

PAPER ABOUT PAPERS IN THE AREA OF METAL FORMING PRESENTED AT *DEMI* CONFERENCES HELD SO FAR

Milentije Stefanović¹, Sribislav Aleksandrović², Dragan Adamović³

Summary: *At the previous nine DEMI conferences, held in the period 1989-2009, the specific area of production technologies – metal forming – was represented with 62 papers in total. Based on performed analysis, this paper presents the connections to institutions to which the authors of papers belong to as well as scientific and technical areas to which the published papers are related. In addition to that, the key results of particular papers which, according to the authors, were most impressive during the previous period of DEMI conferences, are specified. In addition to recommending that more scientists from different institutions should participate in the conference, the conclusions also indicate metal forming areas which are being developed intensively worldwide.*

Key words: *DEMI conferences, metal forming, papers*

1. INTRODUCTION

The basis for writing this paper is the fact that the ongoing conference DEMI is being held for the 10th time (the first one was held in 1998); therefore, there is a good reason to talk about the Conference accomplishments up to now. Here, we shall review only the papers published in the previous period related to metal forming area as an area of specific production technologies, without including other numerous and significant scientific areas. When selecting the papers to be analysed, the attention was primarily paid to the connection of contents, methodology and theoretical foundations which are typical for different metal forming procedures. There are different approaches possible for each classification and determining of connection of particular scientific areas; therefore, the list of papers here presented and analysed can be changed.

Such reviews are extremely significant from many aspects, the most important, probably, being the one that shows the accomplished level of development of a particular scientific area in comparison with the results achieved in the surroundings and worldwide. In addition to that, the contents of published papers indicate the

¹ Prof. dr Milentije Stefanović, Faculty of Mechanical Engineering Kragujevac, Serbia, stefan@kg.ac.rs

² Prof. dr Sribislav Aleksandrović, Faculty of Mechanical Engineering Kragujevac, Serbia, srba@kg.ac.rs

³ Ass.prof. dr Dragan Adamović, Faculty of Mechanical Engineering Kragujevac, Serbia, adam@kg.ac.rs

development of a particular economic area, association with industry, potential of scientific and research institutions outside university etc.

2. THE SELECTION AND ANALYSIS OF PUBLISHED PAPERS

At the previous nine DEMI Conferences, 62 papers in the area of metal forming were published in total. Table 1. shows the list of authors per institutions which employ them. Most papers, as expected, are from the Faculty of Mechanical Engineering in Banja Luka (24), followed by authors from the Faculty of Mechanical Engineering in Kragujevac (19) and the Faculty of Technical Sciences in Novi Sad (5). Experts from the area of industry published only three papers. The authors from the Faculty of Mechanical Engineering from east Sarajevo, Cars Institute Zastava from Kragujevac, Institute for Technology of Nuclear and Other Mineral Raw Materials from Belgrade etc. also took part in the Conferences.

The transformation of social capital into private capital has had a disastrous influence on further existence of factory-related institutes which have been a cooperative link between economy and universities for years. That is the reason for decreasing number of scientific papers in this area and reduced possibilities for transfer of new findings from universities' research centres into industry. There are many such examples in the Republic of Serbia, e.g. closed Institute for Ferrous Metallurgy SARTID in Smederevo and the recent example of the Cars Institute Zastava from Kragujevac.

Table 1 Review of published papers per institutions

Year when conference was held	INSTITUTION						Total of papers
	to which authors of papers in the area of metal forming belong						
	FME Banja Luka	FME Kragujevac	TF Novi Sad	Industry	HTS Doboj	Other*	
1998.	3			1	1		5
1999.	2	2		1	1		6
2000.	3	1	1				5
2001.	5	1			1		7
2002.	3	3	2			1	9
2003.	2	2	1		1	1	7
2005.	1	2				2	5
2007.	3	5	1	1		1	11
2009.	2	3				2	7
Total	24	19	5	3	4	7	62

*FME East Sarajevo (2), IAZ Kragujevac (1), ITNMS Belgrade (1), FME Nis (1), TS Banja Luka (1), Eftime Murgu Univ. Romania (1)

Table 2. reviews the published papers per metal forming areas. This classification is also optional, and can be made in a different way. Main contents are divided into: display of MF status and further development, materials formability in MF procedures, sheet metal forming processes and bulk hot and cold forming. The areas

of micro-forming, composites, machines and tribology are separate. Most papers were published in the area of cold and hot bulk forming (23), sheet metal forming (14) and formability (11) etc.

