MACHINES. TECHNOLOGIES. MATERIALS 2015

16-19.09.2015 Varna, Bulgaria

PROCEEDINGS

VOLUME 3

XII INTERNATIONAL CONGRESS

MACHINES, TECHNOLOGIES, MATERIALS 2015

September 16-19.09.2015, VARNA, BULGARIA

SIMPOSIUM "INDUSTRIAL INFORMATIC"

SIMPOSIUM "ERGONOMICS & DESIGN"

SIMPOSIUM "MANAGENENT"

C O N T E N T S

XIITH INTERNATIONAL CONGRESS

MACHINES TECHNOLOGIES MATERIALS

PROGRAM

ORGANIZER:

SCIENTIFIC-TECHNICAL UNION OF MECHANICAL ENGINEERING

16.09 – 19.09. 2015
Varna, BULGARIA

PROGRAM

14.09.2015 (MONDAY)

16:00 – 20:00	REGISTRATION	IN FRONT OF CONFERENCE HALL №1

15.09.2015 (TUESDAY)

08:00 – 17:00	REGISTRATION	IN FRONT OF CONFERENCE HALL №1

16.09.2015 (WEDNESDAY)

14:00 – 20:00	REGISTRATION	IN FRONT OF CONFERENCE HALL №1

17.09.2015 (THURSDAY)

08:00 – 10:00	REGISTRATION	IN FRONT OF CONFERENCE HALL №1
CONFERENCE HALL №1		
10:00 – 10:15	OPENING OF THE CONGRESS	
10:15 – 11:30	PLENARY SESSION	
11:30 – 12:45	SECTION "MACHINES" – FIRST SESSION	

12:45 – 13:00	COLLECTIVE PICTURES OF PARTICIPANTS	THE STAIRS TO THE POOL

LUNCH 13:15 - 14:30

	CONFERENCE HALL №1	**CONFERENCE HALL №2**
14:30 – 16:30	SECTION "MATERIALS" – FIRST SESSION	SIMPOSIUM "INDUSTRIAL INFORMATIC"
16:30 – 17:00	COFFEE BREAK - CONFERENCE BAR	
17:00 – 18:30	SECTION "MATERIALS" – SECOND SESSION	SIMPOSIUM "ERGONOMICS & DESIGN" SIMPOSIUM "MANAGENENT"

19:30 – 24:00	**"WELCOME" COCKTAIL - CONFERENCE BAR**

21:00	**BODIY ART PERFORMANSCE "ORPHEUS AND EURIDIKE" - INERPRETATION**	**SWIMMING POOL SCENE**

18.09.2015 (FRIDAY)

	CONFERENCE HALL №1	**CONFERENCE HALL №2**
09:00 – 10:15	SECTION "MATERIALS" – THIRD SESSION	SECTION "TECHNOLOGIES" – FIRST SESSION
10:15 – 10:30	COFFEE BREAK - CONFERENCE BAR	
10:45 – 12:00	SECTION "MATERIALS" – FOURTH SESSION	SECTION "TECHNOLOGIES" – SECOND SESSION
12:00	**CLOSING OF THE CONFERENCE WINE AND CHEESE PARTY**	**CONFERENCE BAR**

time for presentation 10-12 minutes,
questions after each presentation

SCIENTIFIC PROGRAM

FIRST DAY

17.09.2015 10:00 – 10:15	**OPENING OF THE CONGRESS**	**CONFERENCE HALL 1**
	CHAIRMAN: *PROF.D.SC G. POPOV*	

17.09.2015 10:15 – 11:30	**PLENARY SESSION**		**CONFERENCE HALL 1**	
CHAIRMAN: *PROF.DR.CVETKOVSKI S. (MK)*		**CO-CHAIR: ASSOC.PROF. DIKOVA TSANKA (BG)**		
1	EFFECT OF ALLOYING ELEMENTS ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF NIAL-CR(MO) EUTECTIC ALLOY	Demirtas H. Phd. , Prof. Gungor A.	07	TR
2	THERMODYNAMIC ANALYSIS OF FRICTION AND WEAR OF ULTRAFINE- GRAINED MATERIALS	Assoc. Prof. Chertovskikh S.V., Prof. Shuster L.Sh., Dr. Eng. Semenov V.I., Prof. Huang S.-J.	15	RU TW
3	THE EFFECT OF CHEMICAL COMPOSITION ON PROPERTIES OF ROCK MELTS	Eng. Diduk I., Prof., Dr. Sc. Bagliuk G.A.	113	UA
4	METALLOGRAPHIC INVESTIGATION OF INDUCTION HARDENED PART TWO-SIDE LEVER	Prof. Dr. Eng. Cvetkovski S., Asoc. Prof. Dr.Eng Nacevski G.	126	MK

18.09.2014 11:30 – 12:45	**SESSION "MACHINES"**		**CONFERENCE HALL 1**	
CHAIRMAN: *PROF.DR.CVETKOVSKI S. (MK)*		**CO-CHAIR: *ASSOC.PROF. DIKOVA TSANKA (BG)***		
5	CAST EQUIPMENT FOR HEAT TREATMENT FURNACES	Dr. Eng. Drotlew A., Dr. Eng. Garbiak M., Prof. DSc. Piekarski B	2	PL
6	A MULTINOMIAL APPROACH TO THE MACHINE INTERFERENCE PROBLEM	Prof. Gurevich G., Prof. Hadad Y., Dr. Keren B.	12	IL
7	STRUCTURAL AND KINEMATIC ASPECTS OF A NEW ANKLE REHABILITATION DEVICE	PhD. Stud. Eng. Racu (Cazacu) C., Prof. Dr. Eng. Doroftei I.	36	RO
8	STUDY OF A TRIAXIAL SPECIMEN AND A REVIEW FOR THE TRIAXIAL MACHINES	PhD Student Eng. Comanici A. M., Prof. Dr. Eng. Goanta V., Prof. Dr. Eng. Barsanescu P. D.	40	RO
9	THE INFLUENCE OF ILLUMINATION PARAMETERS ON THE PERFOMANCES OF COLOR SORTING MACHINES	M.Sc. Markovic Ivana, Prof. PhD. Ilic Jelena, Prof. PhD. Markovic Dragan, M.Sc. Simonovic Vojislav	49	SR
10	ANALYSIS OF COMPLEX PLANETARY CHANGE-GEARS THROUGH THE TORQUE METHOD	Dimitar Karaivanov	134	BG

