

3rd Scientific Expert Conference with International Participation OTEH - 2009

Jovan Isaković, PhD (Eng)¹⁾
Goran Ocokoljić, MSc (Eng)¹⁾

After the introductory part with basic information about the 3rd Scientific Conference of the defence technology researchers, organized by the Military Technical Institute on 8-9th October 2009 in Belgrade, the review concentrates on the most interesting papers presented at the Conference.

THE 3rd scientific meeting OTEH - 2009 was held on 8-9th October 2009 in Belgrade. OTEH is an acronym (in Serbian) for Defence Technologies. The Conference of the defence technology researchers is organized every two years, with the aim of overall and multidisciplinary review of current conditions and further development trends in the area of military-technical science.



The Ministry of Defence entrusted the organization of this year's meeting to the Military Technical Institute. The organization was given to the scientific-research institution with a 61-year long tradition in the development of weapons and military equipment, which developed around 1300 combat and non-combat products for the national army and many foreign armies.

During two days, many high-quality and original papers from current research projects were presented, as well as papers on research already applied in practice or that referring to forecasting and further developments in particular military technology areas. At the OTEH - 2009, 202 papers were presented with more than 400 authors and co-authors. All papers were reviewed and presented in the following 11 thematic sections:

- Armament and ballistics,
- Combat platforms (aircraft, vehicles, ships),
- Ammunition and ordnance,
- Systems for electronic warfare, guidance and sensors,
- Telecommunication and command-information systems,
- Geo-topography technologies,
- System of quality, standardization, codification and metrology,
- Innovation, new materials, technologies and protection,
- Management in the system of defence and logistics,
- Defence-related medicine, and
- Automation of combat systems.

Some of the most interesting papers are presented further on. The list of all papers and authors, as well as other information concerning the OTEH 2009, can be found on the following website: www.vti.mod.gov.rs/oteh.



Military Technical Institute – Belgrade, SERBIA

- *Solid propellant modulus evaluation and its use in structural analysis*, (N.Gligorijević, V.Rodić, Military Technical Institute, Belgrade)

Structural analysis of solid propellant as a viscoelastic material is more complex than an elastic one. There are different mathematical techniques of solving viscoelastic problems like a quasielastic one, using the knowledge from the elastic analysis. This paper gives a short preview of using a relaxation modulus for the analysis, in cases when the loads acting on a solid propellant grain are linearly time dependent. A method for a modulus experimental

¹⁾ Military Technical Institute (VTI), Ratka Resanovića 1, 11132 Belgrade, SERBIA

evaluation is explained. Cyclic loads are usually analysed using a dynamic modulus, evaluated by another experimental technique. There is a connection between the relaxation modulus and the dynamic modulus, and for a complete stress-strain analysis it is enough to know only one.

- *GeniSenseMilitary – GIS based sensor web for war and emergency management*, (L.Stomenov, N.Marković, D.Mitić, University of Niš, Faculty of Electronic Engineering, V.Krstić, Serbian Armed Forces)

This paper presents the implementation of the general GINISENSE architecture for the management of emergency and war situations. The GINISENSE architecture is based on the Sensor Web technology and Geo-Information Systems (GIS). The GIS based Sensor Web provides a platform for visualization of data received from heterogeneous and distributed sources of information (sensors). Such platform can be applied in emergency and hazardous situations, as a tool for target tracking, target classification, target geolocation and target hand-off.

- *A LabVIEWTM based video acquisition and recording system in the T-38 trisonic wind tunnel*, (B.Ilić, Đ.Vuković, M.Milosavljević, Military Technical Institute, Belgrade)

A computer-based video acquisition and recording system for the T-38 trisonic wind tunnel was developed in LabVIEW environment, replacing the old system developed in 1980s. Digital cameras were introduced, together with the LabVIEW control software. Video recording and archiving are automated and the new system is thoroughly integrated with existing systems for wind tunnel control, data acquisition and reduction.

- *Design and calibration of the three-component balance for a wind tunnel model of a missile*, (D.Damljanović, Đ.Vuković, A.Vitić, J.Isaković, Military Technical Institute, Belgrade)

A special-purpose three-component wind tunnel balance was designed, built, calibrated and used for measurements of aerodynamic forces and moments on a control surface of a particular wind tunnel model. The balance had to be designed so as to fit inside a limited space of the rear part of the model body, and yet to enable measurements of desired load components with sufficient accuracy.

