SIRAMM

NEWSLETTER 03

H2020-WIDESPREAD-2018, Project No. 857124 | **December 2021**

Main events

East Europe Conference on AM materials — EECAM21

Belgrade, Serbia & On-line, 2nd - 4th September 2021

⇒ **6 keynote lectures:**

Mechanical Properties and geometric aspects in Selective Laser Sintering, Dr. Dan Stoia (Politehnica University Timisoara, Romania)
Gender in Science and Technology, Dr. Roxana Gita (Politehnica University Timisoara, Romania)
Horizon Europe – new EU framework program, Biljana Glišić (Horizon NCP, Serbia)
Numerical modeling of AM processes, Roberto Brighenti (Univ. of Parma, Italy)
Additive Manufacturing in Aerospace Industry: Present and Future, Ognjen M. Peković (Faculty of Mech. Eng. – Univ. of Belgrade, Serbia)
Design advanced interlocked structures via machine learning approach, Chao Gao (NTNU, Norway)

⇒ **6 sessions with 36 presentations:**

1. ***Characterization of AM materials***
2. ***AM technologies advancements & new experiences***
3. ***Simulation of AM processes***
4. ***Fatigue of AM materials***
5. ***Structural Integrity of AM materials***
6. ***Properties and models of AM materials***

⇒ **2 practical sessions**

Demo from 3DRepublica company
Visit to testing and DIC Lab

⇒ **Social events (city tour + conference dinner)**

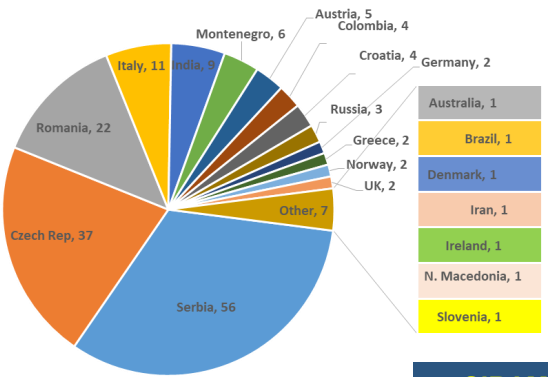
Museum Nikola Tesla
Saint Sava church
River cruise & Conference dinner

⇒ **Post conference tour**

Neolitic pre-historic site Vinča
Viminacium - Roman settlement

Belgrade, 2 September 2021

River cruise, 3 September 2021



172 participants from 21 countries

Papers submitted to a Special Issue of *Structural Integrity and Life* journal published by DIVK

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NEWSLETTER 03

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Main events

Seminar for companies:

New tendencies on Additive Manufacturing

Timisoara, Romania, 11 June 2021 (in presence)

⇒ 40 participants from 11 companies
⇒ 6 presentations
⇒ Live demonstrations for 3D Printing (Nutechnologies), 3D scanning (CADWORKS) and numerical simulation of additive manufacturing processes (CADWORKS)

Timisoara, 11 June 2021

Seminar for companies & students:

Structural integrity of components obtained using additive manufacturing - advantages and disadvantages

Zlatibor, Serbia, 29th June – 2nd July 2021 (in presence)

⇒ 60 participants

Zlatibor, 2nd July 2021

Timisoara, 20th July 2021

Seminar for students:

Applications of Additive Manufacturing

Timisoara, Romania, 20th July 2021 (in presence)

⇒ 50 participants

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NEWSLETTER 03

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Exchange experiences of PhDs involved in the SIRAMM project

Riccardo Alberini from UniPR (IT) to NTNU (N), Dec.2021, Jan-Feb. 2022

I am Riccardo, a PhD student at the University of Parma, and I started my exchange period in Trondheim at the Norwegian University of Technology. From this experience I expected to expand my knowledge and build important collaborations with professors and other PhD students for my research. Despite the pandemic situation, my expectations were confirmed and even exceeded. The environment at NTNU is welcoming and dynamic for foreign students, and there I had the occasion to collaborate even with professors from other universities. The department where I worked is well organized, providing foreign PhD students with offices, experiment facilities, software, and services. Due to the large number of exchanging students working in the department, I had many times the opportunity to talk with them and discuss about our job and impressions. This was very enriching and allowed me to establish new personal relationships for future scientific collaborations.

Ladislav Poczklán from IPM (CR) to UPT (RO), Oct.-Dec. 2021

My thesis deals with fatigue of metals. The stay at Polytechnic University of Timisoara was a great opportunity to get to know with different experimental material. I had a chance to see the process of manufacturing and testing of 3D printed plastic specimens. Another PhD student from Serbia brought a lot specimens with him so I could see how instrumented Charpy impact tests are performed and analyzed.

