ISEM 2020

20th CIRP Conference on Electro Physical and Chemical Machining

Final Program

19th – 21st January 2021, Zurich Switzerland

www.isem2020.ethz.ch
Finally we are able to cordially welcome you to the 20th CIRP Conference on Electro Physical and Chemical Machining. The conference was planned to take place in June 2020 in Zurich. It would have been our honour and pride to receive you here in Zurich and present you industries, our institute, ETH Zürich and the wonderful city of Zurich. Due to COVID-19-reasons we needed to transform it into an online conference or postpone it into a safe time region which at that time was deemed to be January. We realized that a presence conference would be the preferred form of ISEM XX as the personal networking, the cross fertilization between developments in the different non-conventional processes among participants was judged to be one of the assets of an ISEM conference. We really appreciated that you tolerated the postponement. In the end COVID-19 won the race and now not delaying the publication of your research results any further, we organized a hybrid conference and in the end we needed to decide to convert it to a full online version of the ISEM XX and now let’s try to make the very best of it. The organization is in sessions with asynchronous video presentations which you can listen to whenever you like. This enables to follow all sessions. The opening and the Keynote speeches are synchronous and as well asynchronous. Discussion sessions on the different topics are organized synchronously for direct interaction with the authors and we hope for lively participation.

Switzerland is a major manufacturing country. Having been the poorest country in Europe in the beginning of the 19th century Switzerland’s wealth is based on manufacturing. Thus, today comparing countries by value of produced machine tools per capita and year Switzerland leads by far. In a wider sense the region around the Alps is Europe’s machine tool area, within which approximately one fourth of the world’s machine tool production takes place, and Zurich is in its center. From here major machine tool companies as well as manufacturers of all different kinds of goods can easily be reached.

Switzerland played and still plays a major role in the development of one of ISEM’s major topics, electrodischarge machining. After invention in Russia it were the two Swiss companies Charmilles Technologies S.A. in Geneva and AGIE S.A. in Losone, now united under the roof of GF machining solutions, who made the major developments towards industrialization of this technology.

Non-conventional manufacturing technologies typically are considered to overcome weaknesses of conventional technologies mostly in terms of materials, geometries, quality and surface integrity and even productivity. Research in this field therefore aims to further develop the strengths and overcome weaknesses of the individual technologies, which unites these technologies in trends beyond the everlasting tasks in manufacturing research of increase of
productivity, quality, reliability, scope of eligible materials and reduction of ecologic footprint. Characteristic is that tools are defined not by their geometry, but by differential field equations, where the boundary conditions are the geometry of the work piece. Concentrating energy to the process zone requires extreme gradients of state variables. Therefore Process understanding, process modelling and process observability becomes much more difficult and even simplifying meta models for the daily use in industry are lacking. Thus, process modelling, process observation are major targets of actual ongoing research. These topics are not self-sufficient but aimed for a better control of the processes. Here also the re-discovered capabilities of artificial intelligence will complement and cooperate with physical modelling in future.

A vital role plays the cooperation between industry and academia in this area of process technologies. To promote and deepen this collaboration is one of the most important goals of the ISEM XX conference. We are proud of a strong industrial participation despite the adversities of present times and very much appreciate the generous sponsoring of Georg Fischer Machining Solutions, DMG Mori, Sarix National Technology Net IB AM, Oerlikon, 6c-tools, Agathon, Posalux, Swissmem, Swiss Photonics and inspire.

We would like to sincerely thank the CIRP conformance committee, international advisory and scientific committee and all contributors to the conference.