- *Some aspects of stability derivatives measurement in the T-38 wind tunnel*, (Z.Anastasijević, M.Samardžić, D.Marinkovski, S.Vrtlar, Military Technical Institute, Belgrade)

The technique for measurements of stability derivatives applied in the T-38 wind tunnel is the forced oscillation technique. Data reduction procedures used in the MTI to obtain both direct as well as cross and cross-coupling derivatives are described. The determination amplitude and the frequency of the primary motion are described as well as the amplitude of the excitation moment signal and the phase shift between the reference signal and the excitation moment signal.

- *Numerical and experimental investigation of the base pressure for the agard-b calibration model*, (A. Akgül, E. Gülay, Roketsan Missile Industries Inc., Ankara, Turkey, J.Isaković, S.Mandić, Military Technical Institute, Belgrade)

The results of the base pressure measurements of the AGARD-B calibration model in the T-38 blowdown wind tunnel of the Military Technical Institute, Serbia are given in this article. There is a very good agreement between the measured base pressures in the MTI T-38 blowdown wind tunnel and the appropriate measured values in the IAR (NAE) 5ft trisonic wind tunnel (Canada). Also

Computational Fluid Dynamics (CFD) calculations have been performed to predict base pressure values and results are compared against both wind tunnel test results. There is the influence of the sting on the calculated values of the base pressures. The measured base pressures are between the calculated values for the CFD model alone and the CFD model with a sting. The base pressures are also calculated by the semi-empirical method, MTI-DMAC at a zero angle of attack and USAF Missile DATCOM as a function of the angles of attack. The differences between calculated and measured base pressure values can be related to the influence of the sting.

- *Prevention and control of HIV/AIDS in the Armed Forces of Serbia*, (V.Šuljagić, R.Rajić, N.Kuljić-Kapulica, G.Dedić, Military medical Academy)

By the end of 2008, health authorities in Serbia had reported a cumulative total of 2317 HIV cases (prevalence rate is about 0.02%). Armed forces personnel constitute a population group with special risk of exposure to HIV/AIDS. The continuing medical education is the basic activity of our programs "Prevention and Control of HIV/AIDS in Armed Forces of Serbia". The most powerful tool in our preventive activities is our educational film.

- *Investigation of interfacial bonding in HMX/AP model propellant composite*, (J.Petković, A.Wali, D.Mijin, G.Ušćumlić, Faculty of Technology and Metallurgy, Belgrade)

A series of 1,3,5-trisubstituted isocyanurates (substituents: 2-hydroxyethyl, 3-hydroxypropyl, 2-hydroxypropyl and 2,3-epoxypropyl) was synthesized in accordance with a modified literature procedure. All the synthesized isocyanurates were identified by their melting point and FTIR, ¹H NMR and UV spectroscopic data. The Fourier transform infrared spectrophotometry was also used to study the interaction between ammonium perchlorate, hydroxyl terminated poly(butadiene), carboxyl terminated poly(butadiene), cyclotetramethylenetetranitramine and the compounds which can serve as bonding agents, synthesized in this work. The results show that 1,3,5-tri(2-hydroxyethyl) isocyanurate is a universal bonding agent for the ammonium perchlorate/carboxyl terminated poly(butadiene)/cyclotetramethylenetetranitramine composite propellant system.

- *Queueing systems in saturation – modeling and analyses*, (N.Nikolić, Strategic Research Institute, Belgrade)

Saturation of queueing systems assumes that intensity of demands for servicing is equal to the nominal capacity of a service channel. A possibility for theoretical modeling and analysis of such systems is very limited, so that researchers turn their attention to other methodological approaches. This paper presents the results of modeling and analysing a queueing system in saturation, using one novel method of the Monte Carlo simulation modeling.

- *Background radiation in the city area Belgrade, Kumodraž, - measured in the period from 1999 to 2009*, (M.Jevremović, D.Rajić, Ž.Senić, N.Lazarević, Military Technical Institute, Belgrade)

This paper presents the results of monitoring the exposure to gamma radiation as an indicator of background radiation at the location Kumodraž, Belgrade. The exposure rate of gamma radiation in the air has been monitored for 10 years, from May 1999 to May 2009, by a PC-RM gamma radiation monitor. The obtained results show that the average annual effective doses are in the range from 1.01 to 1.19 mSv/y and are lower than the worldwide average.

