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DESETA MEĐUNARODNA LETNJA ŠKOLA MEHANIKE LOMA – IFMASS 10
„Osnove mehanike loma i postupci za ocenu integriteta konstrukcija“

TENTH INTERNATIONAL FRACTURE MECHANICS SUMMER SCHOOL – IFMASS 10
„Fundamentals of fracture mechanics and structural integrity assessment methods“

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Ključne reči
- integritet i vek konstrukcija
- mehanika loma
- letnja škola

Keywords
- structural integrity and life
- fracture mechanics
- summer school

Izvod

Prikazan je razvoj Međunarodnih letnjih škola mehanike loma (IFMASS) i IFMASS 10.

Abstract

Development of International Fracture Mechanics Summer Schools (IFMASS) and IFMASS 10 are presented.

UVOD

Deseta međunarodna letnja škola mehanike loma (IFMASS 10) u organizaciji Društva za integritet i vek konstrukcija (DIVK), Instituta GOŠA i Mašinskog fakulteta Univerziteta u Beogradu, održana je na Zlatiboru od 23. do 27. juna 2008. pod pokroviteljstvom Ministarstva nauke Republike Srbije i HIP Petrohemije iz Pančeva. Škola je okupila eminentne naučnike i stručnjake u oblasti integriteta i veka konstrukcija, primenjene mehanike i mehanike loma iz zemlje i inostranstva kao predavače, a privukla je brojne učesnike iz Srbije i okruženja, velikim delom iz Bosne i Hercegovine.

RAZVOJ IFMASS

Osnovana 1980. od strane profesora Majkla Vnuka i Stojana Sedmaka, Međunarodna letnja škola mehanike loma (IFMASS) je organizovana 9 puta: prvih šest puta u različitim mestima bivše Jugoslavije, IFMASS 7 i IFMASS 8 u smanjenoj Jugoslaviji i IFMASS 9 (2005) u Varni, Bugarska. Naslovi održanih IFMASS su:

1. Uvod u mehaniku loma i konstruisanje sa sigurnošću od loma
2. Savremeni aspekti projektovanja i izrade sudova i cevovoda pod pritiskom
3. Mehanika loma zavarenih spojeva
4. Perspektive razvoja i primene mehanike loma
5. Procena veka komponenata energetskih postrojenja uz primenu mehanike loma
6. Eksploatacijske prsline u posudama pod pritiskom i rezervoarima
7. Eksperimentalne i numeričke metode mehanike loma u oceni integriteta konstrukcija
8. Od mehanike loma do ocene integriteta konstrukcija
9. Izazovi materijala i zavarenih spojeva – ocena integriteta i veka

Tematske monografije 1. do 4. i 6. do 7. su izdate na srpskom pod naslovima škola, monografija 5. je izdata na

INTRODUCTION

The Tenth International Fracture Mechanics Summer School (IFMASS 10), organized by the Society for Structural Integrity and Life (DIVK), GOŠA Institute, and Faculty of Mechanical Engineering, University of Belgrade, was held on Zlatibor, 23–27 June 2008, under the auspices of the Ministry of Science of Serbia and HIP Petrohemija, Pančevo, and has gathered eminent scientists and experts in the field of structural integrity and life, applied mechanics and fracture mechanics as lecturers, and attracted numerous participants from Serbia and neighbouring countries, mostly from Bosnia and Herzegovina.

IFMASS DEVELOPMENT

Established in 1980 by Professors Michael Wnuk and Stojan Sedmak, the International Fracture Mechanics Summer Schools (IFMASS) had been organised nine times: the first six at different places in former Yugoslavia, IFMASS 7 and IFMASS 8 in shortened Yugoslavia and IFMASS 9 in Varna, Bulgaria in 2005. Following are the titles of IFMASS:

1. Introduction to Fracture Mechanics and Fracture-Safe Design
2. Modern Aspects of Pressure Vessels and Penstocks Design and Manufacturing
3. Fracture Mechanics of Weldments
4. Prospective of Fracture Mechanics Development and Use
5. The Application of Fracture Mechanics to Life Estimation of Power Plant Components
6. Service Cracks in Pressure Vessels and Storage Tanks
7. Experimental and Numerical Methods of Fracture Mechanics in Structural Integrity Assessment
8. From Fracture Mechanics to Structural Integrity Assessment
9. The Challenge of Materials and Weldments – Structural Integrity and Life Assessments

Topical monographs 1 to 4 and 6 to 7 are published in Serbian under the School titles, the monograph 5 is published in English, and a shortened version in Serbian. The

engleskom, i u skraćenoj verziji na srpskom. Monografija IFMASS 8 je izdata na engleskom, dostupna je na veb strani DIVK www.divk.org.yu. Monografija IFMASS 9 je izdata na engleskom juna 2008.

Sem predavača iz Jugoslavije, učešće u kolegijumu predavača su prihvatili svetski priznati eksperti iz SAD, Nemačke, Velike Britanije, Francuske, Poljske, Rusije, Ukrajine, Mađarske, Rumunije, Bugarske, Slovačke. Neki od njih su učestvovali više puta sa serijom predavanja, na pr. Stojan Sedmak, Aleksandar Radović, Mladen Berković, Jovo Jarić, kao i Majkl Vnuk, Mohan Ratvani, Dejvid Rid, Hari Mak Henri (SAD), poč. Džon Rejdon (UK), Adam Mazur (Poljska), Gij Plivinaž (Francuska) i Bernd Mihel, Petar Agatonović (Nemačka). Treba navesti i čuvena imena kao Majkl Bardekin, Pedro Marcel, Dominik Fransoa, Vera Ivanova, Džon Landes, Karl Heinc Švalbe, Valerij Trošćenko, Ivan Hrivnak, Laslo Tot. Ponosni smo i na dugačak predgovor Džordža Irvina, utemeljivača mehanike loma kao naučne discipline, u monografiji 3.

Broj učesnika je bio 62 na IFMASS 1, a zatim redom 79, 84, 96, 145, 125, 137, 107 i 51 na IFMASS 9.

Obrazovanje je prvi pristup IFMASS. Koliko je ono uspešno, govori broj predavača iz Srbije, koji su počeli kao slušaoci: njih je bilo 9 na IFMASS 9, i 19 na IFMASS 10.

Drugi aspekt je primena mehanike loma i ocene integriteta konstrukcija u industriji, sa vrlo dobrim rezultatima.

ORGANIZACIJA I RAD IFMASS 10

Eksperti iz Jugoslavije su se vrlo rano uključili u aktivnosti Evropske grupe za lom (EGF), od 1982. na 4. Evropskoj konferenciji o lomu (ECF 4). Uspeh IFMASS je dobro ocenjen, kao i veliki broj članova iz Jugoslavije u Evropskom društvu za integritet i vek konstrukcija (ESIS), novom nazivu EGF. To je bio razlog da se prihvati ponuda Jugoslavije za organizaciju ECF 9 u 1992. Uprkos nepovoljnim okolnostima, ECF 9 je uspešno organizovana u Varni, Bugarska, angažovanjem stručnjaka, najvećim delom iz Beograda i Srbije. Osnivanjem DIVK 2001. godine, organizovanje IFMASS se nastavlja (2003 IFMASS 8, 2005 IFMASS 9). Sa 150 pojedinačnih članova i 18 kompanija–donatora, DIVK podstiče uvođenje postupaka ocene integriteta konstrukcija, prvenstveno organizovanjem seminara za obuku i sastanaka eksperata, kao što je slučaj i sa IFMASS 10.

Osnovni razlozi da se organizuje Deseta međunarodna letnja škola mehanike loma (IFMASS 10) su:

– da se nastavi sa obrazovanjem specijalista radi njihove bolje primene postupaka ocene integriteta konstrukcija;
– da se prikažu novi pristupi u praćenju konstrukcija i razvoju programa za širu primenu računara;
– da se uspostavi forum za razmenu rezultata istraživanja problema vezanih sa oštećenjima konstrukcija i sigurnom eksploatacijom. To je ostvareno na dva okrugla stola:
  Korišćenje softvera u oceni integriteta konstrukcija
  Iskustva u oceni integriteta i veka konstrukcija
  Teme IFMASS 10 su bile:
– Osnove mehanike loma
– Integritet i vek konstrukcija: teorija i praksa
– Numerički pristup analizi integriteta konstrukcija
– Dalji razvoj radi sigurne eksploatacije konstrukcija

IFMASS 8 monograph is published in English, available on DIVK web site www.divk.org.yu. The IFMASS 9 monograph is published in English in June 2008.

In addition to lecturers from Yugoslavia, world recognized experts also took participation as lecturers, from USA, Germany, Great Britain, France, Poland, Russia, Ukraine, Hungary, Romania, Bulgaria, Slovakia. Some of them took part several times having a series of lectures, e.g. Stojan Sedmak, Aleksandar Radović, Mladen Berković, Jovo Jarić, and Michael Wnuk, Mohan Ratwani, David Read, Harry Mac Henry (USA), John Radon (UK), Adam Mazur (Poland), Guy Pluvinage (France) and Bernd Michel, Petar Agatonović (Germany). Some famous names should also be noted, as Michael Burdekin, Pedro Marcel, Dominique Francois, Vera Ivanova, John Landes, Karl Heinz Schwalbe, Valerij Troschchenko, Ivan Hrivnak, Laszlo Toth. We are proud that George Irwin had prepared a long preface for monograph 3.

The number of participants was 62 in the first School, and successively 79, 84, 96, 145, 137, 107, and 51 in IFMASS 9.

Education is the first aspect of IFMASS. How successful it was shows the number of lecturers from Serbia, starting as participants: 9 at IFMASS 9, and 19 at IFMASS 10.

A second aspect is use of fracture mechanics and structural integrity assessment in industry, with very good results.