12:45– 13:00	**COLLECTIVE PICTURES OF PARTICIPANTS**	**THE STAIRS TO THE POOL**

LUNCH 13:00 - 14:30

17.09.2015 14:30 – 16:30	**FIRST SESSION "MATERIALS"**		**CONFERENCE HALL 1**	
CHAIRMAN: *PROF.DS* B*AGLIUK G.A. (UA)*		**CO-CHAIR: *PROF.DRC DOBATKIN S. (RU)***		
11	INVESTIGATION OF DIFFERENT ABLATION TIMES ON THE FORMATION OF ZINC OXIDE NANOPARTICLES SYNTHESIZED BY LIQUID-PHASE PULSED LASER ABLATION TECHNIQUE	Dr. Suha I. Al-Nassar , Ass. Prof. Dr. Adel K. Mahmoud. Ass. Prof. Dr. Zainab F. Albawi	11	IQ
12	HARDENING OF AUSTENITIC STEELS WITH HIGH MN AND AL CONTENT	Prof. Dr. Phys.-Math. Kaputkina L.M.,	111	RU

time for presentation 10-12 minutes,
questions after each presentation

		Prof. Dr. Eng. Svyazhin A.G., Cand. Eng. Bronz A.V., Cand. Eng. Smarygina I.V., Cand. Eng. Bazhenov V.E., Sen. Res. Cand. Eng. Kindop V.E.		
13	AN EXPERIMENTAL INVESTIGATION OF LIME BASED PLASTERS MOISTURE AND TEMPERATURE INDUCED DEFORMATION.	Assoc. Prof., RNDr. Lukovičová J.PhD., Ing. Pavlendová G. PhD., Assoc.Prof., Ing. Kubliha M. PhD., RNDr. Šín P. PhD.	124	SK
14	CHARACTERIZATION OF MECHANICAL ALLOYED Ni-Ti POWDERS	M.Sc.Yurtsever Ö.,Assoc. Prof.Dr.Özkal B.	62	TR
15	INVESTIGATIONS ON MAGNETRON SPUTTERED TANTALUM OXYNITRIDE THIN FILMS	D. Cristea, L. Cunha, M. Pătru, D. Munteanu	24	RO PT
16	INVESTIGATION OF EFFECT OF TEXTURE ON COLD RESISTANCE OF NEW GENERATION STEELS FOR BUILDING STRUCTURES	Sen. Sc., PhD Arsenkin A.M. , Res. Eng. M.V. Zheleznyi, Prof., Dr Sc. Odesskiy P.D., PhD, Ass. Prof. I.V. Schetinin, PhD, Ass. Prof. M.V. Gorshenkov, Prof., Dr Sc. Vedyakov I.I.	61	RU
17	INVESTIGATION OF PROPERTY OF POLYCRYSTALLINE DIAMOND PURIFIED BY TECHNOLOGY OXIDATIVE ALKALINE MELTS	PhD. Kozub P.A, M.Sc. Chernikov I.A., Dr.Sc. Bagliuk G,A. (1), PhD. Kurovskyi V.Ya. (1), PhD. Kozub S.N.	114	UA

16:30 – 17:00	COFFEE BREAK - CONFERENCE BAR

17.09.2015 17:00 – 18:30	SECOND SESSION "MATERIALS"		CONFERENCE HALL 1	
CHAIRMAN: *PROF.DR. ADEL MAHMOUD (IQ)*		**CO-CHAIRMAN: *PROF.DR. UĞUR G. (TR)***		
18	MECHANICAL PROPERTIES OF NANOSTRUCTURED B_4C/C_{60} AND c-BN/C_{60} COMPOSITES PREPARED BY HPHT METHOD	M.Sc. Prokhorov V. PhD., Prof. Blank V., M.Sc. Ovsyannikov D.,M.Sc.Popov M. Dr., M.Sc. Levin V. PhD., M.Sc.Morokov E.	74	RU
19	UV DEGRADATION OF POLYMER-MATRIX COMPOSITES PA + GF	Ing. Lenka Markovičová, PhD., RNDr. Viera Zatkalíková, PhD., Eng. Aneta Tor – Świątek, Ph.D., Dr. Eng. Marcin Bilewicz	18	SK
20	THE RESISTANCE OF AISI 316Ti STEEL TO PITTING IN 1 M CHLORIDE ACIDIC SOLUTION IN THE ABSENCE AND PRESENCE OF INORGANIC INHIBITOR	RNDr. Viera Zatkalíková, PhD., Ing. Lenka Markovičová, PhD., Ing. Miroslav Omasta, Ing. Monika Oravcová	19	SK
21	PLASMA-AIDED SURFACE FINISHING FOR FLAME RETARDATION OF WOOD THROUGH THE USE OF SURFACTANTS	Assist.-Prof. Ivanov I.,Prof. Dineff P. Ph. D.	76	BG
22	CAPILLARY PENETRATION (SPREADING AND WICKING) MECHANISMS IN PLASMA-AIDED SURFACE FINISHING PROCESSES	Assist.-Prof. Ivanov I., Prof. Dineff P. Ph. D., Assoc.-Prof. Gospodinova D. Ph. D.	77	BG MX
23	SIMULTANEOUS THERMAL ANALYSIS ON PLASMA-AIDED CAPILLARY IMPREGNATION FOR EUROPEAN WHITE PINE FLAME RETARDATION IMPROVEMENT	Assist. Prof. Ivanov I., Assoc. Prof. Gospodinova D. Ph.D., Prof. Dineff P. Ph.D.	78	BG MX

17.09.2015 14:30 – 16:30	SIMPOSIUM "INDUSTRIAL INFORMATIC"		CONFERENCE HALL 2	
CHAIR: *PROF. BACHKOVA I. (BG)*		**CO-CHAIR: *ASSOC. PROF. ATANASSOV A.(BG)***		
24	THE SOLUTION OF THE INVERSE PROBLEM OF MOTION CONTROL OF A RIGID BODY, POP-UP IN A STRATIFIED INCOMPRESSIBLE VISCOUS FLUID UNDER THE INFLUENCE OF THE ARCHIMEDES FORCE	Prof., Dr. Tech. Sci. Firsov A.N., MSc Kuznetsova L.V., P.G. Sorokina N.V.	97	RU
25	THE INVERSE PROBLEM OF THE STABILITY OF PROCESSES IN THE DYNAMIC SYSTEM UNDER SMALL PERTURBATIONS OF ITS PARAMETERS	Prof., Dr. Tech. Sci. Firsov A.N., MSc Gladush A.I.,	107	RU
26	COMPUTER-AIDED DESIGN OF POWER SUPPLY SYSTEMS OF VEHICLES	Cand. Sci. (Tech.), Senior researcher Ferenets A., Cand. Sci. (Tech.) Fedorov E.	103	RU
27	STUDY OF THE CAPACITY OF A FANUC M430i-A/4FH ROBOT TO PERFORM TECHNOLOGICAL OPERATIONS	Prof. D.Sc. Guergov S., M.Sc. Beevski L.	112	BG
28	AN INTEGRATED ADD-IN FOR LOCATING PARTS IN SOLIDWORKS	Prof. Nikolcheva G., Eng. Mihaylov O.	117	BG
29	COMPONENT-BASED CONTROL OF PIC ALFA MOBILE OF WORK STATION FESTO MPS HANDLING	Assoc. Prof. Karamishev H., Prof.DSc. Popov G.	125	BG
30	ONTOLOGY BASED DATA AND INFORMATION	Assist. Prof. Dr. Gocheva D. G.,	130	BG

time for presentation 10-12 minutes,
questions after each presentation

	INTEGRATION IN BIOMEDICAL DOMAIN	Assist. Eng. Eminova H. M., Prof. Dr. Batchkova I. A.		
31	COMPARATIVE ANALYSIS OF CONTEMPORARY CASE BASED REASONING SOFTWARE FRAMEWORKS	Assoc. Prof. Atanassov A.	131	BG
32	METAMODELS BASED ONTOLOGY DEVELOPMENT TO ACHIEVE STANDARD-COMPLIANT PROJECT MANAGEMENT	M.Sc. Stoyanova.T.	132	BG
33	DETERMINATION OF THE OPTICAL PROPERTIES OF BULGARIAN HONEY AND THEIR APPLICATION TO HONEY DISCRIMINATION	Prof. Dr. Tsankova D. D., Ass. Prof. Dr. Nikolova K., Prof. Dr. Evtimov T., Assist. Prof. Dr. Lekova S. D.	133	BG
34	MODEL DRIVEN DEVELOPMENT OF AGENT BASED AMBIENT INTELLIGENCE PLACES WITH SERVICE ORIENTED ARCHITECTURE	Assist. Prof. Dr. Antonova I. D., Prof. Dr. Batchkova I. A., Eng. Ivanova Tz.	129	BG