- *Mobile toxicological chemical unit of the national poison control centre*, (M.Jovanović, T.Režić, S.Vučinić, D.Jovanović, National Poison Control Centre, Military Medical Academy)

This paper represents the organization and the way the Mobile Toxicological Chemical Unit of the National Poison Control Centre operates in case of chemical accidents as well as lessons learned and the work experience of this mobile unit.

- *Utilization of TNT equivalent determined from thermochemical calculation for blast effects evaluation*, (Z.Bajić, J.Bogdanov, Military Academy, Belgrade)

The main intention of this paper is to show differences between blast parameters of explosives commonly used in explosive ordnance in the Serbian armed forces. Primary blast wave parameters, overpressure, impulse and positive phase duration are calculated using the modified Sadovskiy equations regarding the TNT equivalent. The TNT equivalents of the observed explosives are determined using thermochemical calculations based on the BKW EOS parameters. The observed explosives are as follows: TNT, cyclotol, octol, FH 5, FO 3 and PPE-01. The calculated blast wave parameters show significant influence of used explosives concerning the TNT equivalent.

- *Preparation of nanometric ceria powders by different synthesis procedure*, A.Benfiala, M.Benabdellah, Military Academy of Serbia, Belgrade, M.Rosić, Institute of Nuclear Sciences "Vinča", Belgrade, O.Cvetković, Centar of Chemistry, Belgrade, Serbia, B.Matović, Institute of Nuclear Sciences "Vinča", Materials Science Laboratory, Belgrade, Serbia)

Abstract - The paper presents the results concerning the preparation of ceria CeO_2 powder by the self-propagating room temperature synthesis (SPRT) and the combustion synthesis (CS) using different fuel mixtures. Nanometric size powder particles were obtained with a fluorite-type crystal structure. The powder properties such as the specific surface area, the crystallite and particle size, and the lattice parameters were followed by the X-ray diffraction and the Raman spectroscopy as well as the BET measurements.

- *Impact of the rain drops onto sea surface and its influence on ambient noise*, (M.Vračar, Military Technical Institute, Belgrade)

The purpose of this paper is to analyze sea ambient noise, which is dominantly under influence of the impact of rain drops onto water surface, using spectra and polyspectra methods. The paper analyses data obtained during the measurement of the ambient noise at sea in periods with heavy rainfall.

- *CFD simulation of small-scale tunnel fire*, (M.Kozić, Military Technical Institute)

The influence of different thermal boundary conditions, i.e. adiabatic and constant wall temperatures, is examined using the CFD simulation of a small-scale tunnel fire. The obtained temperature profiles along the vertical line in the plane of symmetry at three stations along the tunnel are compared with the available experimental and numerical ones. The simple volumetric heat sources are used in modeling combustion. In cases of natural convection and forced convection with a low ventilation velocity, the turbulent flow of heated air and smoke is primarily affected by the buoyant force. The numerical results show that different thermal boundary conditions give considerable differences in temperature distribution in the tunnel. This fact must be taken into account in a fire simulation inside a real traffic tunnel, because the wall heat transfer

coefficients may not be fully known.

- *Fatigue life analysis of aircraft wing-fuselage joints under variable amplitude loading*, S.Maksimović, I.Ilić, M.Blažić, Military Technical Institute, I.Vasović, GOŠA Institute, Belgrade, M.Zrilić, Faculty of Technology and Metallurgy, Belgrade)

This research is aimed at the development of an efficient computation method for the fatigue life analysis of aircraft wing-fuselage joint structure under variable amplitude loading. Particular attention is focused on developing suitable numerical methods for the fatigue life analysis of metal structures, up to the crack initiation stage. The Miner's rule general numerical approach for fatigue life predictions is presented combining the elastic-plastic stress finite element analysis and various mean stress-life relationships as well as the "rainflow" counting procedure. The numerical approach was carried out to improve fatigue life predictions within the framework of the local strain method. Numerical and experimental study in variable amplitude loading, fatigue crack initiation is performed on real structural specimens which are parts of an airplane wing-fuselage joining section. The good agreement of numerical and the experimental results indicates that the presented approach can be used in the fatigue life analysis of same very complex and heavily stressed structures under variable amplitude loading.