ORGANIZATION AND WORK OF IFMASS 10

Experts from Yugoslavia very early joined the activities of European Group of Fracture (EGF), in 1982 at the 4th European Conference on Fracture (ECF 4). The success of IFMASS is well evaluated in EGF, with impressive number of members from Yugoslavia in European Structural Integrity Society (ESIS), new name of EGF. This was the reason the offer Yugoslavia, as organizer of ECF 9 in 1992, accepted. In spite inconvenient circumstances, ECF 9 was successfully organized in Varna, Bulgaria, engaging experts, mostly from Belgrade and Serbia. The establishment of DIVK in 2001 continued organising IFMASS (2003 IFMASS 8, 2005 IFMASS 9). With 150 individual members and 18 companies-donors, DIVK supports introduction of structural integrity assessment methods by organising seminars and experts meetings, as is the case with IFMASS 10.

Basic reasons to organise the Tenth International Fracture Mechanics Summer School (IFMASS 10) are:

– to continue the education of specialists for better application of structural integrity assessment methods;
– to present new approaches in monitoring structures and software development for broader use of computers;
– to establish a forum for exchanging results in problems research, connected with structural damages and safe service. This is achieved through two round tables:
  The use of software in structural integrity assessment
  The experience in structural integrity and life assessment
  The topics of IFMASS 10 were:
– An outline of fracture mechanics
– Structural integrity and life: theory and practice
– Numerical approach to structural integrity analysis
– Further development for safe service of structures

Profesor dr Aleksandar Sedmak, predsednik DIVK, je otvorio IFMASS 10. Učesnicima su se obratili i direktor Vojno-tehničkog instituta, pukovnik prof. dr Mladen Pantić, direktor HIP Petrohemije Jano Kurai i predsednik organizacijskog komiteta dr Zijah Burzić**.**

Prof. Dr Aleksandar Sedmak, DIVK president, opened IFMASS 10. Military Technical Institute director, Col. Prof. Dr Milenko Pantić, HIP Petrohemija director, Jano Kurai, and president of the Organising Committee, Dr Zijah Burzić, had addressed the participants.

Predavanja IFMASS 10
Lectures IFMASS 10

Predavač – Lecturer	**Naslov predavanja**	**Lecture title**
Ponedeljak - Monday 23.06.2008	**Osnove mehanike loma**	**An outline of fracture mechanics**
A. Sedmak	Otkazi konstrukcija u eksploataciji	Failures of structures in service
M. Vnuk	Osnovne jednačine linearno-elastične mehanike loma	Basic equations of linear-elastic fracture mechanics
P. Agatonović	Mehanika loma u oblasti plastičnih deformacija	Fracture mechanics in the plastic range
M. Mićunović	Kriterijumi plastičnog loma za višeosni napon	Ductile failure criteria under multiaxial stress
M. Rakin	Mikromehanički konstitutivni izrazi u mehanici žilavog loma	Micromechanical constitutive expressions in elastic-plastic fracture mechanics
Z. Burzić	Analiza zamora primenom mehanike loma	Fatigue analysis using fracture mechanics
Utorak – Tuesday, 24.06.2008.	**Ocena integriteta i veka konstrukcija: teorija i praksa**	**Structural integrity and life assessment: theory and practice**
M. Zrilić	Eksperimentalno određivanje parametara mehanike loma	Experimental determination of fracture mechanics parameters
V. Grabulov	Značaj mehanike loma u oceni integriteta zavarenih konstrukcija	Significance of fracture mechanics in welded structure integrity assessment
M. Arsić	Praktični aspekti integriteta posuda pod pritiskom	Service aspects of pressure vessels integrity
K. Gerić	Analiza područja vrha prsline	Microstructural analysis of crack tip region
S. Kuzmanović	Poređenje postupaka ispitivanja bez razaranja u oceni integriteta konstrukcija	Comparison of non-destructive testing procedures in structural integrity assessment
M. Burzić	Značaj mehanike loma u oceni integriteta procesne opreme	Significance of fracture mechanics in process equipment integrity assessment
Sreda – Wednesday, 25.06.2008.	**Numerički pristup analizi integriteta konstrukcija**	**Numerical approach to structural integrity analysis**
T. Maneski	Analiza naponskog stanja konstrukcija u eksploataciji	Stress analysis of structures in service
S. Maksimović	Metode procene veka konstrukcija sa inicijalnim oštećenjima za opšti spektar opterećenja	Life assessment methods of initial damaged structures under general loading spectrum
N. Trišović	Modifikacija dinamičkih karakteristika u reanalizi mehaničkih sistema	Dynamic characteristics modification in the mechanical structures reanalysis
J. S. Asul, Alžir	Probabilistički model rasta prsline pod jednovremenim dejstvom pitinga i zamora	Probabilistic model of crack growth under simultaneous effect of pitting and fatigue
Četvrtak i petak Thursday and Friday 26.06.2008 - 27.06.2008.	**Dalji razvoj i obezbeđenje sigurne eksploatacije konstrukcija**	**Further development in safe service assurance of structures**
M. Kirić	Savremene metode ispitivanja bez razaranja	Modern methods for non-destructive testing
N. Gubeljak, Slovenija	Kontinuirano praćenje ponašanja konstrukcija i procena integriteta	Continuous monitoring of structures behaviour by holographic testing
P. Agatonović	Uprošćenja za konzervativnu ocenu integriteta konstrukcija	Simplifications for conservative assessment of structural integrity
N. Gubeljak	Teorijske osnove ocene integriteta i veka konstrukcija	Theoretical basis of structural integrity and life
N. Radović	Uticaj uključaka u metalnim materijalima	Effect of inclusions in metallic materials
Lj. Milović	Prsline u zoni uticaja toplote čelika za povišene temperature	Cracks in HAZ of steels for elevated temperature application
M. Vnuk	Analiza prslina na mezo nivou	Crack analysis at mezzo level
S. Sedmak	Analiza prslina na nano nivou	Crack analysis at nano level

Spisak predavača
List of lecturers

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Spisak učesnika
List of participants

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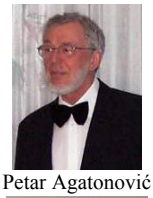
Džindo Emina	Marković Nenad	Pavlović Biljana	Aleksandar Veljović
Gačo Dženana	Manjgo Mersida	Pantić Mladen	Veljović Miodrag
Golubović Snežana	Milanović Miodrag	Petrašković Zoran	Vujić Dragoljub
Hojclajter Marko	Milatović Marija	Prokić-Cvetković Radica	Vukojević Nedeljko

Predavači i koautori prisutni na IFMASS 10
Lecturers and co-authors participating at IFMASS 10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Ljubica Milović

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Marko Rakin

Aleksandar Sedmak

Stojan Sedmak

Nataša Trišović

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Milorad Zrilić

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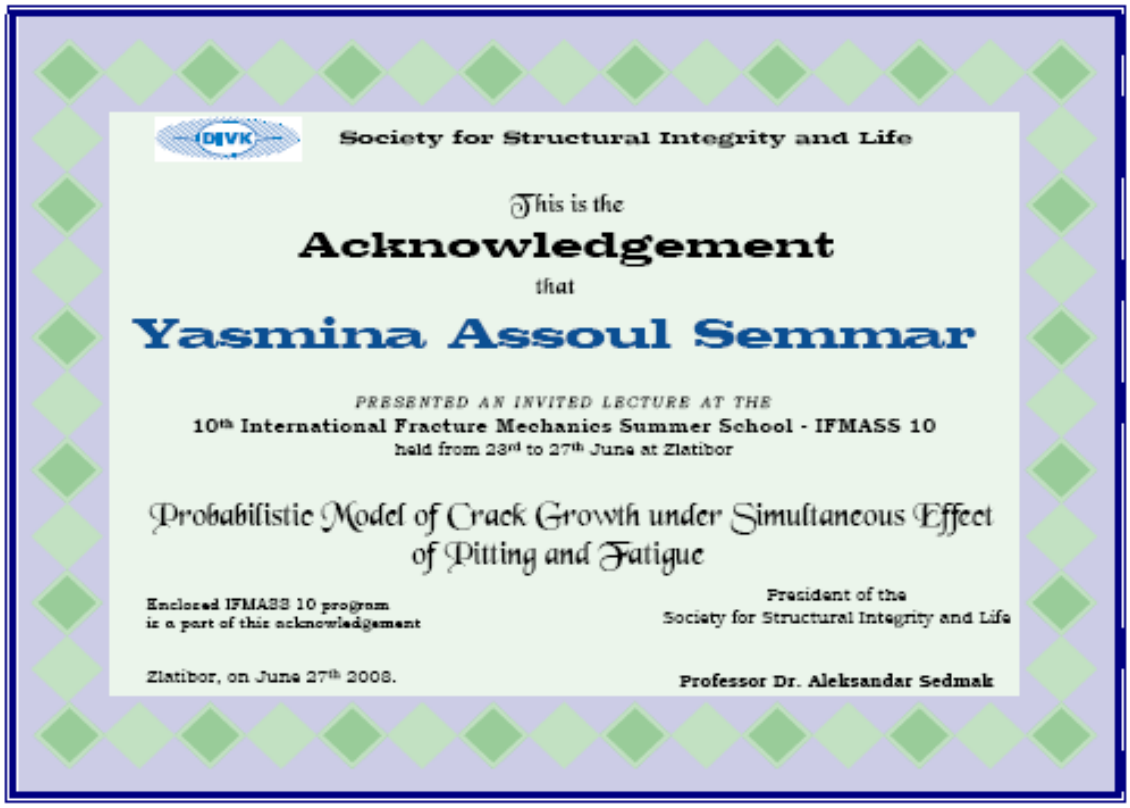

Society for Structural Integrity and Life

This is the

Acknowledgement

that

Yasmina Assoul Semmar

PRESENTED AN INVITED LECTURE AT THE
10th International Fracture Mechanics Summer School - IFMASS 10
held from 23rd to 27th June at Zlatibor

Probabilistic Model of Crack Growth under Simultaneous Effect of Pitting and Fatigue

Enclosed IFMASS 10 program is a part of this acknowledgement

President of the Society for Structural Integrity and Life

Zlatibor, on June 27th 2008.