16:30 – 17:00	COFFEE BREAK - CONFERENCE BAR

17.09.2015 17:00 – 18:30	SIMPOSIUM "ERGONOMICS & DESIGN" SIMPOSIUM "MANAGENENT"		CONFERENCE HALL 2		
CHAIRMAN: *PROF. DR. DIMKOV S.V. (BG)*		CO-CHAIR: *M.SC. IVANOVA MILKA (BG)*			
35	ASSESSMENT OF THE ERGONOMY IN AN OFFICE DECORATED WITH ILLUMINATED SCULPTURES		Ass. Prof. Staneva G., Assoc. Prof. Dr. Murzova C., Assoc. Prof. Dr. Eng. Vasilev R., Ass. Prof. Dr. Eng. Gjurov V.	6	BG
36	THE BARBIE DOLL AS A SIGN OF OUR TIMES DESIGN AND TRADITION IN FELT FIGURES		Ass.Prof. Gadjeva M.G.	65	BG
37	AN APPROACH FOR COMBINING THE CAPABILITIES OF IMMERSIVE VIRTUAL REALITY AND MODERN CAD-CAM SOFTWARE SYSTEMS TO CREATE VIRTUAL MODELS OF WORKSHOPS FOR MECHANICAL PROCESSING		M.Sc. Slavov, Stoyan D., PhD.	70	BG
38	METHOD FOR EVALUATING COOPERATION IN MANAGEMENT OF VIRTUAL ORGANIZATIONS		Prof.Dr. Dimkov S.V.	52	BG
39	TRANSFORMATION MECHANISMS APPLIED RESEARCH IN THE BUSINESS SECTOR OF THE REAL ECONOMY		Топ-менеджер Ускова И., Менеджер Чекунова-Томашева Н.	58	RU
40	THE ORGANIZATION OF SCIENTIFIC-METHODICAL PROVISION AND MANAGEMENT RESEARCH COMPLEX		Менеджер Чекунова-Томашева Н., Топ-менеджер Ускова И.	60	RU
41	CONTEMPORARY METHODS FOR MANAGEMENT AND ORGANISATION OF MULTIMODAL TRANSPORTATION		Eng. Nakova Kate	127	RU

19:30 – 24:00	**"WELCOME" COCKTAIL**	**CONFERENCE BAR**

time for presentation 10-12 minutes,
questions after each presentation

DAY TWO

18.09.2015 09:00 – 10:15	THIRD SESSION "MATERIALS"		CONFERENCE HALL 1	
CHAIRMAN: *PROF. D.SC. KAPUTKINA L. (RU)*		CO-CHAIR: *PROF. DR. ENG. V.I. SEMENOV (RU)*		
42	BASIC APPROACHES TO THE STUDY OF THE STRUCTURE AND PROPERTIES OF THIN OXIDE LAYERS ON THE EXAMPLE OF THE OXIDE FILMS OF ZIRCONIUM ALLOYS	Ph.D. Koteneva M.V., Dr. Sci. Nikulin S.A., Ph.D. Rozhnov A.B.	83	RU
43	INVESTIGATION OF HIGH-TEMPERATURE MULTI-LAYER MATERIAL BASED ON VANADIUM ALLOY AND STAINLESS STEEL	Nikulin S., Nechaykina T., Rozhnov A., Rogachev S.	84	RU
44	INVESTIGATION OF FAILURE OF FREIGHT TRUCKS SIDE FRAMES USING ACOUSTIC EMISSION	Dr. Sci. Nikulin S.A., Ph.D. Khanzhin V.G., Nikitin A.V., Ph.D. Rogachev S.O., Khatkevich V.M., Ph.D. Li E.V., Nechaykina T.A.	79	RU
45	MICROSTRUCTURE AND THERMAL STABILITY OF 0.08%C-17.0%Cr-0.8%Ti STEEL AFTER HIGH-TEMPERATURE NITRIDING AND HIGH PRESSURE TORSION	Ph.D. Rogachev S.O., Khatkevich V.M., Dr. Sci. Kaibyshev R.O., Ph.D. Tikhonova M.S., Dr. Sci. Dobatkin S.V.	82	RU
46	THE COMPREHENSIVE TECHNIQUE FOR QUANTITATIVE ANALYSIS OF THE STRUCTURE IN COMPOSITE SUPERCONDUCTORS BASED ON Nb_3Sn	S.A. Nikulin, prof., Dr. Sc., A.B. Rozhnov, Ph.D., S.O. Rogachev, Ph.D., V.I. Zabolotnikova, postgraduate student E.A. Dergunova, Ph.D, R.T. Aliev	85	RU
47	EFFECT OF EQUAL-CHANNEL ANGULAR PRESSING ON CRACK RESISTANCE AND CORROSION DAMAGE OF ZIRCONIUM ALLOY Zr-2.5%Nb	Ph.D. Belov V.A., Dr.Sci. Nikulin S.A., Ph.D. Rozhnov A.B., Ph.D. Rogachev S.O.	86	RU

10:15 – 10:30	COFFEE BREAK - CONFERENCE BAR

19.09.2014 10:30 – 12:00	FOURTH SESSION "MATERIALS"		CONFERENCE HALL 1	
CHAIRMAN: *PROF. DSc. NIKULIN S. (RU)*		CO-CHAIR: *ASSOC. PROF. DR. KANDROTAITĖ JANUTIENĖ R. (LT)*		
48	COOLANT-LUBRICANT DISPERSIONS BASED ON MODIFIED POTASSIUM POLYTITANATES	Prof. dr. sc. Gorokhovsky A., Associated prof. Ph.D. Tretiachenko E., graduate student Kovaleva D., Associated prof. Ph.D. Zayarsky D.	95	RU
49	SYNTHESIS OF FUNCTIONAL NANOMATERIALS BASED ON THE PRODUCTS OBTAINED BY NEUTRALIZATION OF ELECTROCHEMICAL PLATING SOLUTIONS WITH POTASSIUM POLYTITANATES	Prof. Dr. Sc. Gorokhovsky A., Associated Prof., Ph.D. Tretiachenko E., Graduate Student Vikulova M., Eng. Orozaliev E.	96	RU
50	CONDITIONS OF THE FORMATION OF LOWER CARBIDEFREE-BAINITE UNDER CONTINUOUS SLOW COOLIN	Prof. Dr. Eng. Simonov Y., Dr. Eng. Georgiev M., Cand. Eng. Syuzeva E.	123	RU
51	EFFECT OF CRYSTALLIZATION UNDER PRESSURE ON THERMAL PROPERTIES OF WROUGHT ALUMINUM ALLOYS	Can.Sc. (Engineering) L.Khromova, Dr.Sc. (Engineering) V.Korostylev	32	RU
52	ASSESSING THE CFPFBILITIES OF FORMINGQUASI-CRISTALLINE STRUCTURES DURING CRYSTALLIZATION UNDER PRESSURE IN ALUMINUM ALLOYS CONTAINING MANGANES	Can.Sc. (Engineering) L.Khromova, Dr.Sc. (Engineering) V.Korostylev	33	RU
53	NANOSTRUCTURED ALUMINUM-MATRIX COMPOSITE MATERIAL REINFORCED WITH FULLERENES C_{60}	Dr. Perfilov S., Dr. Evdokimov I., Dr. Pozdnjakov A., Dr. Blank V.	101	RU

time for presentation 10-12 minutes,
questions after each presentation

SECTION "TECHNOLOGIES"