My main task was to help with setting of the Walter Bei fatigue machine so plastic specimens manufactured by additive technology could be tested on it. This machine was previously used for testing of metals. It means that setting of its PID regulators had to be substantially modified. We were able to do so after a consultation with official support. I found a proper set of PID for two materials which mechanical properties were pretty distinct (the ultimate stress 50 MPa and 125 MPa). The R ratio was 0.1 and specimens were cyclically loaded with a frequency 3 Hz. The problem was that for setting of the fatigue machine only specimens fabricated with traditional technology were used. When we finally tried to cycle 3D printed specimen a pressure in machine grips turned out to be too high. The pressure in machine grips caused a destruction of the specimen even though its value was the lowest possible. The only solution is probably in different design of the specimen but unfortunately there was not enough time to do so.

Beside research activities, I also had a chance to explore Timisoara which is a very nice city. I also visited nearby national park and other cities like Resita and Lugoj. The highlight of my stay was a trip to Belgrade. My colleague was there on his stay so I could see the city but also laboratories of University of Belgrade.

NEWSLETTER 03

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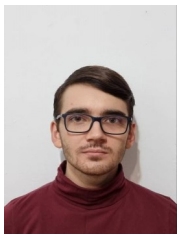
Tomáš Babinský from IPM (CR) to UBG (RS), Oct.-Dec. 2021

In Autumn 2021 I spent two months at the University of Belgrade (UB) in Belgrade, Serbia thanks to the involvement of my parent institute, the Institute of Physics of Materials Brno (IPM Brno), in the SIRAMM project. In cooperation with colleagues from IPM and UB we started a project focused on microstructural characterization of fatigued 3D-printed (specifically DMLS – direct metal laser deposition) Ni-base superalloy IN939 which we first tested for tensile properties at UB. Some of the results obtained so far are going to be presented by Dr. Šulák in February 2022 at the SIRAMM conference held in Brno. Besides, I also took part in Mr. Milovanović's project focused on the evaluation of fracture toughness and tensile properties of PLA and PLA-X plastics, to which I contributed with scanning electron microscopy analyses and the evaluation of experimental data. All in all, I believe the cooperation has been fruitful and might continue in the future.

Regarding personal, non-scientific experience, I enjoyed my stay in Serbia to the fullest. I met wonderful people, I enjoyed the exceptional Serbian food, I explored Belgrade as well as several parts of the country. I can definitely recommend hiking in Đerdap national park with its exceptional views or the mountains near Divčibare. In terms of city sightseeing, I can recommend visiting Novi Sad as well as Timisoara, Romania. However the biggest downfall of tourism in Serbia is the poor quality of public transport so I recommend borrowing a car if you don't come by one.

Mihai Marghitas from UPT (RO) to UniPR (IT), Oct.-Dec. 2021

During my doctoral studies at UPT, I participated in an exchange of experience within the SIRAMM project, at University of Parma, Italy. The purpose of this exchange of experience was to enrich my knowledge, to study specialized publications and to carry out practical tests with 3D printers.



Testing 3D printed specimens is one of the main activities in my doctoral research. To obtain competitive products with this 3D printing mode, we test the specimens in the laboratory and note the results. The conclusions lead to a better understanding of the mechanical parameters of objects obtained by 3D printing, FDM or resins, and their comparison with products obtained by traditional methods. I participated in a technical exhibition at the University of Parma, which I liked, as a presentation and content. I saw interesting things and I appreciated the research work, the passion and the competitive spirit.

The exchange of experience at the faculty also had a cultural side, through the possibility of visiting the beautiful Italian cities of Trieste, La Spezia, Pisa, Modena, Bologna, Genoa, Florence, Milan, Mantua, Rome. I visited the Ferrari Museum in Maranello. I visited the Vatican Museum, where I was especially impressed by the Sistine Chapel. At Tivoli, the museum and gardens are fascinating.

I was glad to taste and see the places where Parma ham and Parmigiano Reggiano are produced, I admired fashion at the highest level, I saw the cities dressed for the holiday and the joy of the Italians to enjoy the moment.

Video on Mihai's experience in Italy

NEWSLETTER 03

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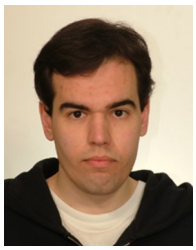
Exchange experiences of PhDs involved in the SIRAMM project

Aleksa Milovanovic and Isaak Trajkovic from UBG (RS) to UPT (RO), Oct.-Dec. 2021



We are grateful and honoured that we participated in the student exchange activity from mid-October to late December 2021 in Timisoara, Romania. The city of Timisoara is the capital of the Romanian Banat region and is the biggest city in the whole of Banat, which is a geographical and historical region of South-Eastern Europe, shared between Romania, Serbia and Hungary. Our hometown Belgrade borders this geographical region and the cultural traits of Banat are familiar to us. The cultural and ethnic diversity of this region makes it a very special and unique place in Europe. This two-month-long stay allowed us to be a part of this city from late Autumn up until the beginning of the Winter period, just before the Christmas holidays. We will never forget the long walks along the river Bega, spacious downtown squares filled with cafes and restaurants and beautiful churches, which are the most well-known landmarks of this city. During our stay, we have experienced the friendly nature of people from Timisoara when we asked for directions and during short conversations with local people in the hope of learning some words from the Romanian language.