Konrad Wegener
Conference Chairman ISEM XX
On behalf of the local organizing committee
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For more information, check out the Partner channel on the conference platform!
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## International Scientific Committee

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<td>Switzerland</td>
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<td>Anjali De Silva</td>
<td>Germany</td>
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<td>Gert-Willem Römer</td>
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<td>Eckart Uhlmann</td>
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<td>Georg Wälder</td>
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## International Advisory Board

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<td>Thomas Bergs</td>
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<td>David L. Bourell</td>
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<td>Kazuo Yamazaki</td>
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<td>Wansheng Zhao</td>
<td>China</td>
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VENUE

ETH Zürich

In 1855, the Swiss Federal Institute of Technology (ETH) was founded mainly as a school for engineers, but also as a compensation to Zurich for not being the capital city of Switzerland. Between 1861 and 1864, the impressive main building was created by Gottfried Semper. Ever since it was first founded, ETH Zurich has been a driving force behind Swiss industry, whose innovative products and services are in demand worldwide. In the history of ETH, many well known scientists and 21 Nobel price winners are associated with this school. 21,400 students, including 4,180 doctoral students, from over 120 countries are matriculated in 16 departments of all technical and scientific disciplines.

The City of Zurich

More than 2000 years ago Zurich was founded by the Romans as a fortress. Today Zurich has about 400'000 inhabitants and is the largest city in Switzerland. Zurich is the main town of a canton also named Zurich. The city has a picturesque downtown with many tourist attractions and is located at the end of the Lake of Zurich. Zurich is not only important for its universities but is also the commercial centre of Switzerland and a platform for international trade.

Switzerland

Switzerland is well known for its food (especially chocolate and cheese), skiing in Zermatt, Gstaad, St. Moritz and many other famous places in the alps, hiking in the Engadin or watching the mountain panorama out of the Glacier-Express train. Many famous places of interest are very close to Zurich and easy to reach by train. Enjoy some days before or after the conference at the Lake of Lucerne, on the Jungfraujoch or at many other beautiful landmarks.
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<td>10:00</td>
<td>Opening</td>
<td>EDM 6 Micro &amp; DrillMill&lt;br&gt;Sponsored by Sarix</td>
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<td>11:00</td>
<td>EDM 1&lt;br&gt;Sponsored by GFMS</td>
<td>ECM 4 Micro</td>
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<td>12:00</td>
<td>EDM 2</td>
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<td>14:00</td>
<td>B. Lauwers*&lt;br&gt;(Hybrid)</td>
<td>A. Klink*&lt;br&gt;(ECM / EDM)</td>
<td>W. Zhao*&lt;br&gt;(EDM)</td>
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<td>14:45</td>
<td>A. Michaelis*&lt;br&gt;(AM, ceramics)</td>
<td>A. Zikin*&lt;br&gt;(Cladding)</td>
<td>M. Schmidt*&lt;br&gt;(Laser)</td>
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<td>15:30</td>
<td>AM 1&lt;br&gt;Sponsored by DMG Mori</td>
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<td>EDM 5 Fundamentals</td>
<td>Plasma &amp; Special Technologies</td>
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* keynote speakers
SESSION CONTRIBUTIONS

Opening
K. Wegener ISEM XX in Switzerland - an introduction
S. Brupbacher Industrial Manufacturing in Switzerland

Keynote sessions
B. Lauwers Hybrid Manufacturing based on the combination of Mechanical and Electro Physical-Chemical Processes
KU Leuven
A. Michaelis Advanced Manufacturing for Advanced Ceramics
IKTS Fraunhofer
A. Klink Digital Twin Concept for EDM and ECM Processes
RWTH Aachen
A. Zikin Laser Cladding – the latest developments in technology.
Oerlikon Metco AG Overview from the industry
W. Zhao Reconstructing CNC platform for EDM machines towards smart manufacturing
Shanghai Jiao Tong University