Table 2 *Review of published papers per metal forming areas*

No.	MF area to which the published paper is related	Papers number	Total of papers
1.	Development of processes and new technologies of MF	6, 33	2
2.	Materials formability in MF processes		
	2.1. Sheet metal forming by deep drawing	7, 16, 27, 30, 37, 38, 39, 53	8
	2.2. Bulk forming	29, 44, 54	3
3.	Sheet metal forming processes		
	3.1. Cutting through/punching	59	1
	3.2. Bending	9, 19, 24, 36	4
	3.3. Deep drawing	5, 21, 23, 40, 41, 43, 47, 50, 57	9
4.	Processes for hot and cold bulk forming		
	4.1. Pipes rolling and forming	2, 3, 4, 10, 13, 18, 20, 22, 35, 52	10
	4.2. Profiles pressing and hardening	1, 8, 15, 25	4
	4.3. Cold extrusion and embedding, rings rolling	12, 28, 55	3
	4.4. Hot forging	11, 32, 42, 48, 56, 61	6
5.	Micro-forming, Size-effect	34, 46,	2
6.	Composites forming	51, 58	2
7.	Machines for MF	14, 17, 45	3
8.	Tribology and ecology in MF processes	26, 31, 49, 60, 62	5

According to their contents, the published papers mainly followed the ongoing trends of worldwide MF development. The published results reflect the capability of research institutions for scientific work and the presence of young researchers, so it is obvious that there are no satisfactory results in particular areas of science and technology. When comparing the contents of DEMI papers with contents of papers presented at eminent conferences worldwide, related to metal forming area, e.g. [1], [2], [3], [4], it is obvious that the particular scientific areas are missing. This is primarily related to the introduction of modern materials into technological processes (composites, bio-materials, alloys Al, etc.) and development and application of innovative technologies (micro-forming, laser application, semi-hot forming, incremental forming, high-speed forming, super-plasticity etc.). Similar conclusions can be reached after the analysis of papers published at conferences in the area of

production engineering in the Republic of Serbia. Quality changes in the research areas, i.e. adjustment to modern trends of MF development, can happen with the further state support, increase of investments into science and inevitable integration of economy and research institutions. In the Republic of Serbia, a very important factor is a new possibility for inclusion of young researchers and students attending doctoral studies into constantly financed work on state projects in the technological development area.

4. CONCLUSION

At previous 9 DEMI conferences, 62 papers were published in the area of metal forming. Only three papers were published by experts from the industry area, 2 were published by research institutes and the others belong to the faculties and colleges. The lack of authors from the economy, i.e. factory-related institutes, is obvious. Due to the privatisation of public companies, many factory-related institutes were closed down, which ruined significantly the possibilities for the transfer of knowledge on relation university-industry and further economic progress of the society as a whole.

According to their connection to the MF area, the published papers were roughly divided into: status reviews and further MF development, materials formability in MF procedures, sheet metal forming processes and bulk hot and cold forming. Areas of micro-forming, composites, machines and tribology are separate. Most papers were published in the area of cold and hot bulk forming (23), sheet metal forming (14) and formability (11) etc. According to their contents, the published papers mainly followed the ongoing trends of worldwide MF development.

The published results reflect the capability of research institutions for scientific work and the presence of young researchers, so it is obvious that there are no satisfactory results in particular areas of science and technology. This is mainly related to introduction of modern materials into technological processes (composites, bio-materials, Al alloys etc.) and development and application of new technologies (micro-forming, laser application, semi-hot forming, high-speed forming, super-plasticity etc.). The presented materials can also be used for more extensive and specific analyses of the position and role of scientific and research work in the economic development of particular countries.

LITERATURE

- [1] 10th ICTP 2011, International Conference on Technology of Plasticity, Aachen, Germany, 2011, www.ictp2011.com
- [2] The 8th international ESAFORM Conference on Metal Forming, Cluj-Napoca, Romania, 2005, <http://conference.utcluj.ro/esaform2005/>
- [3] 50th IDDRG Conference" Graz , Austria, 2010, <http://www.iddrg.com/pub/iddrg/central/index.html>
- [4] The 3rd International Conference on Manufacturing Engineering, (ICMEN) Chalkidiki, 2005., <http://ithaki.meng.auth.gr/index-3.asp>

Enclosure:

The list of authors and papers in MF area published at DEMI conferences from 1989 to 2009:

1998.