Professor Dr. Aleksandar Sedmak

Society for Structural Integrity and Life

CERTIFICATE

That

Dženana Gačo

PARTICIPATED
10th International Fracture Mechanics Summer School
IFMASS 10

"Fundamentals of Fracture Mechanics and Structural Integrity"

held from 23rd to 27th June at Zlatibor

Enclosed IFMASS 10 program is a part of this certificate

President of the Society for Structural Integrity and Life

Zlatibor, on June 27th 2008.

Professor Dr Aleksandar Sedmak

DISKUSIJE OKRUGLOG STOLA

Osobenost ove Škole, IFMASS, su brojne diskusije u vidu organizovanih sastanaka ili slobodnih razgovora. To je bila prilika, ne samo za slušaoce, već i za predavače da steknu nova iskustvena saznanja i da dobiju nove ideje za razvoj i primenu mehanike loma. Nastavljajući ovakav trend i na IFMASS 10 su bila organizovana dva okrugla stola.

Korišćenje softvera u oceni integriteta konstrukcija

Uvodno izlaganje za diskusiju o korišćenju softvera u oceni integriteta konstrukcija je dao Aleksandar Sedmak. Tema je privukla veliki broj učesnika, čiji je doprinos u debati doprineo da se problem u dovoljnoj meri rasvetli.

Naglašena je pionirska uloga Mladena Berkovića u primeni metode konačnih elemenata u numeričkom pristupu za izračunavanje faktora integriteta napona K (predavanje na IFMASS 1) i J integrala (IFMASS 2), na osnovu čega je kasnije u nas razvijena i dobro utemeljena disciplina nazvana „računarska mehanika“. Istaknuto je da su kasnijem razvoju doprineli Stevan Maksimović, Dubravka Mijuca, Aleksandar Sedmak, Marko Rakin, Bojan Međo. Računarska mehanika je bila tema Međunarodne konferencije, održane 2004, koja je bila posvećena M. Berkoviću. Druga dva doprinosa u primeni metode konačnih elemenata su softverski paketi KOMIPS Taška Maneskog i saradnika, primenljiv za dijagnosticiranje konstrukcija u razvoju i eksploataciji, i PAK (Miloš Kojić, Miroslav Živković i saradnici), za rešavanje komplikovanih nelinearnih nestacionarnih problema.

Iako je dostignut zavidan nivo primene softvera u brojnim problemima ocene integriteta i veka konstrukcija, dalji razvoj postupaka je neophodan da bi se rešavali sve zahtevniji problemi u svim fazama razvoja konstrukcija i novih materijala.

U primeni analitičkih metoda i inženjerskih proračuna, posebno mesto zauzima SINTAP (**S**tructural **INT**egrity **A**ssessment **P**rocedure), najcelovitiji softver za analizu integriteta konstrukcija. O tome je N. Gubeljak rekao da je rezultat rada na evropskom projektu, koji predstavlja kompilaciju R6 procedure i ETM (**E**ngineering **T**reatment **M**ethod), kao i drugih razvijenih pristupa, a da uključuje kao svoj bitan deo i analizu integriteta zavarenih spojeva.

Zaključeno je da postojeći softveri omogućavaju pouzdanu inženjersku procenu integriteta konstrukcija, a da se za simulaciju ponašanja konstrukcija sa prslinom, uključujući njen rast, još uvek traže novi numerički alati, uz uvođenje novih metoda, kao što je bezmrežni proračun.

Iskustva u oceni integriteta i veka konstrukcija

Učesnici diskusije, A. Sedmak, Z. Burzić, P. Agatonović M. Wnuk, S. Sedmak, Z. Petrašković, M. Zrilić i drugi, su posebno istakli značaj povezivanja teorije, numeričkih metoda i eksperimenata u rešavanju problema mehanike loma i oceni integriteta konstrukcija. Polemika skoro svih učesnika je bila usmerena na gledište doprinosa numeričkih analiza i eksperimenata. Mišljenja su različita, a može se reći i isključiva. Tako su Wnuk, Burzić, Zrilić isticali eksperimente kao neizbežne. Druga grupa je prednost dala numeričkoj analizi i razvoju softvera.

ROUND TABLE DISCUSSIONS

The particularity of the School, IFMASS, are broader discussions, in the form of organised meetings or open conversations. This was an occasion not only for listeners but also for lecturers to reach new experienced cognitions and to get new ideas in the development and application of fracture mechanics. Following this trend, two round table discussions were organised at IFMASS 10.

The use of software in structural integrity assessment

Aleksandar Sedmak gave an introductory expose on the use of software in structural integrity assessment. The topic attracted a great number of participants, who contributed in a debate and helped to clarified the problem sufficiently.

The pioneer role of Mladen Berković in finite element method applications in numerical approach for calculating the stress intensity factor K (IFMASS 1 lecture) and the J integral (IFMASS 2) were underlined as the basis for further development and establishment of the discipline called “numerical mechanics”. Later, it is emphasized contribution of Stevan Maksimović, Dubravka Mijuca, Aleksandar Sedmak, Marko Rakin, Bojan Medjo. Numerical mechanics was the theme of an international conference, held in 2004, devoted to M. Berković. Other two contributions of the use of finite element method are software packages KOMIPS by Taško Maneski and co-workers, applicable for diagnostics of structures in development and in service, and PAK by Miloš Kojić, Miroslav Živković, and co-workers, for solving complex non-linear non-stationary problems.

Although a respectable level of software use in numerous problems of structural integrity and life assessment is achieved, a further development of procedures is necessary for solving more demanding problems in all stages of structural development and new materials.

A special position in applying analytical and engineering calculation methods is the SINTAP (**S**tructural **INT**egrity **A**ssessment **P**rocedure), a most complete software for structural integrity analysis. N. Gubeljak said that it is the result of European project, the compilation of R6 procedure and ETM (**E**ngineering **T**reatment **M**ethod), as well as other available approaches, including an substantial part of structural integrity analysis of welded joints.

It is concluded that the available software enables reliable evaluation of structural integrity, and in case of simulating cracked structures, including crack growth, yet new numerical tools are requested, in addition to newly introduced methods, as meshless calculation.

Experience in structural integrity and life assessment

Participants in the discussion, A. Sedmak, Z. Burzić, P. Agatonović, M. Wnuk, S. Sedmak, Z. Petrašković, M. Zrilić and others, emphasized the importance of interrelating theory, numerical methods and experiments in solving fracture mechanics problems and structural integrity assessment. Most participants debated on contributions of numerical analysis and experiments. Views are different, even exclusive. Wnuk, Burzić, Zrilić pointed out experiments as inevitable. The other group rather preferred numerical analysis and software development.

Petrašković je ukazao na nedovoljno izučen problem stabilnosti (izvijanja i izbočavanja) lakih i vitkih konstrukcija, koje gube integritet zbog globalne ili lokalne nestabilnosti, iako u njima nema prslina i granična stanja nosivosti nisu prekoračena. On je ukazao i na savremeni pristup ispitivanja građevinskih konstrukcija niskocikličnim zamorom u sistemu zaštite od zemljotresa.

Otvorena je i diskusija nivoa razmatranja mehanike loma, odnosno, šta se dešava pri dilataciji i posle raskida atomske veze, što je interesantno za nano materijale, i kakva je priroda te veze. Tako su pominjani makro, mezo, mikro i nano nivoi, ali bez jasnog zaključka.

DRUŠTVENE AKTIVNOSTI

Vreme na Zlatiboru je bilo izuzetno pogodno, naročito zaljubljenicima u duge šetnje pored Zlatiborske reke i jezera, zaštitnog znaka Zlatibora, i kroz bogatu šumu. Učesnici škole su mogli da razgledaju jedinstveni ambijent. Većina učesnika IFMASS 10 je pohvalila odličnu organizaciju. Hotel Lovac u Vodicama na 1200 metara nadmorske visine doprineo je impresivnoj atmosferi.

Izlet

Za učesnike Škole je organizovan izlet na vodopadu reke Katušnice i muzeju na otvorenom prostoru „Staro selo“. U blizini vodopada se nalazi selo Gostilje, u kome je rodna kuća Dimitrija Tucovića, zatim Stopića pećina, blizu sela Rožanstvo, i banja Vapa sa izvorima lekovite vode.

Vodopad, jedan od najvećih (20 m) i najlepših u Srbiji, je turistička atrakcija živopisnog kraja.

Posle posete vodopadu i prelepoj okolini, put je nastavljen ka muzeju, gde su posetioce ljubazni domaćini upoznali sa ovim lepim mestom. U muzeju „Staro selo“ je izložena arhitektura i uređenje naselja, privređivanje i život u planinskim predelima Zlatibora. Etno selo predstavlja tradicionalno materijalno i duhovno nasleđe tipičnog srpskog sela. Zgrade su autentične i nameštene kao u staro doba, ukupno 50 brvnara sa preko 2000 eksponata. U posebnoj zgradi za odmor, posetioci su predahnuli i okrepili se poznatim zlatiborskim specijalitetima.

Svečana večera i dodeljena priznanja

Svečanoj večeri prisustvovalo je ukupno 82 zvanice, predavači i koautori, učesnici, predstavnici sponzora, organizatori i pozvani gosti. Veče je proteklo u prijatnoj atmosferi, uz dobra jela i lepu muziku. To je bila prilika za druženje, ali i za stručne razgovore.

Organizacijski odbor je ovom prilikom podelio predavačima zahvalnice za doprinos, a učesnicima sertifikate o prisustvu.

Upravni odbor DIVK je obeležio 28 godina postojanja IFMASS i jubilarnu IFMASS 10, proglašenjem priznanja za uspešan rad i uspostavljenu tradiciju. Legendama IFMASS su proglašeni

Stojan Sedmak i **Majkl Vnuk,** osnivači**,**

Jovo Jarić i **Mladen Berković,** utemeljivači teorijskog i numeričkog pristupa, i

Aleksandar Radović, koji je uveo analizu ponašanja materijala u konstrukcijama.

Petrašković drew attention to a scarcely analysed stability problem (buckling and warping) of light and slim structures that loose integrity due to local and total instability, although they do not contain cracks and limit load states are not exceeded. He also presented a modern approach in testing civil engineering structures by low-cycle fatigue in earthquake protection systems.