Session: AM1 ➔ Q&A-session: January, 19th 2021 15:30
PROCIR-D-19-01288 Direct Metal Deposition (DMD) for Tooling Repair of DIN 1.2343 Steel
M. Rabiey, P. Schiesser, P. Maerchy
PROCIR-D-19-01001 Laser-based Hybrid System for Inconel 718 part repairing
F. Mazzucato, M. Menerini, A. Valente
PROCIR-D-20-00041 A Study on the accuracy of Thermography-based Temperature measurement in Powder-fed directed energy deposition
C. Kledwig, M. Hofer, M. Reisacher, F. Brückner, J. Bliedtner, C. Leyens
PROCIR-D-19-00996 Modeling of laser power attenuation by powder particles for laser solid forming
J. Wang, F. Han, S. Chen, W. Ying
PROCIR-D-19-01038 Compact Cold Spray system for in-situ processing of steel components
D. Gitardi, A. Valente
PROCIR-D-19-00884 Towards Wire and Arc Additive Manufacturing of High-Quality Parts
D. Baier, M. F. Zaeh
PROCIR-D-19-00894 Development of low-cost production process for prototype components based on Wire and Arc Additive Manufacturing (WAAM)
N. Chernovol, B. Lauwers, P. Van Rymenant
Development of additive manufacturing method by selective melting using micro arc plasma

W. Xie, S. L., X. Yang

Research on Technology of Additive Manufacturing 3D Metallic Microstructure by Mask-less Localized Electrodepositing Method

M. Wu

3D vision system integration on Additive Manufacturing machine for in-line part inspection

A. Vandone, S. Baraldo, D. Anastassiou, A. Marchetti, A. Valente

Vision-based control for track geometry optimization of complex AM motion profiles by on-line laser power modulation

S. Baraldo, A. Vandone, A. Valente, E. Carpanzano

Improvement in mechanical properties of Rene 104 superalloy during laser additive manufacturing process

W. Ying, F. Han, J. Wang


I. A. Daniyan, K. Mpofu, L. Daniyan, O. Tobi, O. Moses

Development and validation of a home-built electrospinning unit

O. H. Degryse, R. Gibney, L. De Vogelaer, E. Ferraris

Mechanical and microstructural evolution of a 3D printed AlSi11Cu alloy

J. Munoz, D. Ten, B. Viacheslav, A. Komissarov, A. Gromov

Surface quality improvement and adjustment of SLM-processed CM247LC samples by modulated laser parameters

M. Gerstgrasser, M. Cloots, K. Wegener

Dimensional analysis of the effect of SLM parameters on surface roughness and material density

J. Kozak, T. Zakrzewski

SLM processing of elementally blended NiTi shape memory alloy

P. Stoll, A. Spierings, K. Wegener

Determining process stability of Laser Powder Bed Fusion using pyrometry

K. Gutknecht, L. Haferkamp, M. Cloots, K. Wegener

Distortion mitigation in additive manufacturing of AlSi10Mg by multilayer laser peening

G. Madireddy, J. Liu, M.P. Sealy
Session: E-Beam & Special Technologies ➔ Q&A-session: January, 21st 2021 12:00

PROCIR-D-19-01024 Developing a desktop electron beam micro-machining system in the low-pressure argon atmosphere
C-H. Chien, D-Y. Sheu, A. Zawada, P. Konarski

PROCIR-D-19-00919 Effects of Pseudo-spark Discharge Pulsed Electron Beam Irradiation on the Microstructure and Properties of 6061 Aluminum Alloy
X. Cao, J. Hu, W. Huo, X. Xi, W. Zhao

PROCIR-D-19-01002 Clarification of Temperature Distribution for Metals with Different Thermal Conductivity in Large-area Electron Beam Irradiation

PROCIR-D-19-00947 Experimental investigations of nanosecond-pulse electron beam profile and its influence on metal surface treatment
W. Huo, J. Hu, X. Cao, W. Zhao

PROCIR-D-19-01063 Microstructure modification of AISI1045 steel induced by high-current pulsed pseudospark electron beam
Y. Fu, J. Hu, W. Zhao, F. Peng, W. Huo, X. Cao

PROCIR-D-19-01008 Highly Efficient Surface Repairing of AMed Metal Parts by Large-area EB Irradiation
T. Shinonaga, T. Watanabe, A. Yamaguchi, A. Okada

PROCIR-D-20-00384 Combining process and machine modelling: A Cold Spray Additive Manufacturing case
P. Stavropoulos, H. Bikas, T. Beklaris