Our working hours were spent at UPT, at the Department of Mechanics and Strength of Materials where we were studying and working with the available testing equipment. We take this opportunity to praise our colleagues from UPT for their hospitality, selfless help and guidance during our two-month-long exchange period. Besides getting acquainted with their equipment, professor Marsavina has arranged a few visits to neighbouring Institutes, where except for mechanical testing we have seen that our cooperation can be extended with material characterization techniques, using optical, SEM and TEM microscopes. Most of the exchange period was used to test PLA material Charpy specimens on instrumented pendulum and analysis of the obtained results. All Charpy specimens are 3D printed with a notch and have 80x10x4 mm in bulk dimensions. Before our stay we have prepared 30 specimen batches, with seven specimens per batch. Five specimens are mandatory according to the standard and the other two specimens serve as replacements. Variation in PLA specimens was in layer height i.e., 0.3, 0.2 and 0.1 mm, and in infill density, ranging from 10 up to 100%, with 10% increment. The reason for this is to see the layer height and infill density influence on impact toughness of PLA material. The effort in material testing and data analysis will be exploited in the publication of obtained results in Journal papers.

Video on Aleksa and Isaak's experiences in Romania

SIRAMM

NEWSLETTER 03

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Scientific papers published in 2021

All open access available at http://www.siramm.unipr.it/Publications.htm

Journal papers

⇒ Benedetti, M., Du Plessis, A., Ritchie, R. O., Dallago, M., Razavi, S.M.J., Berto, F. (2021). Architected cellular materials: A review on their mechanical properties towards fatigue-tolerant design and fabrication. **Materials Science and Engineering: R: Reports**, 144, 100606.

⇒ Derban, P., Negrea, R., Romino, M., Marsavina, L. (2021) Influence of the printing angle and load direction on flexure strength in 3D printed materials for provisional dental restorations. **Materials**, 14, 3376.

⇒ Stoia, D.I., Marsavina, L., Linul, E. (2021) Mode I critical energy release rate of additively manufactured polyamide samples. **Theoretical and Applied Fracture Mechanics**, 114, 102968.

⇒ Brighenti, R., Cosma, M.P., Marsavina, L., Spagnoli, A., Terzano, M. (2021). Mechanical properties of polymers obtained through photo-induced polymerization: a multi physics-based approach. **Advanced Manufacturing Technology**, 117, 481-499.

⇒ Brighenti, R., Cosma, M.P. (2021). Mechanical behaviour of photopolymerized materials. **J. Mechanics and Physics of Solids**, 153, 104456.

⇒ Milovanović, A., Sedmak, A., Golubović, Z., Mihajlović, K. Z., Zurkić, A., Trajković, I., & Milosević, M. (2021). The effect of time on mechanical properties of biocompatible photopolymer resins used for fabrication of clear dental aligners. **Journal of the Mechanical Behavior of Biomedical Materials**, 119, 104494.

⇒ Cosma, M.P., Brighenti, R. (2021). Photopolymerized AM materials: modelling of the printing process, mechanical behavior and sensitivity analysis. **Material Design and Processing Communication**, e225, 2021.

Conference papers

⇒ Alberini R., Spagnoli A., Terzano M., Raposio E. (2021). Computational mechanical modeling of human skin for the simulation of reconstructive surgery procedures. **Structural Integrity Procedia**, 33, 556-563.

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NEWSLETTER 03

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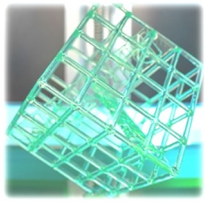
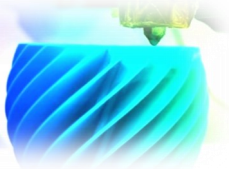
Forthcoming Events

⇒ Final **international conference** on
Mechanics and Integrity of Additively Manufactured Materials - MIAMM23
Central Library, Polytechnic Univ. of Timisoara (UPT), Romania
Dates to be defined (March 2023)



⇒ 3rd **Winter School**:
Trends on Additive Manufacturing for Engineering Applications
Faculty of Mechanical Engineering, Univ. of Belgrade, Serbia
Dates to be defined (Feb. 2023)

⇒ **International Workshop** on
Reliability and Design of Additively Manufactured Materials - RdAMM22
Faculty of Mechanical Engineering, Univ. of Belgrade, Serbia & Online
4th-6th Oct. 2022



⇒ 2nd **Winter School**:
Trends on Additive Manufacturing for Engineering Applications
Brno, Czech Rep., 6th-10th February 2022

⇒ 2nd **International Workshop**
Structural Integrity of Additively Manufactured Materials - SIAMM22
Brno, Czech Rep., 4th-5th February 2022
selected papers will be considered for a special issue of *Journal of Mechanical Science and Technology* (Springer)

Participation in all Events is free! However, a limited number of places is available and registration is required.

More information about future events on:
http://www.siramm.unipr.it/Events.htm
https://www.facebook.com/SIRAMM2020
https://twitter.com/SIRAMM1

Contact Us

Contact us for more information about our project

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