A discussion took on to the scale levels of fracture mechanics, as what goes on during dilatation and after atomic bond breaking, and is an interesting matter in nano materials, and what is the nature of this bond. Macro, mezzo, micro and nano levels are referenced, but without a clear conclusion.

SOCIAL EVENTS

The weather on Zlatibor was nice, particularly in favour of those passionate in long walks around Zlatibor river and lake, as brands of Zlatibor, and through the rich forest. Participants enjoyed in a unique ambient. Most of the participants praised the organisation as excellent. Hotel Lovac (Hunter) and its environment at 1200 m above sea level in Vodice contributed to the impressive atmosphere.

Excursion

An excursion was organised to the Katušnica waterfalls and to the “Old Village” open area museum. Participants visited Gostilje, a village in the vicinity of the falls, known as the birth house of Dimitrije Tucović, and then Stopića cave, near village Rožanstvo, and the health spa Vapa.

The waterfalls, one of the highest (20 m) and nicest in Serbia, is a touristic attraction of this picturesque region.

After the visit to the waterfall and beautiful environment, the route continued to the museum, where hospitable hosts presented this nice place. The “Old Village” museum is an open air arrangement and architecture of traditional colony economy and life in mountainous regions of Zlatibor. The ethno village represents material and mental heritage of a typical Serbian village. Village remains are authentic and preserved as in the past, altogether 50 wooden houses with over 2000 exhibits. Visitors relaxed the afternoon in one of the premises consuming traditional delicacies from Zlatibor.

Gala dinner and awarded recognitions

All together 82 invited attended the gala dinner, lecturers and co-authors, participants, sponsor representatives, organisers and invited guests. The evening passed in agreeable atmosphere, with good meals and nice music. It was the opportunity for communion, also for professional talks.

The Organising committee used the event to deliver acknowledgements to lecturers for their contribution and certificates to attendees.

DIVK Governing Board marked 28 years of IFMASS and the IFMASS 10 jubilee, announcing recognitions for successful work and established tradition. As Legends of IFMASS are proclaimed:

Stojan Sedmak and **Michael Wnuk,** founders**,**

Jovo Jarić and **Mladen Berković,** establishers of theoretical and numerical approaches, and

Aleksandar Radović, involved the analysis of material behaviour in structures.

Posebnu zahvalnost Upravni odbor DIVK je izrazio **Mohanu Ratvaniju** za pet predavanja na prvoj letnjoj školi o osnovama mehanike loma, i za njegova kasnija brojna predavanja, **Džonu Rejdonu** za više lekcije o zamoru, **Adamu Mazuru** za predavanja o naponskoj koroziji i analizi havarija, **Dejvidu Ridu** za prikaz i primenu njegove metode direktnog merenja J integrala, i **Petru Agatonoviću** za više sjajnih fundamentalnih i preglednih predavanja**.**

U istoj prilici dodeljena su specijalna priznanja **Vencislavu Grabulovu** za prisustvo na svim školama (jedini uz Stojana Sedmaka), **Nenadu Gubeljaku** za vernost Školi i podršku u najtežim trenucima (na pr. IFMASS 6), **Blagoju Petrovskom** za doprinos u međunarodnoj saradnji.

U skladu sa njihovim dosadašnjim doprinosom i godinama, očekuje se od **Marka Rakina, Nenada Gubeljaka, Gorgi Adžieva i Nenada Radović**, da preuzmu budućnost IFMASS u svoje ruke.

Special gratitude DIVK Governing Board expressed to **Mohan Ratwani** for five lectures at first Summer School, on fundamentals of fracture mechanics and his numerous lectures that followed, to **John Radon** for several lectures on fatigue, to **Adam Mazur** for lectures on stress corrosion, to **David Read** for the presentation and use of his method for direct measurement of J integral, and to **Petar Agatonović** for several brilliant fundamental and reviewing lectures.

The occasion also served to present special recognitions to **Vencislav Grabulov** for participating at all the Schools (the only one aside to Stojan Sedmak), to **Nenad Gubeljak** for fidelity and his support in most difficult situations (e.g. IFMASS 6), to **Blagoj Petrovski** for international cooperation.

According to their contribution so far and their age, it is expected **Marko Rakin, Nenad Gubeljak, Gorgi Adžiev** and **Nenad Radović** to take the future of IFMASS into their hands.

IFMASS 10 U SLIKAMA
IFMASS 10 IN IMAGES

Otvaranja škole i pozdravi *School opening and addresses*

Aleksandar Sedmak u ime DIVK
Aleksandar Sedmak on behalf of DIVK

Mladen Pantić u ime VTI
Mladen Pantić on behalf of VTI

Zijah Burzić za organizacioni odbor
Zijah Burzić for Organizing Committee

Predavanja *Lectures*

Zajednička slika grupe učesnika Joint photograph of participants

Na predavanjima At the lectures

Michael Wnuk

Katarina Gerić

Stevan Kuzmanović

Vencislav Grabulov

Nenad Gubeljak

Meri Burzić

Nataša Trišović

Stevan Maksimović

Milan Mićunović

Milorad Zrilić

Pauze za kafu *Coffee breaks*

Diskusije za okruglim stolom *Round table discussions*

Vesti iz DIVK **News from DIVK**

LJUBICA MILOVIĆ, GENERALNI SEKRETAR DIVK

Zaposlena je na Tehnološko-metalurškom fakultetu Univerziteta u Beogradu.

Na Mašinskom fakultetu Univerziteta u Beogradu diplomirala je sa radom „Projekat hidraulične podizne platforme za rad na elektrorazvodnim mrežama“, magistrirala sa radom „Numeričko i analitičko određivanje parametara elastoplastične mehanike loma“ i doktorirala sa radom „Analiza integriteta zavarenih komponenata procesne opreme za povišene radne temperature“.

Do prelaska na Tehnološko-metalurški fakultet radila je na Mašinskom fakultetu na katedrama za Mehanizaciju, Opšte mašinske konstrukcije i Motorna vozila.

Koautor je 4 priručnika i autor 36 radova i učestvovala je na mnogim međunarodnim i domaćim naučno-istraživačkim projektima.

Organizovala je tri Međunarodne letnje škole mehanike loma–IFMASS 6, 7 i 8, a član je Društva za integritet i vek konstrukcija (DIVK) od osnivanja 2001. godine, Evropskog društva za integritet konstrukcija (ESIS) i Društva za unapređivanje zavarivanja u Srbiji (DUZS).

Is employed at the Faculty of Technology and Metallurgy, University of Belgrade.

At the Faculty of Mechanical Engineering, University of Belgrade, she has received the following degrees: diploma “The Design of Hydraulic Elevated Platform for Electric Distributing Networks,” defended masters thesis “Elastic-plastic Fracture Mechanics Numerical and Analytical Parameters Determination,” and earned her doctoral degree by defending “The Analysis of Integrity of Process Equipment Welded Components for Elevated Operating Temperatures”.

Before her present employment, she worked at the Institutes of Mechanization; General Machine Elements; and Motor Vehicles, at the Mechanical Engineering Faculty in Belgrade.

She is co-author of 4 handbooks and author of 36 papers and participated in numerous foreign or domestic science and research projects.

She has organized three International Fracture Mechanics Summer Schools–IFMASS 6, 7, and 8, and is member of: the Society for Structural Integrity and Life (DIVK) since its foundation in 2001; the European Society for Structural Integrity (ESIS), and Serbian Society for Advancement of Welding (DUZS).

SEDNICA UPRAVNOG ODBORA DIVK

U četvrtak, 4. septembra 2008. na Tehnološko-metalurškom fakultetu održana je sednica Upravnog odbora DIVK. Prisutni su bili predsednik prof. dr Aleksandar Sedmak, potpredsednik dr Zijah Burzić, članovi Upravnog odbora Miodrag Pavišić, Vasilije Sarić i dr Milorad Zrilić.

Dnevni red

1. Jesenje aktivnosti DIVK. Za naredni period planirano je:
a. Peta godišnja konferencija DIVK
b. Seminar „Ispitivanje zatezanjem metalnih materijala“
c. Seminar „Izrada i integritet predizolovanih toplovoda“
d. Saradnja u ARW NATO “Security and reliability of damaged structures and defective materials”
2. Imenovanje generalnog sekretara
3. Izveštaj o radu časopisa Integritet i vek konstrukcija u 2008. god.
4. Finansijski izveštaj za 2008. godinu
5. Izveštaj Nadzornog odbora
6. Predlog promene statuta i organizacije DIVK

Upravni odbor je razmatrao predlog o izmenama i dopunama Statuta DIVK.

7. Plan rada u 2009. godini
8. Saradnja sa ESIS i organizacija 18. Evropske konferencije o lomu 2010
9. Razno

GODIŠNJA KONFERENCIJA DIVK

Godišnja konferencija DIVK zakazana je za 4. i 5. decembar 2008. U četvrtak 4. decembra, prvog dana Konferencije (u Institutu za ispitivanje materijala–IMS Beograd, www.institutims.rs) biće prikazano 5 radova članova DIVK izloženih na ovogodišnjem *NATO Workshop (An Advanced Research Workshop on Security and Reliability of Damaged Structures and Defective Materials)*, održanom 19.–22. oktobra ove godine u Portorožu, kao i 5 radova sa *New Trends in Fatigue and Fracture 8th Meeting NT2F8*, održanom u Ankaranu 23. i 24. oktobra.

Pozivamo zainteresovane članove DIVK da 4. decembra, u obliku rada, izlože svoja postignuća i novosti iz prakse iz protekle godine. Radove treba poslati najkasnije do 15. novembra 2008. na adresu acibulj@tmf.bg.ac.yu.