18.09.2015 09:00 – 10:15	FIRST SESSION "TECHNOLOGIES"		CONFERENCE HALL 2	
CHAIRMAN: *ASSOC. PROF. DR. DAEI SORKHABI A. H .(IR)*	CO-CHAIR: *ASSOC. PROF. CHARNIAK I. (BY)*			
54	INVESTIGATION OF THE PARAMETERS OF THE QUALITY AT AN AXISYMETRIC DRAWING	Doctor of engineering, Prof. Nazaryan E. A., Candidate of physicist of mathematical sciences Arakelyan M. M. PHD student Simonyan A.S.	9	AM
55	INDUCTIVE ENERGY INPUT IN FLUIDIZED BEDS	Dipl.-Ing. Vesselin V. Idakiev, Jun.-Prof. Dr.-Ing. Andreas Bück, Prof. Dr.-Ing. habil. Evangelos Tsotsas, Prof. Dr.-Ing. habil. Dr. h. c. Lothar Mörl	21	DE
56	MICROSTRUCTURE AND MECHANICAL BEHAVIOR OF TIG BIMETALLIC JOINTS	M.F. Benlamnouar, R. Badji, M. Hadji, A. Boutaghane, N. Bensaid	115	DZ
57	PRODUCTION AND CHARACTERIZATION OF Al - WC COMPOSITE POWDERS VIA MECHANICAL ALLOYING	M.Sc. Şelte A., Assoc. Prof. Dr. Özkal B.	39	TR
58	PRESENTATION OF A NOVEL APPROACH TO RECYCLE METAL COATED PRODUCTS	Dipl.-Ing. Prumbohm M. F., Prof. Dr.-Ing. Lohrengel A., Dr.-Ing. Schaefer G.	48	DE
59	MAGNETIC PULSE COMPACTION AND SUBSEQUENT SPARK PLASMA SINTERING OF NANOSTRUCTURED ALUMINA	Kovaleva I., Zholnin A., Grigoryev E., Olevsky E.	57	RU USA
60	COMPARATIVE ANALYSIS OF THE ANALYTICAL METHODS FOR ASSESSING THE PRECISION OF THE MEASURING SYSTEM	Mr.Eng.Gjakovski I,Executive manager Dr.Eng Brkovski D,Prof.Dr.Cvetkovski S.	128	MK

10:15 – 10:30	COFFEE BREAK - CONFERENCE BAR

18.09.2015 10:30 – 12:00	SECCOND SESSION "TECHNOLOGIES"		CONFERENCE HALL 2	
CHAIR: *DR. GRIGORYEV E. (RU)*	CO-CHAIRMAN: *DIPL.ENG.PRUMBOHM (DE)*			
61	OBTAINING OF ALUMINIUM FOAM BY INTRODUCING MECHANOCOMPOSITES INTO THE MELT	Prof., Dr. Eng., Cor. Member of NAS of Belarus Ilyushchenko A., Cand. Eng., Assoc. Prof. Kusin R., Cand. Eng., Assoc. Prof. Letsko A.I., Charniak I., Ilyukevich A.I., Zhehzdryn D., Haliakov M.	59	BY
62	RESEARCH OF THE LIMIT PROCESSES IN MACHINING OF HOLES	Assoc. Prof. Dr. Eng. Evstati Lefterov, Assist. PhD. Eng. Eng. Tanya Avramova	75	BG
63	DETERMINING OF STRAIN RATIO IN TENSILE TEST USING BY IMAGE PROCESSING	Ass. Prof. Dr. Daei Sorkhabi A. H., Eng. Vahdat Panahi Shokouh V., Eng. Parsa Khanghah S.	110	IR
64	MODELING AND OPTIMIZATION OF ELECROCHEMICAL MACHINING OF 321-STAINLESS STEEL USING RESPONSE SURFACE METHODOLOGY	M.Sc. Mehrvar A. PhD Student., Dr. Basti A. PhD., Dr. Jamali A. PhD.	38	IR
65	THE ROLE OF METALLOGRAPHIC ANALYSIS FOR QUALITY EVALUATION OF WELDED STEEL PIPES	Prof. dr. Rrahim M., Prof. dr. Mursel R., Prof.dr.Hamit M.	3	MK

POSTER SESSION

THURSDAY (17.09)	10:00 – 19:00	POSTER SESSION "MACHINES"	CONFERENCE HALL 1		
FRIDAY (18.09)	09:00 – 13:00				
66		DIMENSIONING OF LINEAR ROLLER BEARING	Assoc. Prof. Pandev G., PhD., Eng.	30	BG
67		ANALYSIS OF WORKING OF NOVEL PUMPS	Sunny Narayan	46	IN

time for presentation 10-12 minutes,
questions after each presentation

68	DEFECTS DETECTION IN GEAR USING DIRECT SPECTRUM ANALYSIS OF VIBRATION	Dr.sc. ing. Litvinov D., Mg.sc. ing. Priževaitis A.	55	LV
69	STUDYING ROTATIONAL MOTION OF LUFFING BOOM CRANES WITH MAXIMUM LOAD USING SIMULATIONS	Prof. Doci Ilir, PhD., Prof. Hamidi Beqir. PhD.	73	KO
70	INVESTIGATION OF THE POSSIBILITY FOR MODELING AND USING THE IMPACT FORCE TRANSMISSION COEFFICIENT AT AN IMPACT OF A RIGID BODY WITH A RUBBER BUFFER	Assoc. Prof. Mitev N. , PhD., Eng.	98	BG
71	NUMERICAL INVESTIGATION FOR MODELING OF SOME ENERGY-FORCE PARAMETERS AT AN IMPACT OF A RIGID BODY WITH A RUBBER BUFFER WITH SPHERICAL SHAPE OF THE FREE FRONT FACE RECEIVING THE IMPACT	Assoc. Prof. Mitev N., PhD., Eng.,	99	BG