1. M. Šljivić, O. Miletić, Ž. Babić, Possibilities of the Technology of Halfhot Extrusion, pp. 21-25.
2. Z. Božičković, Computer Aided Manufacturing of Polygonal Tubes on CNC-Hydraulic tandem Press, pp. 26-31.
3. O. Miletić, M. Šljivić, Ž. Babić, Phenomena of Outstripping and Remaining in Rolling Process of Thin Sheet Metals, pp. 32-39.
4. B. Mišić, I. Šušić, M. Šljivić, Horizontal Solution of Strip Accumulation on the Rolling Lines of Welded Tubes, pp. 45-49.
5. Ž. Babić, Measurement Deep-Drawing Process Force, pp. 50-55.

1999.

6. M. Šljivić, O. Miletić, Ž. Babić, New Technology -THIXOFORMING, pp. 66-71.
7. M. Stefanović, S. Aleksandrović, M. Milovanović, M. Samardžić, New Materials and Technologies in Car Body Manufacturing , pp. 61-65.
8. O. Miletić, M. Šljivić, Ž. Babić, Pressing of Aluminium alloy by backward extrusion method, pp. 76-81.
9. Z. Božičković, Additional analysing on tools problem and possibility for manufacturing protective rail-bumper by bending process, pp. 107-109.
10. B. Mišić, M.Šljivić, Contribution to the plasticity analysis in pipes rolling, pp.110-113.
11. V. Mandić, M. Stefanović, Physical simulation of hot forming process by applying plasticine as modelling material, pp. 72-75.

2000.

12. Miroslav Plančak, Dragiša Vilotić, Đorđe Čupković, An Contribution to the Investigation of Double Inverted Extrusion, str.18-21.
13. Ostoja Miletić, Milan Šljivić, Drago Blagojević, Živko Babić, High-speed Expand Process Applied on Tube Joints in Heat Exchangers, pp. 78-81.
14. Ostoja Miletić, Vid Jovišević, Mladen Todić, Tihomir Latinović, Concept of crank press with rotary tools for hot pressing, pp.102-105.
15. Mladen Todić, Ostoja Miletić, Tihomir Latinović, Normal and tangential stresses on contact surface at axis-symmetrical profiles drawing, pg. 106-109.
16. M. Stefanović, S. Aleksandrović, M. Milovanović, M. Samardžić, Development and Application of Al-Alloys in Manufacture of Carbody Elements of Passenger Cars, pp.37-40.

2001.

17. .V. Jovišević, P. Dakić, O. Miletić, M. Todić, Some Aspects of Research of Heavy Presses Production Possibilities, pp. 45-50.
18. O. Miletić, M. Todić, M. Đurđević, Enlargings of Tubs Adapters for Bushing, pp. 75-80.
19. O. Miletić, P. Dakić, M. Todić, T. Latinović, Analysis of process of thin-waled work-piece in die bending tool and by roll bending, pp. 93-102.
20. M. Todić, O. Miletić, V. Jovišević, T. Latinović, Balance of Energy by Pulling Axis of Symmetry Profiles, pp. 103-108.
21. Ž. Babić, M. Šljivić, D. Adamović, Influence of Tribological Conditions on Limit Drawing Ratio, pp. 116-120.
22. B. Mišić, Parameters for Value of Phases Number Configuring Aright-angle Tubes, pp. 143-148.
23. S. Aleksandrović, M. Stefanović, Deep Drawing of Aluminium Alloy AlMn4,5Mn Thin Sheet in Nonmonotonous Forming with Variable Blank Holder Force, pp. 69-74.

2002.

24. O. Miletić, M. Todić, Work - hardening angle at contour roll bending, pg. 65-70.
25. M. Todić, O. Miletić, V. Jovišević, T. Latinović, Significance of parameters in drawing process related to mechanical properties of axis-symmetrical profile, pg. 91-96.
26. Đ. Čupković, M. Plančak, D. Vilotić, Influence of Initial Disc Dimensions on Diagram for Determination of Coefficient of Friction in Metal Forming, pp. 97-102.
27. Ž. Babić, M. Šljivić, Application and Development Tailored Blanks in Manufacture of Body Cars, pp. 121-126.
28. M. Milutinović, D. Vilotić, Đ. Čupković, Strain analysis at manufacture of conical punch by embedding method, pg. 127-133.
29. M. Kraišnik, Determining of formability of materials at cylinder compression by spherical dies, pg. 159-165.
30. M. Stefanović, S. Aleksandrović, Ž. Babić, T. Vujinović, Formability of Thin Sheet Metals at Deep Drawing in New Technologies Conditions and Applications of Modern Materials, pp. 43-54.
31. D. Adamović, M. Stefanović, V. Lazić, Investigation of parameters which influence the ironing process, pg. 166-172.
32. V. Mandić, M. Stefanović, Significance of physical-numerical modelling in designing hot forging technology, pg. 147-152.