U petak 5. decembra 2008. godine, u Vojnotehničkom institutu u Žarkovu (www.vti.mod.gov.yu) održaće se seminar pod nazivom *Lomovi i vek vazduhoplova (Aircraft Failures and Life Assessment)*. DIVK će ove godine ugostiti dr Rasela Vanhila (Russel Wanhill) iz *National Aerospace Laboratory NLR* (Holandija) i dr Simona Bartera iz *Defence Science and Technology Organisation DSTO* (Melburn, Australija), koji će imati dva uvodna predavanja. Seminar će se nastaviti radovima iz oblasti loma i veka vazduhoplova koje će izložiti kolege iz VTI Žarkovo. Detaljan program oba dana Konferencije biće objavljen na sajtu (www.divk.org.yu) 16. novembra 2008. godine i u narednom broju (br.3) časopisa IVK za 2008. godinu.

DIVK – MONOGRAFIJE

Obaveštavamo sve članove DIVK da je izašla iz štampe monografija na engleskom jeziku sa 9. Međunarodne letnje škole mehanike loma–IFMASS 9, održane u Bugarskoj 2005. godine. Knjigu možete naručiti preko kancelarije DIVK kancelarija@divk.org.yu po ceni od 800 dinara plus troškovi poštarine.

IFMASS 9

THE CHALLENGE OF MATERIALS AND WELDMENTS

– Structural Integrity and Life Assessments –

Editors: S. Sedmak, Z. Radaković, J. Lozanović
Belgrade 2008

Contents:

– Preface
– S. Sedmak: Crack problems in welded structures
– M. Wnuk: Structural integrity of bonded joints
– D.M. Constantinescu: Stress intensity factors and integrity assessment by strain gauges and photo elasticity
– M. Rakin, A. Sedmak: Micromechanical analysis in structural integrity assessment
– N. Radović, A. Radović: Advanced Structural Steels
– V. Grabulov, Z. Burzić, D. Momčilović: Significance of mechanical testing for structural integrity
– M. Kirić, R. Jovičić, J. Kurai: Testing for detection and evaluation of cracks
– K. Gerić: Cracks and microstructure modelling in welded joints
– V. Šijački-Žeravčić, G. Bakić, M. Đukić, B. Anđelić: Failure at elevated temperatures
– M. Zrilić: Residual stresses induced by welding
– I. Orynyak: Limit load calculation model of ductile failure of defective pipe and pressure vessel
– T. Maneski: Numerical analysis for integrity assessment of welded structures
– G. Pluvinage: Failure and damage in pipes by subcritical and critical crack growth
– L. Marsavina, R. A. Tomlinson: Thermoelastic methodology for structural integrity assessment
– G. Adžiev: Structural integrity assessment procedures and their application

SKUPOVI – EVENTS

TREĆA MEĐUNARODNA KONFERENCIJA O ANALIZI OTKAZA KONSTRUKCIJA (ICEFA-III) 2008

održana je u Sidžesu u Španiji od 13. do 16. jula 2008. godine
detaljnije informacije o konferenciji naći ćete na
www.icefa.elsevier.com

Posle prve konferencije u Lisabonu 2004. godine, druge u Torontu 2006. godine i ove godine je održana konferencija međunarodnog značaja sačinjena od pojedinačnih kraćih usmenih prezentacija i poster sekcije koja pokriva široko polje mehanizama otkaza pojedinih delova i konstrukcija. Jer dok god analiza otkaza sama po sebi predstavlja vredan alat kojim se određuje šta je pošlo naopako i dovelo do otkaza, važno je izvući pouke iz istraživanja uzroka koji su doveli do otkaza da bi se oni ubuduće izbegli i da bi se poboljšalo projektovanje, konstruisanje, prerada, proizvodnja i rukovanje.

Konferencijom su rukovodili Dejvid Džouns sa Kembridža, Engleska, i Gustavo Gvinea sa Politehničkog univerziteta u Madridu, Španija.

Na trodnevnoj konferenciji izloženo je 6 uvodnih predavanja, 48 usmenih desetominutnih izlaganja; prikazan je 121 poster. Predavanja su bila razvrstana u sledećih 12 sekcija:

1. Otkazi vazduhoplova i vozova,
2. Otkazi kao posledica zamora–prvi deo,
3. Otkazi nemetalnih materijala,
4. Otkazi mehaničkih sklopova,
5. Otkazi konstrukcija,
6. Projektovanje i otkaz u plastičnoj oblasti i kod puzanja,
7. Krti lom i mehanika loma,
8. Projektovanje mehaničkih sklopova,
9. Projektovanje i otkaz vozila,
10. Korozija i uticaj okoline na nastanak prslina,
11. Otkazi kao posledica zamora–drugi deo, i
12. Otkazi gasnih turbina.

Od članova DIVK na ovogodišnjoj ICEFA-III predstavile su poster Ivana Cvijović-Alagić i Ljubica Milović:

– *Effect of alloy purity on fracture behaviour of overaged 7000 alloy plates*, Z. Cvijović, M. Vratnica, I. Cvijović-Alagić
– *Failure analysis of rotary screw pump*, Lj. Milović, M. Zrilić

Sidžes je letovalište pedesetak kilometara južno od Barselone do koje se za nepun sat stiže vozom. Glavni organizator ICEFA profesor Dejvid Džouns još uvek nije odlučio gde će se održati sledeća konferencija. U igri je i Beograd, jer, kako reče, potrebni su lep krajolik i međunarodni aerodrom. S obzirom da su teme ICEFA vrlo aktuelne i interesantne, a učešće na konferenciji prilično skupo, Beograd kao potencijalni cilj na koji bi Elsevirov tim idući put sleteo i nije loša zamisao!

THIRD INTERNATIONAL CONFERENCE ON ENGINEERING FAILURE ANALYSIS ICEFA-III 2008

was held in Sitges in Spain, from July 13–16, 2008.
for more detailed information please go to
www.icefa.elsevier.com

After the first conference in Lisbon in 2004, and the second in Toronto in 2006, this years conference of international importance was composed of individual short oral presentations and poster sections, covering a wide field of failure mechanisms in certain parts and structures. So as far as failure analysis by itself represents a valuable tool for determining what went wrong and had resulted in failure, it is also important to draw out lessons from researching the causes that had led to failure so they can be avoided in the future and to improve design, construction, processing, manufacture and handling.

The conference was led by David Jones from Cambridge, England, and Gustavo Guinea from the Politechnical University in Madrid, Spain.

The three-day conference had 6 introductory lectures, 48 oral 10-minute presentations and 121 posters. Presentations were arranged in the following 12 sections:

1. Aerospace and railway failures,
2. Fatigue failures I,
3. Failure of non-metallic materials,
4. Failures of mechanical systems,
5. Structural failures,
6. Design and failure with plasticity and creep,
7. Brittle fracture and fracture mechanics,
8. Design of mechanical systems,
9. Design and failure of vehicles,
10. Corrosion and environmentally-assisted cracking,
11. Fatigue failures II,
12. Gas turbine failures.

Ivana Cvijović-Alagić and Ljubica Milović, both DIVK members, had presented posters:

– *Effect of alloy purity on fracture behaviour of overaged 7000 alloy plates*, Z. Cvijović, M. Vratnica, I. Cvijović-Alagić
– *Failure analysis of rotary screw pump*, Lj. Milović, M. Zrilić

Sitges is a summer resort located 50 kilometres south of Barcelona, and can be reached by train in less than an hour. ICEFA main organiser, David Jones, has not yet decided where the following conference will be held. Belgrade is a candidate, the beautiful surroundings and international airport are a requirement, as he had said. ICEFA topics are so up-to-date and interesting, participation is usually very expensive, leaving Belgrade as a potential host the Elsevier team might visit. A good idea!

17. EVROPSKA KONFERENCIJA O LOMU (ECF 17)

Multilevel Approach to Fracture of Materials, Components and Structures
održana je u Brnu, Češka, od 2. do 5. septembra 2008. godine
detaljnije informacije o konferenciji naći ćete
http://ecf17.fme.vutbr.cz

Počev od 1976. u Francuskoj, Evropska konferencija o lomu se održava svake druge godine u zemljama Evrope. Ove godine prvi put u Češkoj, ECF 17 su organizovali Mašinski fakultet Tehnološkog Univerziteta u Brnu i Institut za fiziku materijala Češke Akademije Nauka. Konferencijom su predsedavali profesori Jaroslav Pokluda i Petr Lukaš.

Cilj ovogodišnje konferencije ECF 17 bio je da se na jednom mestu okupi forum korisnika, proizvođača i istraživača, kako inženjera tako i naučnika, koji bi predstavio rezultate različitih aspekata loma. ECF 17 je usmerena ka tzv. *multilevel* pristupu lomu

17TH EUROPEAN CONFERENCE ON FRACTURE

Multilevel Approach to Fracture of Materials, Components and Structures
held in Brno, Czech Republic, from September 2 to 5, 2008
more detailed information about the conference at
http://ecf17.fme.vutbr.cz

Since 1976 in France, the European Conference on Fracture is held every second year in European countries. This year, for the first time in Czech Republic, ECF 17 was organized by Faculty of Mechanical Engineering at the University of Technology in Brno, and the Czech Institute for Physics of Materials of the Czech Academy of Sciences. The conference was led by professors Jaroslav Pokluda and Petr Lukaš.

This year's ECF 17 goal was to gather a forum of users, manufacturers and researchers, both engineers and scientists, that had presented results in different aspects of fracture. ECF 17 targets at

materijala, komponenata i konstrukcija sa naglaskom na istraživanje procesa loma na mikro, mezo i makro nivou.

Ovogodišnja konferencija nije bila posećena kao prethodna koja je održana u Grčkoj, iako su vodeća imena koja se bave fenomenom loma bila prisutna. Održano je 13 plenarnih predavanja, 256 radova je izloženo usmeno, a prisutni su mogli da pogledaju 62 postera.