THURSDAY (17.09)	10:00 – 19:00	POSTER SESSION "MATERIALS"		CONFERENCE HALL 1	
FRIDAY (18.09)	09:00 – 13:00				
72		INVESTIGATION OF THE MG-DY-SM PHASE DIAGRAM IN THE MG-RICH PART	E.A. Lukyanova, T.V. Dobatkina, L.L. Rokhlin, I.G. Korolkova, I.E. Tarytina	26	RU
73		STRUCTURE AND FATIGUE STRENGTH OF CR-NI STAINLESS STEELS AFTER SEVERE PLASTIC DEFORMATION	O.V. Rybalchenko, Phd, A.A. Tokar, A. Kliauga, Phd, D.V.Prosvirnin, Phd,V. F. Terenťev, Prof., S.V. Dobatkin,Prof.	27	RU
74		ULTRAFINE-GRAINED MG-AL-ZN ALLOY WITH INCREASED MECHANICAL PROPERTIES AFTER RADIAL-SHIFT ROLLING	S. Dobatkin, Prof., Yu. Estrin, Prof., S. Galkin, Prof., V. Serebryany, Phd, M. Diez, N. Martynenko	37	RU
75		QUALIMETRIC PRINCIPLES OF ASSESSMENT OF REINFORCED STEEL	O.N. Krivtsova, V.A. Talmazan, N.Y. Kuz'minova, E.A. Panin, E.A. Shirokova	51	KZ
76		RELATIONSHIP BETWEEN PARAMETERS OF TEMPERING AND EDDY CURRENT TESTING OF CARBURIZED PARTS	Ivanov J. St., MSc	72	BG
77		CHANGES IN THE STRUCTURE AND HEAT RESISTANCE OF MULTILAYER TITANIUM-ALUMINUM COMPOSITE OBTAINED BY DIFFUSION IN SOLID PHASE	Cand. of tech. sci., senior researcher Korzhov Valerij P., doctor of tech. sci., corresponding member of the RAS Karpov Mikhail I., graduate Zheltyakova Irina S.	102	RU
78		INCREASE WEAR RESISTANCE HARD ALLOYS T15K6 BORIDE COATINGS	Prof. Dr. Chernega S., Poliakov I., Grinenko K., Krasovskiy M.	104	UA
79		ELECTRONIC, ELASTIC AND VIBRATIONAL PROPERTIES OF Cu_2TMAl(TM=Sc, Ti, Cr) FROM FIRST-PRINCIPLES CALCULATIONS	Prof. Dr. Uğur G., M.Sc. Bozan İ.	22	TR
80		STRUCTURAL, ELASTIC AND ELECTRONIC PROPERTIES OF Cu_2MnZ(Z=Al, Ga, In, Si, Ge, Sn, Sb): A FIRST-PRINCIPLES STUDY	Assoc. Prof. Dr. Uğur Ş., M.Sc. Ulusu E.	23	TR
81		DENSITY FUNCTIONAL STUDY OF LUSE AND LUTE INTERMETLLIC COMPOUNDS	Assoc. Prof. Dr. Nihat ARIKAN, Asist. Prof. Dr. Osman ÖRNEK, Assoc. Prof. Dr. Şule UĞUR and Prof. Dr .Gökay UĞUR	28	TR
82		STRUCTURAL, ELECTONIC, ELASTIC, PHONON AND THERMAL PROPERTIES OF $L1_2$ INTERMETALLIC COMPOUNDS BASED ON IRIDIUM (Ir Hf)	Assoc. Prof. Dr. Nihat ARIKAN, Asist. Prof. Dr. Osman ORNEK, Assoc. Prof. Dr. Şule UĞUR and Prof. Dr.Gökay UĞUR	29	TR
83		INVESTIGATION OF PLASTIC DEFORMATIONS OF CARBURIZED ALLOY STEEL DURING HEAT TREATMENT	Assoc. Prof. Dr. Kandrotaitė Janutienė R.	53	LT
84		PSEUDO-POTENTIAL CALCULATIONS OF STRUCTURAL, ELECTRONIC, ELASTIC AND PHONON PROPERTIES OF Os_2YPb (Y=Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn)	Assoc. Prof. Dr. Uğur Ş., M.Sc. Nazlı S.	44	TR

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THURSDAY (17.09)	10:00 – 19:00	POSTER SESSION "TECHNOLOGY"		CONFERENCE HALL 1	
FRIDAY (18.09)	09:00 – 13:00				
85		RESEARCHES 0F THE INHIBITING PROPERTIES OF WATER AND ORGANIC EXTRACTS OF OIL SLIMES	Cand. of tech. science Assoc. prof. Chkhaidze D., Dr. of tech. science, Full prof. Megrelishvili Z., Academy doct.	8	GE

time for presentation 10-12 minutes,
questions after each presentation

		Assist. prof. Loria M.		
86	LIGHT STEEL FRAMED CONSTRUCTION AND MODULAR HOMES	Beqir Hamidi, Lindita Hamidi	5	KO
87	SOME OPTIMIZATION METHODS FOR INCREASING THE ENERGY EFFICIENCY OF THE WATER SUPPLY SYSTEMS	Kostadinova S., M.Sc. Student, Panev A., M.Sc. Student, Prof. Dr Cingoski V.	10	MK
88	MODELING AND STUDY OF THE PROCESS OF BILLETS EXTRUSION WITH ADDITIONAL BACK-PRESSURE IN EQUAL CHANNEL STEP MATRIX	S.N. Lezhnev, As.R.Toleuova, E.A. Panin	20	KZ
89	НЯКОИ АСПЕКТИ ОТНОСНО ЛАЗЕРНОТО ПОВЪРХНОСТНО УЯКЧАВАНЕ В ЗАВИСИМОСТ ОТ ТОПЛОФИЗИЧНИТЕ СВОЙСТВА НА ОБРАБОТВАНИЯ МАТЕРИАЛ	PhD. Vladimir Shtarbakov, PhD. Maik Shtreblau	25	BG
90	HOOP TENSILE PROPERTIES OF FILAMENT WOUND PIPES	Prof. d-r Srebrenkoska V., MSc. Zhezhova S. and Naseva S.	45	MK
91	THREE-DIMENSIONAL S-N CURVE METHOD TO ESTIMATE FATIGUE LIFE OF EN AW 6063.T66 ALUMINIUM ALLOY DURING COMBINED LOADING UNDER IN-AND-OUT OF PHASE SHIFT 0° AND 90° AND COMPARING WITH FATIGUE CRITERIA	Ing. Uhríčik M., PhD.; Ing. Kopas P., PhD.; Prof. Ing. Palček P., PhD.1; Ing. Hurtalová L., PhD.	54	SK
92	OPTIMIZATION OF DEWATERING PROCESS BY ECONOMICAL CRITERIA	Assoc. prof. Parashkevova D.. Eng.Stoykova L.	66	BG
93	BOUSINESQ'S PROBLEM IN THEORY OF ELASTICITY AND ULTRASONIC	Alexander Popov	68	BG
94	CREATING NANOSTRUCTURED SUPERHARD AND HEAT-RESISTANT SURFACE LAYERS ON CARBON TOOL STEEL AT INFLUENCE TO INTENSE ELECTRON BEAMS	Senior Researcher, Candidate of Engineering Sciences Milonov A.S., Postgraduate Danzheev B.A., Research Officer Dasheev D.E., Main Scientist Researcher, Doctor of Engineering Sciences, Assoc. Prof. Smirnyagina N.N.	80	RU
95	MODELING AND OPTIMIZATION OF THE COMPOSITION OF TITANIUM -BASED ALLOYS BY APPROXIMATION WITH REGRESSION MODELS	Nikolay Tontchev, Martin Ivanov Emil Yankov	105	BG
96	DESIGN OF POLYMER COMPOSITE PIPES PRODUCED BY FILAMENT WINDING TECHNOLOGY	*Pop Metodieva B.*, MSc. Zhezhova S., *Srebrenkoska S.* , Naseva S. , Prof. Dr Srebrenkoska V.	108	MK
97	THE SPREADING OF MAGNETO ELASTIC WAVES IN TWO-LAYER SYSTEM IN CONDITIONS OF SLIDING CONTACTS	Artyom Davtyan	35	AM

