EUROMECH Final Report

EUROPEAN MECHANICS SOCIETY

Please send this report to the Secretary General of EUROMECH, within one month after the Colloquium.

EUROMECH Colloquium No: 419

Title: ELASTIC WAVES IN NON-DESTRUCTIVE TESTING

Dates and location: 3 - 5 October 2000, Prague, Czech Republic

Chairperson: Zdenek PREVOROVSKY, PhD, Institute of Thermomechanics AS CR, Czech Rep.

Co-Chairperson: Prof. Pier Paolo DELSANTO, Politecnico di Torino, Italy

Is there need of another Colloquium on the same or a related subject? Which year? Yes, 2004

Full registration fee: 200 €

What other funding was obtained? No one

What were the participants offered?
3 days of contributing lectures and discussions, excursion to laboratories of IT, daily lunches and refreshments, colloquium materials including book of extended abstracts, additionally distributed colloquium proceedings, free local transport tickets, and free transfer from and to the airport (for foreign participants only), panel discussion in the old town palace joint with a concert of baroque music, and closing ceremony on a steamboat passing Prague.

Number of members of EUROMECH (reduced registration fee): 3

Number of non-members of EUROMECH (full registration fee): 18

Number of participants from each country:

Austria		Germany	1	Romania	3
Belgium	2	Great Britain		Russia	2
Byelorussia		Greece	1	Slovakia	
Bosnia		Hungary		Slovenia	
Bulgaria		Ireland		Spain	
Croatia		Italy	2	Sweden	
Czech Republic	23	Latvia		Switzerland	
Denmark		Lithuania		Ukraine	
Estonia	1	Netherlands		Yugoslavia	
Finland		Norway		Turkey	
France	3	Poland	1	Others (Israel)	1
Georgia		Portugal		Total	40

Scientific Report

The EUROMECH 419 Colloquium was organised in the Institute of Thermomechanics of the Academy of Sciences in Prague. The aim of the Colloquium was to meet together researchers working in two apparently different fields: elastodynamics and acousto-ultrasonic non-destructive diagnostics, evaluation, and testing of materials and structures. Only few contacts still exist between both groups solving common problems from different point of view. It is evident that the latest progress in numerical modelling with 2D and 3D computer simulations of elastic wave propagation in both isotropic and anisotropic bodies can explain experimental observations, and enhance ultrasonic and acoustic emission testing reliability.

Colloquium has been firstly announced one year before, with a call for papers related to following topics: modelling of elastic waves in solids, elastodynamic inverse problem solution, non-linear effects, dispersion and attenuation effects, acousto–ultrasonic methods, advanced ultrasonic signal processing, AE source characterisation, AE modal analysis, ultrasonic material evaluation. 41 contributing authors from 14 countries were electronically registered one month before the Colloquium opening. Twelve of them cancelled their participation at the last moment, due to visa, or other problems (2 of Ukraine, 4 of Russia, 1 of Romania, 1 of Sweden, 1 of UK, 1 of France, and 2 Czech participants). Scientific Committee has not accepted one contribution, as its theme didn't cohere with the colloquium subject. As a result, 29 scientific papers were presented at the colloquium (27 oral presentations and 2 posters). It must be noted that only one of co-authors has been charged to pay full conference fee. 40 people took part in colloquium sessions. 21 of them were participants paid full or reduced registration fee, 1 young author obtained a grant (C.Rugina from the Institute of Solid Mechanics in Bucharest, Romania). 18 non-charged participants were PhD students from organising Institute, one-day visitors, co-authors, and or accompanying persons. Two other demanded grants for young participants (first of Romania and second of Russia) could not be applied due to the visa problems at the last moment.

Final program of the Colloquium is enclosed to this report (Enclosure1). The Book of Extended Abstracts, edited by Z. Prevorovsky and M. Landa from IT AS CR, comprised all electronically pre-registered papers (see enclosure 2), while the Colloquium Proceedings (in press) include only presented contributions. The final program has been divided into three topical sessions:

A) Elastic wave modelling and numerical simulations (11 papers)
B) Non-linear effects and non-destructive evaluation techniques (12 papers)
C) Acoustic emission treatment (7 papers, 2 Czech authors from Brno absented).

Colloquium chairmen reported the opening lecture, entitled "Necessity of elastic wave modelling in ultrasonic NDT applications". The lecturer has pointed out the role of theoretical solutions and numerical simulations in the ultrasonic signal waveform analysis and deconvolution as in a lot of diagnostic applications and in material research as well. Particularly, problems arising from non-linearity, dispersion, and attenuation cause troubles in ultrasonic and acoustic emission signal interpretation. The only way of really quantitative NDE seems to be comparing experimental data with either analytical solutions or computer simulations.

Various aspects of advanced numerical wave propagation modelling by FEM, finite differences (LISA code) and finite integration techniques were themes of the first session (A). Problems ranging from computational schemes automatically generated by computer algebra, grid dispersion effects, and other questions concerning different computer simulation codes, up to results modelling guided waves or elastic wave propagation in pre-stressed media were discussed during first session. As a conclusion, requirement of large 3-D modelling was stated.

During the second day, experimental NDE/NDT techniques and interesting measurement results were mentioned. Particular attention was paid to new non-linear acoustic diagnostics technique, based on the spectral analysis of high-order vibration modes at different excitation amplitudes. This promising method is now subject of European Science Foundation project called "NATEMIS". Other interesting aspects were related to laser induced ultrasonic waves, generating of solitary waves in solids, and ultrasonic characterisation of material structure and properties. The session was accompanied by extensive discussion and opinion exchange between theorists and experimentalists.

The last session was concentrated on problems relating acoustic emission (AE) treatment. Particular interest is now given to AE source identification and recognition. Discussion showed that advanced signal processing methods including wavelet transform and the application of artificial neural networks can contribute to that field substantially. At the close of meeting, the excursion in AE and ultrasonic laboratories of the Institute of Thermomechanics was organised. Modern laboratory equipment, including ultrasonic scanners, scanning acoustic microscope, and DSP-based AE analysers provoked many discussions and stimulated extensive exchange of specific experience between participants.

It can be concluded that this non-traditional colloquium fulfilled its aim, and initiated new collaborations between European laboratories. The extent of the Colloquium was not too large, but all the more useful were common and personal discussions in the specific field. All presentations were less formal but they have high scientific level, and opened problems of practical interest, which are not yet completely solved. All participants expressed effectiveness of the meeting and anticipated similar action in near future.

Prague, 20 December 2000

Zdenek Prevorovsky
EUROMECH 419 Colloquium chairman