Od članova DIVK na ovogodišnjoj Evropskoj konferenciji o lomu prisustvovale su Ljubica Milović i Slobodanka Boljanović. Prvog dana konferencije, u okviru sekcije *Temperature Effect* kojom je predsedavao Guocai Chai (guocai.chai@sandvik.com) iz Švedske, Ljubica Milović je usmeno izložila rad *Experimental Determination of J-integral at Elevated Temperatures* autora Lj. Milović, M. Zrilić, S. Sedmak, A. Sedmak i M. Burzić. U petak, poslednjeg dana konferencije, Slobodanka Boljanović je u okviru sekcije *Reliability and Life of Components* kojom je predsedavao Hans-Peter Genser (Hans-Peter.Gaenser@unileoben.ac.at) iz Austrije, usmeno izložila rad *Fatigue Life Analysis of Damaged Structural Component using Strain Energy Density Method*, autora S. Maksimović, S. Boljanović, V. Orović, M. Komnenović. U okviru poster sekcije imali smo rad *Modelling of Ductile Crack Growth in Welded Joints using Micromechanical Failure Criterion* autora M. Rakin, N. Gubeljak, M. Dobrojević, B. Međo, A. Sedmak.

Organizatori su učesnicima priredili koktel dobrodošlice u auli Univerziteta Brno, zatim banket u prelepom zdanju iz 1890. godine, Besední Dům, gde su učesnici imali prilike da uživaju u izvrsnom pevanju podmlatka hora *Vox Iuvenalis*. Svečana večera uz tradicionalnu dodelu ESIS nagrada i odličnu pratnju lokalnog džez orkestra je bila u Vanik galeriji, velikom industrijskom kompleksu sa proizvodnim halama i pratećim objektima, sazidanim 1865. godine, koji je od marta 2006. pretvoren u moderan galerijski prostor gde se, pored stalne postavke savremenih čeških slikara iz perioda 1985-2005, održavaju koncerti, predstave i izložbe.

ESIS savet

U sredu 3. septembra održan je sastanak ESIS. Pored tekućih pitanja kao što je visina članarine, broj članova (Srbija 74 člana 2006. i 75 članova 2007.), način glasanja, izbor komisije za dodelu nagrada (ovogodišnji laureati su Emanuel Tutos, Cetin Moris Sonsino, Alberto Karpinteri i Robert Entoni Einsvort), izabrani su i novi predsednici TC1–Elastic-plastic Fracture Mechanics, rus Valerij Šljanikov i za TC8–Numerical Methods, nemac profesor Juan. S obzirom da se članovi TC7–FM Nomenclature ne sastaju, predloženo je da se grupa ugasi ukoliko ne oživi do sledećeg sastanka koji će biti kroz godinu dana. Najavljen je i nov 9th International ASTM/ESIS Symposium on Fatigue and Fracture koji će se održati u Vankuveru u Kanadi od 20. do 22. maja 2009. Sledeća konferencija ECF 18 biće u Drezdenu od 29. do 3. septembra 2010, apstrakte treba poslati do 1. septembra 2009, a gotove radove do 31. marta 2009. Utvrđena je i kotizacija koja će za učesnike iznositi 660 EUR, za članove ESIS 640 EUR i za studente 150 EUR.

Ove godine nije bilo više od jednog predloga za ECF 19: jedinu kandidaturu je izneo Robert Goldstein, dopisni član Ruske Akademije Nauka i potpredsednik Ruske grupacije za lom, za 20. do 24. avgust 2012. u Permu (Rusija). Perm je čuveni naučni i univerzitetski grad na granici Evrope i Azije, na zapadnoj strani Urala, na obali jedne od najdubljih ruskih reka–Kama. Vremenska razlika u Permu iznosi +5 GMT, udaljen je od Moskve 2 sata leta avionom i 18 sati putovanja vozom. Reakcije na predlog profesora Goldsteina bile su glasne i negativne. Većina članova ESIS Saveta bi podržala Rusiju ukoliko bi ponudili Moskvu ili Sankt Peterburg. Posle duže i neprijatne rasprave dogovorili su se da do kraja ove godine članovi ESIS Saveta glasaju e-mailom prihvataju li Perm ili ne.

the so-called multi-level approach to fracture of materials, components and structures with emphasis on researching fracture processes at the micro, mezzo, and macro scales.

The conference was not massively attended as the previous, held in Greece, despite the presence of leading names in fracture phenomena. There were 13 plenary lectures, 256 papers with oral presentation, and participants were able to view 62 posters.

Among DIVK members who had attended this year's European Conference on Fracture were Ljubica Milović and Slobodanka Boljanović. On the first day of the conference, within the scope of section *Temperature Effect*, chaired by Guocai Chai from Sweden (guocai.chai@sandvik.com), Ljubica Milović presented the paper *Experimental Determination of J-integral at Elevated Temperatures* by Lj. Milović, M. Zrilić, S. Sedmak, A. Sedmak and M. Burzić. On the last day Friday, Slobodanka Boljanović had presented the paper *Fatigue Life Analysis of Damaged Structural Component using Strain Energy Density Method*, by S. Maksimović, S. Boljanović, V. Orović, M. Komnenović, in section *Reliability and Life of Components*, chaired by Hans-Peter Genser from Austria (Hans-Peter.Gaenser@unileoben.ac.at). In the scope of the poster section our members presented *Modelling of Ductile Crack Growth in Welded Joints using Micromechanical Failure Criterion*, by M. Rakin, N. Gubeljak, M. Dobrojević, B. Međo, and A. Sedmak.

The organisers arranged a welcoming cocktail in the hall of the Brno University of Technology, and a banquet in a magnificent neo-renaissance building Besední Dům, where participants enjoyed the lovely junior chorus *Vox Iuvenalis*. The ceremonial dinner was arranged with traditional ESIS awards and excellent background performance of the local jazz orchestra at the Vanik gallery, a large industrial complex with halls and auxiliary structures, built in 1865, and converted into a modern gallery in March 2006 that hosts concerts, shows and exhibitions, including a permanent exhibition of modern Czech painters from the period 1985-2005.

ESIS Council

The ESIS Council held a meeting on Wednesday, 3rd September. Aside to current issues, as membership fee, enlisted members (Serbia has 74 members 2006, and 75 in 2007), voting procedure, election of the Committee for awards (this year's laureates are Emmanuel Gdoutos, Cetin Morris Sonsino, Alberto Carpinteri and Robert Anthony Ainsworth), the new chairmen are elected: TC1–Elastic-Plastic Fracture Mechanics, Valerij Shlyannikov from Russia; and TC8–Numerical Methods, professor Juan from Germany. Since members of TC7–FM Nomenclature did not meet, the group will eventually be deactivated unless it activates until the next meeting within a year, as suggested. The upcoming 9th International ASTM/ESIS Symposium on Fatigue and Fracture is announced to be held in Vancouver, Canada, from May 20 to 22, 2009. The next conference ECF 18 will be held in Dresden, from Aug. 29 to Sep. 3, 2010, abstracts deadline is Sep. 1, 2009, and for final papers March 31, 2009. The conference fee for regular participants is 660 EUR, for ESIS members 640 EUR, and for students 150 EUR.

Only one suggestion was made this year for ECF 19: a single candidacy came from Robert Goldstein, a corresponding member the Russian Academy of Science and vice-president of the Russian Group for Fracture, declaring it for 20-24 August 2012, in Perm (Russia). Perm is a famous science and university city on Europe-Asia border, on the western part of Ural mountains, on the coast of one of deepest Russian rivers–Kama. The time difference in Perm is +5 GMT, and can be reached by a 2-hour flight, or 18 hours by train, from Moscow. Reactions to Prof. Goldstein's suggestion were loud and negative. Most ESIS Council members would support Russia if they would offer Moscow or Sankt Petersburg as venues. After a long and unpleasant argument, the ESIS Council members agreed to vote by e-mail until the end of the year.

ARW NATO
SIGURNOST I POUZDANOST OŠTEĆENIH KONSTRUKCIJA I MATERIJALA SA GREŠKAMA

od 9–22.10.2008, Portorož, Slovenija

U zajedničkoj organizaciji Univerziteta u Mecu (Francuska) i Univerziteta u Beogradu (Srbija) pod okriljem NATO programa Nauka za mir i sigurnost. Direktor je prof. Gij Plivinaž, a ko-direktor prof. Aleksandar Sedmak.

ARW NATO
SECURITY AND RELIABILITY OF DAMAGED STRUCTURES AND DEFECTIVE MATERIALS

from 9–22.10.2008, Portorož, Slovenia

Organised jointly by the University of Metz–UNIM (France) and University of Belgrade (Serbia) under the auspices of NATO Programme Science for Peace and Security. Director is Prof. Guy Pluvinage, and co-director Prof. Aleksandar Sedmak.

Spisak prezentacija – List of presentations

Autor – Author	Koautor - Co-author	Naslov	Title
Aleksandar Sedmak	Jasmina Lozanović *Lubica Milović*	Razvoj i primena parametara prsline	Development and application of crack parameters
Nenad Gubeljak		Postupci za ocenu integriteta konstrukcije	Procedures for structural integrity assessment
Ihor Dmytrakh	Volodymir Panasyuk	Ocena lokalnog oštećenja od korozije zavarenih cevi od različitih materijala	Assessment of localised corrosion damaging of welded dissimilar pipes
Valeriy Kharchenko	Valerij Troshchenko	Naponsko stanje i kriterijumi čvrstoće NPP konstrukcijskih elemenata sa prslinom	Stressed state and strength criteria of NPP structural elements with flaws.
Stojan Sedmak	Zijah Burzić, Vencislav Grabulov, Radomir Jovičić	Ponašanje zavarenih spojeva u eksploataciji (sa posebnim osvrtom na opremu pod pritiskom)	Welded joints behaviour in service (with special reference to pressurized equipment)
Jano Kurai	*Miodrag Kirić*	Iskustva u ispitivanju bez razaranja procesne opreme	Experience in non-destructive testing of process equipment
László Tóth	Gyongyver Lenkey	Sigurnost termoelektrana	Security in thermoelectrical power plants
Moussa Nait - Abdelazziz		Lom komponenti od gume pri višeosnom opterećenju	Fracture of rubber components under multiaxial loading
Vladimir Stevanović		Sigurnost gasovoda	Security of gas pipelines
Philippe Jodin		Produženje veka oštećenih cevovoda	Life extension of damaged pipelines
Hans Walter	Bernd Michel	Ispitivanja mehanike loma na mikro i nano nivou	Testing of fracture mechanics at micro and nano scale
Liviu Marsavina	Tomasz Sadowski	Međudejstvo prsline i dodirne površine (interfejs) keramičkih kompozita	Crack - interface interaction in ceramic composites
Guy Pluvinage		Metode projektovanja sa sigurnošću i pouzdanošću metalnih komponenti i konstrukcija	Safe and reliable design methods for metallic components and structures
Ky Dang-Van		Projektovanje zarezanih komponenti na zamor novom metodom na bazi šejkdauna	Fatigue design of notched components by a new method based on shakedown
Michael Wnuk		Sigurnost materijala na mezo nivou	Security of materials at meso level
Radu Bancila	*Edward Petzek*	Ocena eksploatacijske sigurnosti čeličnih konstrukcija	Evaluation of service security of steel structures
David Read		Sigurnost tankih filmova	Security of thin films
Donka Angelova		Ocena razvoja prsline: od Grifitovih osnova do najnovije primene mehanike loma na zamor	Crack development assessments: From Griffith fundamentals to the last Fracture Mechanics applications in fatigue
Dragoslav Šumarac	*Zoran Petrašković*	Kontrola oštećenja i popravka radi sigurnosti zgrada	Damage control and repair for security of buildings
Petar Agatonović		Eksperimentalni i numerički aspekti sigurnosti konstrukcija	Experimental and numerical aspects of structural security

Autori koji su prikazali radove su označeni italik slovima.
Bliže informacije na aktivnoj veb strani
http://www.lfm.univ-metz.fr/natoarw/
Knjigu sa naslovom vorkšopa će izdati 2009 Springer Verlag.