THURSDAY (17.09)	**10:00 – 19:00**	**POSTER SESSION** **SIMPOSIUM "ERGONOMICS & DESIGN"** **SIMPOSIUM "MANAGENENT"**	**CONFERENCE HALL 1**		
FRIDAY (18.09)	**09:00 – 13:00**				
98	ERGONOMICS IN E- LEARNING		Assist. Prof Karamanska D. Y. PhD., PhD student Todorova, M.V .	43	BG
99	SOME PROJECT MANAGEMENT TECHNIQUES		M.Sc. Ivanova Milka	91	BG
100	ДИЗАЙН И ДИЗАЙНЕРСКИ ПРОДУКТ		Assoc. prof. Evtimova M.	109	BG
101	CONTEMPORARY MATERIALS AND STRUCTURAL SYSTEMS FOR THE CONSTRUCTION OF MODULAR AND MOBILE ICE SPORTS FACILITIES		PhD. Stud. Vasileva M.	50	BG
102	THE ROLE OF THE SOFTWARE IN THE CONTEMPORARY ARTS AND DESIGN		PhD. Stud. Georhieva E.	100	BG

THURSDAY (18.09)	**10:00 – 19:00**	**POSTER SESSION** **SIMPOSIUM "INDUSTRIAL INFORMATIC"**	**CONFERENCE HALL 1**		
FRIDAY (19.09)	**09:00 – 13:00**				
B	ANALYSIS OF PARALLEL RESONAT CONVERTERS WITH COMPUTER SIMULATIONS		Assist. prof. Dr. Eng. Stefanov G., Assos. prof. Dr. Eng. Sarac V., Assist.	4	MK

time for presentation 10-12 minutes,
questions after each presentation

		Msc. Eng. Kukuseva Paneva M.		
104	RELIIABILITY IMPROVEMENT PROBLEM OF INSTRUMENTATION AND CONTROL SYSTEMS SOFTWARE	Prof. Dr. Eng. Antamoshkin A., Prof. PhD Antamoshkina O.	13	RU

ANALYSIS OF PARALLEL RESONAT CONVERTERS WITH COMPUTER SIMULATIONS

Assist. prof. Dr. Eng. Stefanov G.[1] , Assos. prof. Dr. Eng. Sarac V.[2], Assist. Msc. Eng. Kukuseva Paneva M.[3] Faculty of Electrical Engineering-Radovis, University 'Goce Delcev'-Stip, Macedonia [1,2,3]
goce.stefanov@ugd.edu.mk, vasilija.sarac @ugd.edu.mk, maja.kukuseva@ugd.edu.mk

Abstract: *In this paper analysis of power converters with parallel resonant circuit by using of computer simulations is made. The full bridge IGBT power converter is analyzing. The simulations are made in PowerSim simulation program. Calculation is the efficiency of the converter and is made harmonic analysis of the output voltage and current. Also, is made and compare on the obtained results of the parallel resonant converter with the results of the serial resonant converter in applications with variable RL-load.*

Keywords: POWER CONVERTER, EFFICIENCY, HARMONIC DISTORTION

1. Introduction

Power converters have great application in power electronics as in the devices for consumers (UPS, amplifiers) such and in indus-trial applications (driver converter, DC converter, and converter for induction heating). Basic elements in the power converter are semi-conductors switching elements: diodes, thyristors, bipolar transis-tors, MOST transistors, IGBT transistors and GTO thyristors, [1], [2], [3]. The main target is semiconductors switching elements to operate with reduced losses of switching. The choice on the reso-nant circuit of the output of converter provides turn on and turns off of the switching elements in the bridge to be done at time as the voltage is zero or the current is zero. So the losses of power from switching are reduced, [1], [2].

Load resonant converters which used at devices for induction heating are with serial or parallel resonant circuit [1]. The resonant converters with serial *RCL* circuit are supply by a source of direct voltage. Output power in them is regulated by the control on differ-ence between switching (operating) and resonant frequency. The output current of these converters, for switching frequency close to the resonant, has the shape close to a sine wave form and then transmitted energy is greatest. The resonant converters with parallel *RCL* circuit are supply by a source of the constant current. In these converters, output power is also regulated by control on difference between switching and resonant frequency. The output voltage of these converters, for switching frequency close to the resonant fre-quency has a shape close to a sine wave form and then transmitted energy is greatest [1].

The process on design of the power converter is defined with the purpose of the converter, and output load. Output load of con-verter defines the required output power, output voltage, output current, and output frequency. From the physical state of the output load on the converter depends configuration of hardware and soft-ware part of managing electronics. The work is simple if the output load is a stationary, time able not changed, such as output load in the mode of motor or regulated source of voltage. But the design of converter is complicated if the physical state of the output load is a dynamic, time-variable process and its dynamic affects on output variables of the converter: impedance, voltage, current, power, fre-quency. Such output load has in power converter burdened with parallel and serial resonant circuit in the mode of induction furnace, [1], [5], [6]. The mode of induction furnace changes the impedance of resonant circuit and it affects on the voltage, current and power on the converter. So the design on the converter with such load requires knowledge of the dynamics of the process. The design of converter is facilitated by using on the computer simulation programs, [5],[7].

The main task in this paper is the researching for operating of parallel resonant converter with output loads whose dynamics are changing and is affecting of sizes on the resonant circuit.

2. Power Converters at Devices by Variables RL Load

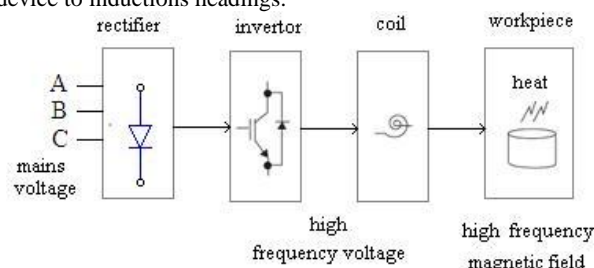In the Fig. 1 is presented block diagram in the power converter at device to inductions headings.

Fig. 1. *Power converter at device to inductions headings.*

The resonant converters used in applications where the dynamic of the process affects on the parameters of the converter. In the paper on the basis of a defined change on inductance and resistance on the resonant circuit, determined of the dynamics of induction device obtained by ELTA simulation program, is analyzed the work of full bridge IGBT converter with parallel resonant circuit, [5].

Definition of working conditions

We analyze the processink on the work piece metal with induc-tion heating under follow operating conditions [5]: 1.Working piece metal 0.4% C steal 2T anneal, shape-cylinder, length 35cm, finite system length, R_{int} = 3cm, R_{ext} = 8cm, maximum temperature is 1000ºC, time cycle is 600s; 2. Maximum output power (Smax) is 100000VA; 3. Switching frequency (f_{sw}) 10 kHz was assumed for the design of maximum power; 4. IGBT devices are used.
With these conditions in ELTA simulation program is define the dynamics of the parameters (power, current, voltage, frequency, inductance, impedance) important for the design of the converter, [1], [5]. In Table 1 are given the results for changing the parameters of the system converter-inductor-work piece.