The youngest participant of the OTEH - 2009 was Zoran Mihajlović, a student of the Faculty of Electronic Engineering, University of Belgrade, SERBIA.

- *Algorithm for automatic selection of PN sequences for the protection of unmanned, aerial vehicle control signals*, V.Orlić, B.Todorović, IMTEL Communacations, Belgrade)

Unmanned Aerial Vehicle control signals can be efficiently protected against jamming by using the direct sequence spread spectrum technique. If several pseudonoise sequences are applied, it is desirable that they are mutually orthogonal. In this paper we present a computer algorithm for the automatic analysis of crosscorrelation properties, selection and optimal arrangement of sequences from a defined set of PN sequences.

- *Robotisation of combat field for short range anti-tank fighting*, (M. Jezdimirović, N. Žegarac, G. Obradović, G. Vračarević, Military Technical Institute)

In this paper one possible scenario for the robotisation of a combat field for a short range anti-tank battle is presented. Some of the current projects in the MTI which may be used in an anti-tank battle took part in this scenario. These projects may be used for the reduction and protection of a combat crew.

- *Integration of simulations and GIS*, (M. Borisov, R. Banković, S. Drobnjak, Military Geographical Institute, Belgrade)

In this article, digital elevation models (DEMs) of the Avala test area were simulated on the basis of the Monte Carlo stochastic simulation. The purpose of this study is to generate multiple DEMs using error propagation techniques, then derive nitrogen storage for each realization, and finally evaluate how the propagated uncertainty correlates to various topographic parameters.

- *Comparative analysis of noise measurement methods for light propeller-driven airplanes according to icao, Annex 16 with application to airplane UTVA 75*, (G. Jurin, M. Pavlović, Đ. Jankuloski, TOC, Belgrade)

This paper presents a comparative analysis of two noise certification methods for light propeller-driven airplanes. The methods are defined by the international standard

ICAO Annex 16, Chapter 6 and Chapter 10, and applied in the measurement of noise levels of the domestic airplane UTVA 75, the results of which are also presented.

- *Activity of Be-7 in the air in the city area Belgrade, Kumodraž*, (N. Lazarević, Ž. Senić, D. Rajić, M. Jevremović, Military Technical Institute, Belgrade, A. Nouri, A. Jamhour, Ministry of Defence, NBC Department, Libya)

We propose a very simple method to estimate the fractions of cosmogenic radionuclide Be-7 in the air. The experiment was located in Kumodraž, Belgrade in the period from July 2008 to June 2009. The activity of Be-7 radionuclide in air filters was determined on an HPGe detector by the standard gamma spectrometry. All the activities Be-7 showed seasonal behaviour and kept lower than the accepted mean values and in most cases were around the background activity.

After two days of presentations of papers, the 3rd Scientific Expert Conference OTEH 2009 was closed, awarding the Archimedes plaques and the MTI sign plaques. Apart from high-quality papers and good organization, this conference will be remembered by an increased number of young researchers interested in military technologies. The conference was closed with the desire to get an international character in two years' time.

Received: 25.10.2009.

Treći naučno-stručni skup OTEH-2009

Dat je prikaz rada trećeg naučnog skupa istraživača koji se bave odbrambenim tehnologijama, a koji je u organizaciji Vojnotehničkog instituta iz Beograda održan 08 - 09. oktobra 2009. godine. Nakon prikaza toka skupa, predstavljeni su neki od prihvaćenih radova koji su po opštem mišljenju pobudili najviše interesovanja.



Третье научно-специалистическое собрание (конференция) OTEH - 2009

Здесь показана работа третьего научного собрания исследователей, которые изучают оборонительные технологии, а которое организовал Военно-технический институт из Белграда с 8 по 9 октября 2009-ого года. После показа этого собрания, представлены только некоторые из совокупных 202 принятых работ, которые по общему мнению побудили по большей части интересования.



La 3rd conférence scientifique et d'experts OTEH 2009

Un compte-rendu sur les activités lors de la seconde conférence scientifique des chercheurs qui travaillent dans le domaine de la technologie de défense est présenté dans cet article. La conférence, organisée par l'Institut militaire technique de Belgrade, a eu lieu du 8 au 9 octobre 2009. Après le compte-rendu sur cette réunion scientifique, on a présenté certains de 202 travaux acceptés qui, selon l'opinion générale, ont attiré la plus grande attention.