Presenting authors are labelled italic.
Detailed information are found on active web page
http://www.lfm.univ-metz.fr/natoarw/
The workshop book will be published by Springer Verlag in 2009.

KONFERENCIJA
NOVI TRENDOVI U ZAMORU I LOMU – NT2F8
8. SKUP, ANKARAN–SLOVENIJA, 23–24.10.2008

Skup je održan uz značajni doprinos članova DIVK (5 radova) posle NATO ARW „Sigurnost i pouzdanost oštećenih konstrukcija i materijala sa greškama“ (19–22.10.2008, Portorož-Slovenija).

CONFERENCE
NEW TRENDS IN FATIGUE AND FRACTURE – NT2F8
8TH MEETING, ANKARAN–SLOVENIA, 23–24.10.2008

The meeting is organised with significant contribution of DIVK members (5 papers) after NATO ARW “Security and Reliability of Damaged Structures and Defective Materials” (19–22.10.2008, Portorož-Slovenia).

Spisak prezentacija – List of presentations

Autori – Authors	Naslov	Title
Tóth László	Neke napomene o zakonu Parisa	Some remarks on the Paris Law
Stevanović Vladimir	Dinamičko opterećenje od različitih oblika vodenog čekića	Dynamic loads by various waterhammer phenomena
Gubeljak Nenad	Uticaj mismečinga na ponašanje pri lomu zavarenog spoja	Effect of strength mis-match on fracture behaviour of weld joint
Petrašković Zoran	Analiza histerezisa niskocikličnog zamora na čelične prigušivače uticaja zemljotresa	The analysis of hysteresis in low cycle fatigue of steel dampers for earthquake application
Milović Ljubica	Analiza loma zavojne rotacione pumpe u radu	In-service failure analysis of rotary screw pump
Sedmak Stojan	Značaj prslina za ponašanje pri zamoru i lomu zavarenih komponenti	Crack significance for fatigue and fracture behaviour of welded components
Pluvinage Guy J. Capelle, M. Hadj Meliani	Ocena zareznih oštećenja cevi i pridruženi problem dimenzija	Gouge assessment for pipes and associated transferability problems
Kirić Miodrag A. Sedmak, J. Lozanović	Uporedna analiza inženjerskih metoda mehanike loma	A comparative analysis of engineering methods in fracture mechanics
Capelle Julien	Uticaj vodonika na zamor i lom čeličnih cevi API 5L X52	Hydrogen effect on fatigue and fracture of a pipe steel API 5L X52
Ihor Dmytrakh	Elektrohemijski uticaj vodonika na zamor čelika API X52 i na lokalni lom iz iniciran iz zareza	Electrochemical hydrogen absorption of API X52 steel and its effects on local fracture emanating from notches
Jodin Philippe	Ocena zamornog veka kutije ruke bagera – eksperiment i proračun	Fatigue life assessment of an excavator arm box - Experiments and computations
Pluvinage Guy N.Kazi Tani, T. Tamine	Numerička analiza za ocenu brzine oslobađanja energije prsline po pravcu i položaju blizu interfejsa bi-materijala	Numerical evaluation of the strain energy release rate with orientation and position of a crack near a bi-material interface
Nait-Abdelazziz Moussa	Uticaj svetlosnog razlaganja na mehaničke osobine PLA polimera	Photodegradation effects on the mechanical properties of a PLA polymer

Prezentacije radova su dostupne na disku. Radovi će biti objavljeni u časopisu Integritet i vek konstrukcija, 1/2009. Za bliže informacije otvoriti veb stranu http://www.lfm.univ-metz.fr/nt2f8/

Konferenciju NT2F9 će 2009. organizovati Društvo za integritet i vek konstrukcija (DIVK).

Presentations of contributions are available on disc. Papers will be published in the journal Structural Integrity and Life, 1/2009. For detailed information visit http://www.lfm.univ-metz.fr/nt2f8/

Conference NT2F9 will be organised in 2009 by the Society for Structural and Life (DIVK).

DRUGI MEĐUNARODNI KONGRES U ORGANIZACIJI SRPSKOG DRUŠTVA ZA MEHANIKU

Kongres će se održati na Paliću, kod Subotice (Srbija), od 1. do 5. juna 2009., pod pokroviteljstvom Srpskog društva za mehaniku (SDM) i podržan od strane Ministarstva za nauku Republike Srbije, kao i od strane Inženjerske komore Srbije. Zvanični jezici su srpski i engleski. Radove treba napisati na engleskom, a predavanja mogu biti ili na srpskom ili na engleskom.

Teme kongresa su: opšta mehanika; mehanika fluida; mehanika čvrstih tela; interdisciplinarni i multidisciplinarni problemi.
Rok za podnošenje jednostranog apstrakta: 26. dec. 2008
Obaveštenje o prihvatanju rada: 30. januar 2009.
Rok za podnošenje konačnog rada i uplate kotizacije: 31. mart 2009.

Autori koji su jedini u svojim radovima, starosti do 35, učestvovaće kao kandidati za nagradu „Dr Rastko Stojanović“ za mlade naučnike. Program kongresa sastoji se iz plenarnih i radova predavača po pozivu (45 minuta), kao i radova učesnika (20 minuta). Zbornik radova kongresa će biti štampan pre početka kongresa.

Članovi Društva se pozivaju da predlože teme Minisimpozijuma koji će biti sastavni deo programa. Očekuje se da teme pokrivaju pojedine oblasti od posebnog interesa za teorijsku i primenjenu mehaniku i da daju prikaz dometa istraživanja. Minisimpozijumi će biti predavanja (20 minuta) bar 5 učesnika. Učesnici minisimpozijuma su sami odgovorni za dodatne troškove, koji neće biti pokriveni budžetom kongresa ili kotizacijama.

Palić je poznat po jezeru, zoološkom vrtu, prijatnom okolinom, i kao odmaralište sa dobrim hotelima i vilama. Predavanja kongresa će se odvijati u kongresnom centru, udaljenom 150 metara od jezera. Smeštaj je organizovan zajedno sa „Elitte Palić“ u hotelima „Park“ i „Jezero“, kao i u ostalim zdanjima. Informacije o hotelima i njihovim uslugama videti na: http://www.elittepalic.co.yu

Više informacija o Paliću, njegovoj istoriji i ponudi možete videti na http://www.palic.co.yu. Društveni program za učesnike obuhvatiće pozdravni koktel i banket.

Uplate kotizacije treba obaviti do 31. marta, 2009:

2ND INTERNATIONAL CONGRESS OF THE SERBIAN SOCIETY OF MECHANICS

The Congress will take place at Palić, near Subotica (Serbia) on 1–5 June 2009, and is organised under the auspices of Serbian Society of Mechanics (SSM) and supported by Ministry of Science of the Republic of Serbia and the Serbian Chamber of Engineers. Official languages are Serbian and English. Papers should be written in English and presentations may be either in Serbian or in English.

Topics will include: general mechanics; fluid mechanics; mechanics of solid bodies; interdisciplinary and multidisciplinary problems.
Deadlines: submission of one page abstract: Dec. 26, 2008.
Notification of acceptance: January 30, 2009.
Submission of full paper and registration payment: March, 31, 2009.

Single authors of contributed papers of ages to 35 are eligible for “Dr Rastko Stojanović” award for young scientists. The programme will include plenary and invited lectures (45 minutes) by invited guests and contributed papers (20 minutes). Proceedings will be published before the Congress.

Society members are invited to propose topics for Mini-symposia that may be included in the programme. Topics are expected to cover particular fields of special interest for theoretical and applied mechanics and present frontier research activities. Mini-symposia should consist of lectures (20 min.) from at least 5 participants. Mini-symposia organisers are responsible for additional costs and cannot be covered by Congress budget or by Registration fees.

Palić is known for its lake, zoo, pleasant surroundings, as well as a resort with splendid hotels and villas. Congress sessions will be held in the congress centre, 150 meters from lake. Accommodation is organised in cooperation with “Elitte Palić” at Hotels “Park” and “Jezero”, as well as other facilities. Information on these hotels and their rates are available at: http://www.elittepalic.co.yu

More information about Palić, its history and facilities can be found at http://www.palic.co.yu. The social programme for participants will include a reception cocktail and banquet.

The registration fees should be settled before March 31, 2009:

- članovi SDM: 100 EUR
- ostali učesnici: 120 EUR
- studenti 80 EUR

Troškovi pokrivaju: program Kongresa; Zbornik radova i CD-ROM; prisustvo na svim sekcijama; kafe pauze; ručkovi tokom tri radna dana (2–4. juna), kao i društveni program. Uputstvo za uplate će biti objavljeno na internetu.