Table 1. *Parameters of the system converter-inductor-work piece*

	L (µH)	C_{reson} (µF)	C_{real} (µF)	R (Ω)	I_{ind} (A)	U_{conver} (V)	P_{conv} (kW)	η_{ele} (%)	PF
	11.89	21.4	13.9	0.37	571	225	92.3	0.76	0.5
	23.93	10.6	13.9	1.14	238	285	65	0.96	1
% (min/max)	49.6	49.5		18.4	41.7	79	70.4		50

From Table 1 can be concluded:
- The changing on temperature of the work piece from 20 to 1000 ° C produces change on the inductance for 49.6%.
- C_{reson} is value on capacitance required for compensate of changes of inductance for preserve the resonance frequency from 10000Hz.
- C_{real} is a real value of the selected capacitor.
- The changing on the inductance produces change of power of the converter for 30%.
- When the inductance is minimum, the power and the current have a maximum value.
- The changing on power of the converter shows that in such variable loads is necessary to build a system for controlling on output power.

Construction of converter

From the results for the parameters of the induction device obtained by ELTA simulation program, in PowerSim program with computer simulations the operating of the converter is analyzes [4].

Full bridge parallel resonant converter

In the Fig. 2 is show the circuit for simulation of the full bridge IGBT converter with parallel resonant circuit.
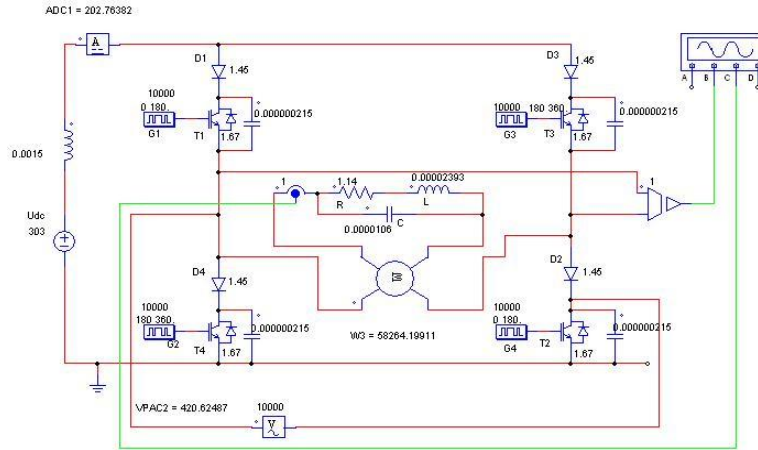

Fig. 2. Circuit for simulation of the full bridge IGBT parallel resonant converter.

In this paper the results to the parallel converter are comparing with the results for full bridge converter with serial resonant circuit obtained in [5]. In the simulation of the two types of converters took into consideration output power in both cases be the same.

Maximum inductance

From Table 1 can be seen that when the inductance and the resistance of the circuit are maximum, the capacitance is minimum, the output voltage of the converter is maximum and the output current is minimum. For this state, in Fig. 3 are given wave forms of the voltage and the current of output from the converter for full (100 %) output *RCL* load. In the Fig. 3a is shown wave forms for the converter by serial resonant circuit obtained to paper [5], and in the Fig.3b is shown wave forms for the converter by parallel circuit obtained by simulations in PowerSim program of the circuit of the Fig. 2.
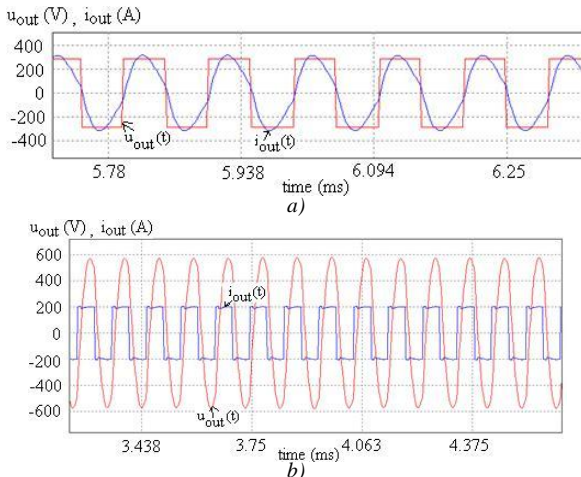

Fig. 3. Wave forms of the voltage and the current of output from converter for maximum inductance and 100 % *RCL* load: a) wave forms for the converter by serial resonant circuit in paper [5], b) wave forms for the converter by parallel circuit from Fig. 2.

From Fig. 3 can be seen that the output voltage in the converter by serial resonant circuit is with rectangular form, and the output current is with sine form, and in the converter by parallel circuit the output voltage is with sine form and the output current is with rectangular form.

The harmonics distribution of the output voltage (voltage amplitude spectrum) for maximum inductance and 100 % *RLC* load for serial resonant converter is shown in the Fig. 4a, and for parallel converter is shown in the Fig. 4b.

Fig. 4. Harmonics distribution of the output converter voltage for maximum inductance: a) for serial resonant converter, and b) for parallel resonant converter.

The harmonics distribution of the output current (current amplitude spectrum) for maximum inductance and 100 % *RLC* load for serial resonant converter is shown in the Fig. 5a, and for parallel converter is shown in the Fig. 5b.
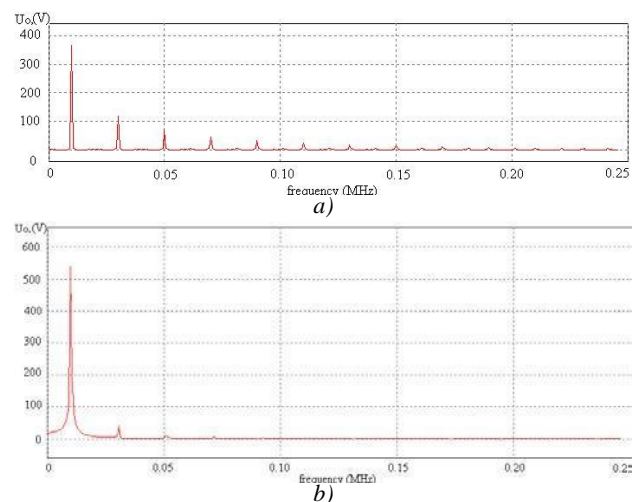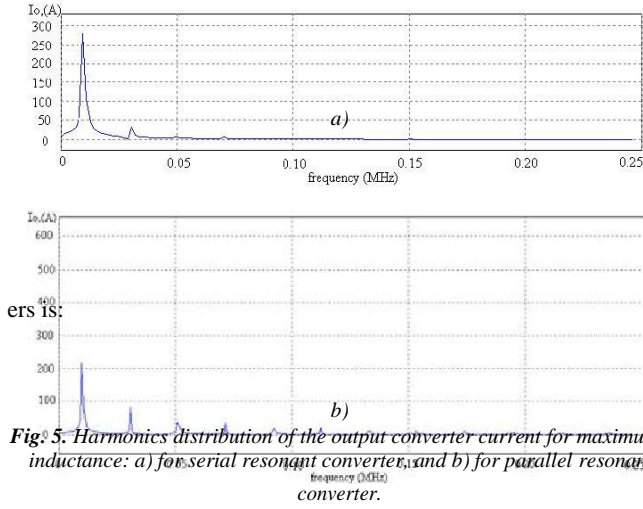
Fig. 5. *Harmonics distribution of the output converter current for maximum inductance: a) for serial resonant converter, and b) for parallel resonant converter.*

The voltage total harmonic distortion of the output on the power converter is calculates with the equation, [1]:

$$THDV = \frac{\sqrt{U^2_{o(3)} + U^2_{o(5)} + U^2_{o(7)} + U^2_{o(9)} + U^2_{o(11)} + U^2_{o(13)}}}{U^2_{o(1)}} \quad (1)$$

Where: $U_{o(1)}$, $U_{o(3)}$, $\cdots U_{0(13)}$ are effective values on the first, second,…..thirteenth harmonic.