2003.

33. M. Šljivić, Achievements and Perspectives in Development of Production Technologies, pp.11-22.
34. M. Plančak, D. Vilotić, J. Jevremov, Size Effect in Metal Forming, pp. 51-54.
35. B. Mišić, S. Bajić, Z. Božičković, Applicability of manufacture method for tubular elements with complex longitudinal and cross section, pp. 101-106.

36. O. Miletić, M. Todić, Strain flow at bending at 180° , pp. 125-134.
37. M. Milovanović, M. Stefanović, V. Milovanović, Analysis of Possibility for Introduction of New Materials and Technologies for Manufacturing of Car Body Parts, pp. 557-562.
38. S. Aleksandrović, M. Stefanović, V. Mandić, T. Vujinović, Application Perspective and Current Formability Problems of High Strength Steel Sheets, pp. 579-84.
39. M. Stefanović, V. Mandić, M. Živković, S. Aleksandrović, Physical and Numerical Modeling of Deflexion Appearances at Thin Sheet Metals-Yoshida test, pp. 45-50.

2005.

40. Ž. Babić, M. Šljivić, New Technologies in Manufacture of a Carbody, pp.183-190.
41. L. Coman, Technological Considerations Regarding Deep Drawing, pp.203-208.
42. V. Mandić, Elimination defects in Metal Forming Processes by Using Modelling and FEM Simulation, pp. 153-158.
43. S. Aleksandrović, M. Stefanović, T. Vujinović, Control of Blank Holding Force in Deep Drawing Proces-Significance and Limitations, pp.159-164.
44. M. Kraišnik, D. Vilotić, M. Plančak, M. Stefanović, Material Formability in the Process of Upsetting of Cylinder by Holoww Dies, str. 225-230.

2007.

45. O. Miletić, M. Todić, Examination of Carrying Structure of Hydraulic Press, pp. 159-168.
46. M. Stefanović, S. Aleksandrović, M. Samardžić, Micro Forming – Possibilities and Limitations pp.181-186.
47. S. Aleksandrović, M. Stefanović, T. Vujinović, Possibilities of Deep Drawing Process Control pp.187-192.
48. M. Stefanović, Z. Gulišija, V. Mandić, Specific Properties of Forging of High Strength Al-alloys pp.193-198.
49. D. Adamović, M. Stefanović, M. Živković, Experimental Methods for Determination of Friction Coefficient During Ironing, pp.199-206.
50. M. Samardžić, M. Milovanović, M. Stefanović, Forming Simulation of Deep Drawing in Concurrent Concept the Car Body Development Process, pp. 207-212.
51. M. Todić, O. Miletić, Influence of Position of Layer of Two-Layer Composite at Bending on Stability of Process, 221-226.
52. R. Mijić, Minimal Radius of “R” Bending of Pipes by Cool Deformation, pp.251-258.
53. Ž. Babić, M. Šljivić, Parameters of Laser Welding Blanks Forming, pp. 213-220.
54. Z. Gulišija, A. Patarić, M. Stefanović, Effect of Electromagnetic Field on Mechanical Properties of Continually Casted Al EN AW 2024 Alloy, pp. 277-282.
55. I. Trbojević, Factors which Impact Manufacturing Technology for Ring-Shaped Parts, pp. 283-290.

2009.

56. V. Marinković, Analysis of the Influential Factors on the Flow Stress in the Warm Forging Processes by Applying Latin Square Design, pp. 163-168.
57. Ž. Babić, S. Aleksandrović, M. Šljivić, Influence of a Weld-Line Location in Deep Drawing of Tailored Blanks, pp.181-188.
58. M. Todić, O. Miletić, D. Marić, Hardness in Function of Stress-Strain State of Two-Layer Composite, pp.189-194.
59. D. Marić, M. Todić, O. Miletić, Influence of Clearance of the Separation of Closed Contours, pp. 195-200.
60. M. Stefanović, M. Đorović-Stanojević, S. Aleksandrović, Ecologically Aspects of Development Metal Forming Technologies, pp. 335-338.
61. M. Stefanović, Z. Gulišija, V. Mandić, Modern Procedures for Hot Forging of Orthopaedic Implants, pp. 151-156.
62. D. Adamović, M. Stefanović, S. Aleksandrović, Modelling of Tribological processes in Ironing, pp. 151-156.