Kontakt: Sekretarijat Kongresa, Srpsko društvo za mehaniku (SDM), Srbija, Kneza Miloša 9/1, 11000 Beograd

Tel.: +381-11-324-2273
http://www.ssm.org.yu/congress2009
http://www.ssm-congress2009.com
E-mail: ssmcongress2009@ftn.ns.ac.yu

- SSM members: 100 EUR
- Other participants: 120 EUR
- Students 80 EUR

Fees include: Congress programme; Congress proceedings and CD-ROM; attendance to all sessions; coffee breaks; lunches during three work days (2–4 June), and social programme. Registration and payment instructions will be given on the web site.

Contact: Congress Secretariat, Serbian Society of Mechanics (SSM), Serbia, Kneza Miloša 9/1, 11000 Belgrade

Phone: +381-11-324-2273
http://www.ssm.org.yu/congress2009
http://www.ssm-congress2009.com
E-mail: ssmcongress2009@ftn.ns.ac.yu

ŠESTI MEĐUNARODNI KONGRES HRVATSKOG DRUŠTVA ZA MEHANIKU

Kongres će se održati u Dubrovniku (Hrvatska), od 30. septembra do 2. oktobra 2009. u organizaciji Hrvatskog društva za mehaniku pod pokroviteljstvom Srednje-evropskog društva za računarsku mehaniku, i Univerziteta u Zagrebu.

Svi predloženi radovi će biti podvrgnuti procesu recenziranja radi obezbeđivanja visokog kvaliteta prezentovanih informacija, sa posebno pažnjom ka originalnosti i značaju. Među temama, od posebnog interesa su: biomehanika i računarska biologija; računarske mehanike čvrstog tela i konstrukcija; dinamika oštećenja i loma; eksperimentalna mehanika; mehanika fluida i interakcije fluid–konstrukcija; geomehanika; računarstvo visokih performansi u mehanici i primenjena matematika; mehanika unapređenih materijala i konstrukcija; bezmrežne i druge novije računarske metode; multi-fizika i modeliranje u različitim nivoima razmere; nanomehanika i nanokonstrukcijski materijali; optimalno projektovanje inženjerskih konstrukcija; pametne konstrukcije.

Autori se pozivaju da podnesu jednostrani apstrakt korišćenjem Forme za apstrakte (*Template*). Konačni radovi se pripremaju prema Formi za radove (*Template*). Molimo vas da posetite veb stranu radi preuzimanja formi za pripremu apstrakta i radova. Finalni radovi (najviše do 8 strana) se očekuju do 31. marta 2009. Potreban uslov za uvrštavanje rada u program je da bar jedan od autora prisustvuje konferenciji i predstavi rad. Apstrakti, celi radovi i prezentacije treba da su napisani na engleskom. E-mail adresa za korespondenciju je: iccsm2009@fsb.hr

Velelepno zdanje Centra za napredne akademske studije je u centru ovog prekrasnog grada na hrvatskom delu Jadranskog mora, blizu značajnih istorijskih mesta u Starom gradu. Prijavljivanje za konferenciju obaviće se u atrijumu Centra 29. septembra 2009.

Adresa zgrade Kongresa je: Centre for Advanced Academic Studies, Don Frana Bulica 4, 20000 Dubrovnik, Croatia. Molimo da posetite veb stranu radi obezbeđivanja smeštaja.

Vremenski rokovi:
podnošenje apstrakta (produženo): 27. oktobar 2008
prihvatanje apstrakta: 30. novembar 2008
podnošenje konačnih radova i rana kotizacija: 31. marta 2009
rezervacija smeštaja: 16. avgusta 2009.

Kotizacija (obična i za studente) uključuje Prijem-dobrodošlicu, kafe pauze i ručkove tokom svih dana trajanja konferencije, Svečana večera, knjiga apstrakta (štampano) i Zbornik radova (CD). Kotizacija za osobe u pratnji pokriva troškove Prijema-dobrodošlice i Svečane večere. Kotizacija za studente podrazumeva studente doktorskih studija.

Iznosi kotizacija:
- pre 31. marta 2009 (rana kotizacija): obična 450 EUR, za studente 250 EUR, osobe u pratnji 70 EUR.
- posle 1. aprila 2009: obična 500 EUR, za studente 300 EUR, osobe u pratnji 100 EUR.

6TH INTERNATIONAL CONGRESS OF THE CROATIAN SOCIETY OF MECHANICS

The Congress will take place in Dubrovnik (Croatia) from September 30 to October 2, 2009, and is organised by the Croatian Society of Mechanics under auspices of Central European Association for Computational Mechanics, and University of Zagreb.

All proposed papers will be submitted to a reviewing process in order to ensure high quality of presented information, with special emphasis on its originality and relevance. Among the topics, of particular interest are: biomechanics and computational biology; computational solid and structural mechanics; damage and fracture dynamics; experimental mechanics; fluid mechanics and fluid–structure interactions; geomechanics; high performance computing in mechanics and applied mathematics; mechanics of advanced materials and structures; meshless and other novel computational methods; multi-physics and multiple-scale modelling; nanomechanics and nanostructured materials; optimal design of engineering structures; smart structures.

Authors are invited to submit one-page abstracts using Template for Abstracts. Full length papers are to be prepared by using Template for Papers. Please visit the website for abstracts and paper templates. Full length papers (maximum 8 pages) are expected not later then March 31, 2009. The condition for including the paper in the programme is that at least one of the authors attends the conference and presents the work. Abstracts, full length papers and presentations should be in English. E-mail address for all correspondence: iccsm2009@fsb.hr

The magnificent building of the Centre for Advanced Academic Studies is in the centre of this splendid city on the Croatian Adriatic Coast at the vicinity of prominent historical sites in the Old Town. Conference Reception will take place in the atrium of the Centre on September 29.

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Deadlines:
Abstracts submission (extended): October 27, 2008
Abstracts acceptance: November 30, 2008
Submission of full length papers and early registr.: March 31, 2009
Reservation of Accommodation: August 16, 2009

Registration Fee (regular and student) includes Welcome Reception, coffee breaks and lunches on all conference days, Conference Dinner, Book of Abstracts (paper) and Conference Proceedings (CD). Fee for accompanying persons covers Welcome Reception and Conference Dinner. Student registration considers PhD students.

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DOKTORATI – DOCTORAL DEFENCES

ODBRANJENA DOKTORSKA DISERTACIJA IZ OBLASTI INTEGRITETA I VEKA KONSTRUKCIJA
Doctoral thesis defended in the field of structural integrity and life

Ljubica Milović, ANALIZA INTEGRITETA ZAVARENIH KOPONENATA PROCESNE OPREME ZA POVIŠENE RADNE TEMPERATURE
(The Analysis of Integrity of Process Equipment Welded Components for Elevated Operating Temperatures)

Mašinski fakultet Univerziteta u Beogradu, datum: 30.06.2008.
Komisija: red. prof. dr Aleksandar Sedmak (mentor), vanr. prof. dr Slaviša Putić (Tehnološko-metalurški fakultet Univerziteta u Beogradu), doc. dr Zoran Radaković, vanr. prof. dr Aleksandar Jovović, dr Zijah Burzić (naučni savetnik, Vojnotehnički institut, Beograd).

Naučna oblast: mašinstvo

Uža naučna oblast: integritet konstrukcija

Apstrakt

Povećanje sigurnosti i ekonomičnosti termoenergetskih postrojenja na fosilno gorivo je godinama jedan od vodećih problema koji timovi istraživača širom sveta pokušavaju da reše. Istraživanja su usmerena ka unapređenju postojećih i razvoju novih legura za rad na povišenim temperaturama i pritiscima.

Proračuni mašinskih delova izloženih dugotrajnom delovanju ultra-superkritičnih uslova pare zahtevaju poznavanje celokupnog toka puzanja do loma da bi se dotrajali delovi pravovremeno zamenili novim.

Prsline tipa IV su karakteristične kod čelika feritno-martenzitne strukture. Ispitivanja objavljena u ovom radu pokazuju koje su metode ispitivanja selektivne u pogledu otpornosti na stvaranje prslina tipa IV.

Konačno, da bi se potpuno upoznalo ponašanje materijala potrebno je uporediti njegove osobine u trenutku ugradnje i posle određenog vremena eksploatacije.

U ovom radu je ispitan feritno-martenzitni čelik P91 sa stanovišta mikrostrukture, mehaničkih osobina i mehanike loma na temperaturi ugradnje, 20°C, i na radnoj temperaturi od 600°C.

Ključne reči: čelik P91, prsline tipa IV, puzanje, lom na povišenim temperaturama

Faculty of Mech. Engng., Univ. of Belgrade, date: June 30, 2008.
Committee: Dr Aleksandar Sedmak–full prof. (mentor), Dr Slaviša Putić–associate prof. (Faculty of Technology and Metallurgy, Univ. of Belgrade), Dr Zoran Radaković–docent, Dr Aleksandar Jovović–associate prof., Dr Zijah Burzić–scientific advisor (Military Technical Institute, Belgrade).

Science topic: mechanical engineering

Special topics: structural integrity

Abstract

Higher security and cost-effectiveness of fossil power plants are one of major problems for years that worldwide research teams attempt to manage successfully. Investigations are focused on the improvement of existing, and introduction of modern methods of fossil power plants remnant life evaluation as well as development of new alloys for operating at higher temperatures and pressures.

Calculations of mechanical parts exposed to ultrasuper critical steam conditions require knowledge of entire creep to failure processes in order for the used parts to be replaced.

Type IV cracks are characteristic for ferritic-martensitic structure. Tests published in this work reveal the test methods are selective regarding the resistance to forming of type IV cracks.

Finally, for complete insight into the behaviour of the material, it is necessary to compare its properties at the moment of installation and after a certain period of utilization.

In this work, the ferritic-martensitic P91 steel is examined from the aspect of its microstructure, mechanical properties and fracture mechanics at 20°C instalment temperature, and at working temperature of 600°C.

Keywords: P91 steel, type IV cracking, creep, failure at elevated temperatures