The harmonic effective values of the output voltage for serial and parallel converter base in figure 4 are given in the Table 2.

Table 2. *The harmonic effective values of the output voltage for serial and parallel converter and 100 % RLC load*

	$U_{o(1)}$ (V)	$U_{o(3)}$ (V)	$U_{o(5)}$ (V)	$U_{o(7)}$ (V)	$U_{o(9)}$ (V)	$U_{o(11)}$ (V)	$U_{o(13)}$ (V)
serial circuit	258	72	22.9	22.7	15.5	13.5	8.1
parallel circuit	381	26.01	6.20	3.84	2.05	0	0

So voltage total harmonic distortion of the output for both converters is:

THDV = 31.7 % for power converter by serial circuit

THDV = 7.11 % for power converter by parallel circuit (2)

The current total harmonic distortion of the output on the power converter is calculates with the equation:

$$THDC = \frac{\sqrt{I^2_{o(3)} + I^2_{o(5)} + I^2_{o(7)} + I^2_{o(9)} + I^2_{o(11)} + \cdots + I^2_{o(19)}}}{|I^2_{o(1)}|} \quad (3)$$

Where: $I_{0(1)}$, $I_{0(3)}$, $\cdots I_{0(19)}$, are effective values on the first, second,….. nineteen harmonic. The harmonic effective values of the current for serial and parallel converter base in Fig. 5 are given in the Table 3.

Table 3. *The harmonic effective values of the output current for serial and parallel converter and 100 % RLC load*

	$I_{0(1)}$ (A)	$I_{0(3)}$ (A)	$I_{0(5)}$ (A)	$I_{0(7)}$ (A)	$I_{0(9)}$ (A)	$I_{0(11)}$ (A)	$I_{0(13)}$ (A)	$I_{0(15)}$ (A)	$I_{0(17)}$ (A)	$I_{0(19)}$ (A)
serial circuit	199	22.2	5.2	0	0	0	0	0	0	0
parallel circuit	153	44.53	25.12	21.16	11.16	10.50	9.84	7.40	6.84	3.95

So current total harmonic distortion of the output for both converters is:

THDC = 11.5 % for power converter by serial circuit THDC = 38.73 % for power converter by parallel circuit (4)

In the Table 4 are given the cumulative results from analyze on the tables 2 and 3 and the equations (1) and (3), and in the Table 5 are given the results from analyze in the Fig. 3, 4, 5 and Table 1.

Table 4. *Total harmonic distortion on output voltage and current at serial and parallel converter for full (100 %) RLC load*

	THDV(%)	THDC(%)
serial circuit	31.7	11.5
parallel circuit	7.11	38.73

Table 5. *Parameter of the resonant circuit and output parameter at serial and parallel converter and 100 % RLC load*

	L (mH)	C (µF)	R (Ω)	I_{out} (A)	U_{out} (V)	S_{conv} (kVA)	I_{DC} (A)	U_{DC} (V)	P_{DC} (kW)	PF	P_{conv} (kW)	$\eta_{conv.}$ (%)
circuit												
parallel circuit	0.02393	10.6	1.14	197.80	431.73	85.40	202.76	303	61.45	0.68	58.26	94.81

In the Table 5 sizes are:
- U_{out} and I_{out} are effective values of the output converter voltage and current
- PF is power factor of the converter

- $S_{conv} = U_{out}I_{out}$ output apparent power
- $P_{conv} = S_{conv}PF$ is output power of the converter
- $\eta_{conv} = (P_{conv}/P_{DC})100\%$ is efficiency on the full bridge converter

Affection on the pulse width of gate from IGBT of total harmonic distortion

In the Fig. 6a are shown wave forms on the output voltage and the output current in serial resonant converter by 50% load *RLC* load in case of maximum inductance, [5], and in the Fig.6b wave forms in parallel resonant converter for same case. This wave form are obtained with simulations on the circuit from Fig. 2 in PowerSim program.
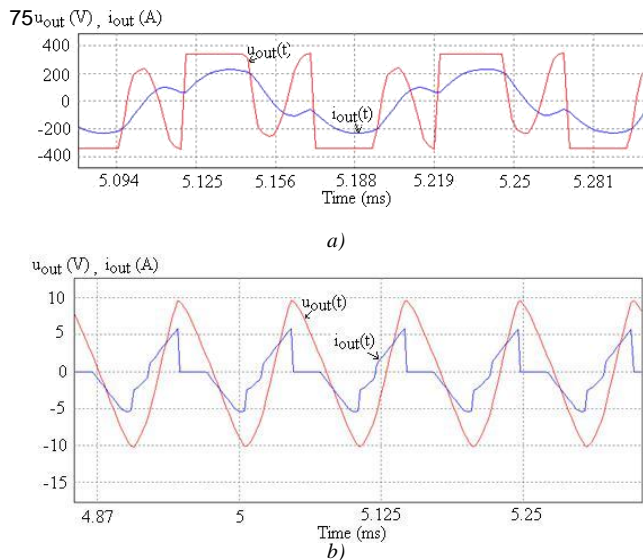
a)

b)

Fig. 6. *Wave forms of output voltage and current for 50% load RLC load in case of maximum inductance: a) for the serial resonant converter, b) for the parallel resonant converter.*

In the table 6 are given the results for the voltage total harmonic distortion and the current total harmonic distortion obtained with same analyze as for full output *RCL* load and used on the equations (1) and (3).

Table 6. *Total harmonic distortion on output voltage and current at serial and parallel converter and 50 % RLC load*

	THDV(%)	THDC(%)
serial circuit	145.0	24.6
parallel circuit	6.5	29.9

3. Analysis of results

Based of the results in point 2 can be concluded:

- Both types' resonant converters, parallel and serial satisfy the requirements for power and current defined in the Table 1.

- For same output power the parallel resonant converter works with more voltage and less current of serial converter.

- Also, for same output power in parallel resonant converter power factor *PF* and efficiency *η* are smaller from serial converter.

- In the parallel resonant converter current total harmonic distortion is greater, and in serial converter voltage total harmonic distortion is greater.

- In the converter with 50% load *RCL* load the voltage total harmonic distortion in serial resonant converter is increased. The sum on effective values on harmonics is greater than effective value on basic harmonic.

- It should be noted is that in parallel resonant converter to 50% load *RCL* load, the output power is significantly reduced.

- In the serial resonant converter, IGBT transistors operate with greater current (greater stress) than the parallel resonant converter for same output power.

- Since the mode of induction device has a variable dynamic, the converter which operates with such a device must monitore and regulate the output power with adequate methods of controlling.

4. Conclusion

In the paper is shown the procedure for construction of IGBT bridge parallel resonant converter with computer simulations. Here is analysis power converter with output load in mode of the induction device. Operation of the parllel converter is compared with the operation of the serial converter. The parameter of the resonant circuit and the required output power is obtained in the program package ELTA, with simulation of device for induction heating. In the analyse of the power converter is used PowerSim simulation program. The analyzed is the operation of the converter with change on the pulse width of the gate of IGBT transistors, as and changes of the output voltage and the current on the converter with change on the dynamics of resonant circuit. Also are analyze harmonics generated from the operation of the converter and is determined total harmonic distortion of the output voltage and current.

5. References

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