Session: ECM 1 ➔ Q&A-session: January, 20th 2021 12:00

PROCIR-D-19-01005 Working Gap Analysis in Electrochemical Precision Machining of External Geometries with Ring Cathodes
I. Schaarschmidt, M. Hackert-Oschatzchen, G. Meichsner, M. Zinecker, A. Schubert

PROCIR-D-19-00969 Improvement of flushing efficiency of stamp flushing method in ECM
M. Nakamura, M. Kunieda

PROCIR-D-19-01009 Investigation of working gap phenomena in Mechano-Electrochemical Milling
D. Van Camp, J. Qian, MR. Vetrano, J. Vleugels, B. Lauwers

PROCIR-D-19-00934 Study on the influence of dynamic characteristics of bubbles on electrochemical discharge machining conductive materials
Z. Zou, J. Liu, Y. Xiao, Y. Deng, Z. Guo

PROCIR-D-19-01020 Behavior of Multi-Cathode-Arrays with differentiated current for the Electro-Chemical Machining
M. Herzig, O. Kröning, H-P. Schulze, C. Kranhold

PROCIR-D-19-00950 Simulation Assisted Cathode Design for the Manufacturing of Complex Geometries by Electrochemical Machining (ECM)
T. Bergs, L. Heidemanns, A. Klink

PROCIR-D-19-01003 Geometrical Analysis of Wire Electrochemical Machining for the Manufacture of Turbine Disc Slots
T. Herrig, K. Oßwald, I. Lochmahr, A. Klink, T. Bergs
Session: ECM 2 ➔ Q&A-session: January, 20th 2021 18:30
PROCIR-D-19-00902  Wire Electrochemical Trimming of Wire-EDMed Surface for the Manufacture of Turbine Slots
X. Fang, Z. Han, D. Zhu
PROCIR-D-19-00961  Research on ECM Finishing Process using Wire Electrode
M. Kunieda
PROCIR-D-19-01000  Problems and Solutions in Scanning Electrochemical Machining of Titanium Alloys
S. Hizume, W. Natsu
PROCIR-D-19-00942  Numerically Controlled Electrochemical Machining Using a Parallel Mechanism
T. Koyano, T. Honda, A. Hosokawa, T. Furumoto, Y. Hashimoto
PROCIR-D-19-00665  Investigation on flatness and surface integrity of pure copper processed by electrochemical mechanical polishing
J. Guo, Z. Liu, X. Guo, Z. Jin
PROCIR-D-19-00976  Experimental Investigation concerning the Influence of Electrochemical Machining on Process Chain induced Residual Stress States
T. Bergs, B. Rommes, E. Kohls, H. Meyer, S. Harst
PROCIR-D-19-01284  Experimental study on the mitigation of surface damages caused in electrochemical discharge machining of glass
Y. Chen, M. Sundaram

Session: ECM 3 ➔ Q&A-session: January, 20th 2021 13:00
PROCIR-D-19-00930  Discharge Characteristics in Electrochemical Discharge Machining of Ceramic-coated Ni-superalloy
W. D. Tang, X. Kang, W. Zhao, J. Qian, B. Lauwers
PROCIR-D-19-00914  Investigation of the anode shaping process in counter-rotating electrochemical machining of a convex array
D. Wang, J. Li, D. Zhu
PROCIR-D-19-01048  Experimental Characterization of Resource Efficient Process Chains for Electrochemical Precision Machining of Form-bore Patterns
G. Meichsner, L. Boenig, M. Hackert-Oschätzchen
PROCIR-D-19-00936  Experimental study on micro electrochemical slab milling using disc tool electrode
Y. Wang
PROCIR-D-19-01467  Simulation and experiments of abrasive assisted electrochemical jet machining of SiC reinforced aluminum matrix composites
Z. Liu, C. Gao, C. Guo, Y. Qiu
PROCIR-D-19-00932  Reduction of stray corrosion in electrochemical discharge drilling by changing the electric field distribution
Z. Xu
Session: ECM 4 Micro ➔ Q&A-session: January, 20th 2021 11:00

