue life estimation and the fatigue analysis in frequency domain including multiaxial fatigue criteria.



Massimiliano Palmieri: postdoctoral researcher in Machine Design at the Department of Engineering of University of Perugia, where he finished PhD in 2020. His research activities involve dynamics and fatigue with the focus on the durability of non-linear systems subjected to random non Gaussian, stationary and not stationary loads in time and in frequency domain, using FE and multibody modelling and simulation.



Jan Papuga: Works at the FME CTU in Prague (2007-...) and in Evector, spol. s r.o. (2006-...). Ph.D. thesis in 2006 at the FME CTU. He focuses on multiaxial fatigue, fatigue in notches, benchmarking of fatigue estimation methods, experimental fatigue databases. Developer of PragTic fatigue freeware (www.pragtic.com), chairman of WCFA meetings, leader of FABER (www.pragtic.com/faber.php), member of the editorial board of International Journal of Fatigue.



Milan Růžička: Works at the FME CTU in Prague (1983-...), former head of Dept. of Mechanics, Biomechanics and Mechatronics (2015-2020). Ph.D. thesis in 1984 at the FME CTU, habilitation 1999 (Doc.), 2005 (Prof.). He focuses on fatigue in notches, fatigue of welded structures, composite structures, use of optical fibres, structural health monitoring. Secretary of the Czech Society for Mechanics.



Janko Slavič: Full Professor at the University of Ljubljana from 2018 (PhD there in 2005), postdoc at University of Texas at Austin (2005-06). He focuses on vibration fatigue as related to structural dynamics theory. First author of the scientific monograph “Vibration Fatigue by Spectral Methods”, Elsevier (2021). Open-source contributor, maintainer of FLife - Vibration Fatigue by Spectral Methods. Researches the image-based methods in structural dynamics, 3D printed smart dynamic structures. www.ladisk.si/~slavic/.

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 (line B) is directly on the edge of this building. The lecture room No. 215 will host the workshop.

Course Options

Basic principles of the common fatigue damage estimation are described in the first day to allow also freshmen to understand basic fatigue estimation principles and to digest the content related to the vibration fatigue analysis treated extensively in the last two days. To better suit needs of participants and to fit the course better to the level of their knowledge, several variants of the course are available:

Monday Nov 14, 2022	V1: Introduction to Fatigue (M. Růžička, J. Papuga, M. Nesládek)	V3: Complete course
Tuesday Nov 15, 2022	V2: Vibration Fatigue Analysis (J. Slavič, D. Benasciutti, F. Cianetti, M. Palmieri, A. Niesłony)	
Wednesday Nov 16, 2022		

Content of Lectures

The complete program of the workshop can be found on the workshop website www.pragtic.com/2VFAttbl.php. Only an overview of discussed topics is provided hereafter for the individual lecturing days.

Nov 14: Introduction to Fatigue (M. Růžička, J. Papuga, M. Nesládek): Fatigue Curves, Materials Considerations, Loading Considerations, Statistical Aspects, Stress-Life Based Fatigue Estimate, Factors Affecting Fatigue Life, Strain-Life Based Fatigue, Fracture mechanics Approach, Stress Intensity Factor, Fatigue Crack Growth, Examples of the Workflow, Fatigue in Welds, Multiaxial Fatigue, Available Software Applications & Data Sources, FATigue BEnchmark Repository

Nov 15: Signal Processing (J. Slavič): 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), Moments, 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 From Time Signals, Hand calculations from a PSD, Case Study.

Uniaxial Vibration Fatigue Analysis (D. Benasciutti): Analysis of variable amplitude loadings (cycle counting, damage accumulation, critical damage,...), Extension to random loadings: amplitude probability distribution, expected damage, fatigue life. Switching to frequency domain: random processes, different analysis levels (from amplitude distribution to damage), Recaps of PSD concepts (spectral moments, bandwidth parameters). Types of PSD (narrow band, wide band, bimodal) and relationship with cycle distribution damage.

Nov 16: Dynamic Analysis (F. Cianetti & M. Palmieri): Undamped and damped free-response, Harmonic and general forcing excitation, Frequency response function, Base excitation, Dynamic analysis by FE, Dynamic analysis by modal approach, How to obtain strain/stress PSD responses and spectral moments, Case Study.

Multiaxial Vibration Fatigue Analysis (A. Niesłony): Understanding multiaxial load and multiaxial stress state, Description of the spatial stress state, Relation between stress state components, non-proportionality, General concept of frequency domain fatigue life assessment in multiaxial stress state, Multiaxial fatigue failure criteria (von Mises stress and its evaluation in frequency domain, critical plane concept criteria), Case Study.

Used Language

English language is the official language of the lectures.

Attendance Fee

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

After informing, a substitute can be sent for the registered participant, who cannot come, for no other additional cost. It is also possible to share some of the longer course variants among several employees.

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

The fee is set in several versions, which can be paid either in EUR or in CZK.

The **Early Bird rate (EB)** is available to those who will pay before Sep 26, 2022, the **Regular rate (REG)** is to be paid afterwards.

The individual variants of the course composition are these:

More details about the payment conditions can be found on the workshop website, section Payment (www.pragtic.com/2VFApay.php).

Type	Fee	Attendance type		
		On-site	On-line	Recorded
V1	EB:	150 EUR/3600 CZK	100 EUR/2400 CZK	To be set later
	REG:	170 EUR/4100 CZK	125 EUR/2700 CZK	
V2	EB:	440 EUR/10500 CZK	340 EUR/8100 CZK	
	REG:	500 EUR/12000 CZK	375 EUR/9000 CZK	
V3	EB:	550 EUR/13200 CZK	410 EUR/9900 CZK	
	REG:	625 EUR/15000 CZK	460 EUR/11000 CZK	

Item	Attendance type		
	On-site	On-line	Record
Access to the recorded lectures	X	X	X
Presentations in pdf	X	X	X
Attendance certificate	X	X	
Real-time access to the workshop	X	X	
Interaction with lecturers during lectures	X	X	
Interaction with participants and lecturers during breaks	X		
Printouts of the presentations	X		
Access to the lectures on-site	X		
Lunches and coffee breaks	X		
Social evening (Tuesday, Nov 15)	X		

Organizing Committee

Chairman: Jan Papuga, papuga@pragtic.com

Finances: Jitka Havlínová, csm@it.cas.cz

Conference Contacts

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