PROCIR-D-19-00916 Study on electrochemical milling deep-narrow groove with tube electrode
  C. Zhang, X. Chen, J. Yao, S. Wang, R. Zhao, Y. Zhang

PROCIR-D-19-00966 Study on Machining Instability Phenomenon in Electrochemical Machining of Large Aspect-ratio Holes
  M. Sakamoto, W. Natsu

PROCIR-D-19-00974 Effect of Anisotropically-etched Silicon Electrode on Electrolytic Products Flow in Micro ECM
  G. Liu, Y. Li, H. Tong, H. Zhong

PROCIR-D-19-01847 Through metallic mask electrochemical micromachining of micro-groove with a porous cathode
  X. Chen, G. Fan, K. K. Saxena, J. Qian, D. Reynaerts

PROCIR-D-19-00895 Machining performance study in Radial Ultrasonic-Assisted Rolling Electrochemical Micromachining
  M. Wang, X. Chen, J. Wang, X. Xu, Y. Ma

PROCIR-D-19-00968 Characteristics research of different electrode tip shapes by electrodeposition for micro slot ECM
  J. Hung, P. Chen

PROCIR-D-19-01948 Synthesis of titanium nanotubes (TNT) and its influence on electrochemical micromachining of titanium
  M. Tak, R. G. Mote, H. Tomar

PROCIR-D-19-01026 Micro Machining by Wire-Preposed Jet Electrochemical Machining
  Q. Jing, P. Li, Y. Zhang, J. Li, Fang Ji

Session: EDM 1 ➔ Q&A-session: January, 19th 2021 11:00

  A. Giusti, M. Dotta, M. Boccadoro, U. Maradia, L. M. Gambardella, A. Nasciuti

PROCIR-D-19-00923 Influence of tool electrode material on material removal and surface integrity in electrical discharge machining
  Q. Li, X. Yang

PROCIR-D-19-00920 Modeling of Black Layer and Tool Wear in EDM of AISI 4340 using Cu-W electrode
  S. A. H. Rizvi, S. Agarwal, A. Singh, U. Bhardwaj, R. Shukla

PROCIR-D-19-00874 Super-hydrophobic and Super-hydrophilic Effect by Means of EDM Surface Structuring of γ-TiAl
  M. Kliuev

PROCIR-D-19-00927 Polycrystalline diamond tools fabrication by micro EDM and their application of brittle material machining
  L. Zheng, D. Sheu

  M. Hashizu, S. Hayakawa, F. Itoigawa

PROCIR-D-19-01035 Influence of Wear Pattern of Graphite Electrode on EDM Geometric Accuracy of Slot Machining
  Y. Jia, G. Chi, W. Li, Z. Wang
Study of Graphite Tool Wear in EDM with Water-based Dielectrics and EDM Oil
S. Zan, Y. Jia, Z. Wang, Y. Wang, G. Chi

Session: EDM 2 ➔ Q&A-session: January, 19th 2021 12:00

Wear of the tool electrode at simultaneous electrical discharge machining of different materials
A. Hrituc, M. Coteata, O. Dodun, G. Nagit, L. Slatineanu, M. Ripanu, I. Besliu

Ultrasonic vibration-assisted electrical discharge machining on Fe-based metallic glass by adding conductive powder
H.-Tsui, P. Lee, C. Yeh, J. Hung

Investigation of Ultrasonic Vibration Assisted Powder Mixed Electrical Discharge Machining for Antibacterial Coating on Implant Surfaces
V. Bui, V. Boehme, J. W. Mwangi, T. Berger, A. Schubert

Influence of Carbon based Fillers on EDM Machinability of CFRP
V. Urundolil Kumaran, M. Klyuev, R. Billerter, K. Wegener

EDM of Nickle and Titanium Alloy Sheets aided by Vibration
Z. Yu, L. Ma, X. Wang, T. Song, J. Long, B. Yan

Electrical Discharge Machining using Copper Electrode made by Additive Manufacturing
D. Yanagida

Study of the Characteristics of EDM by Using Silicone Oils as Dielectric
A. Wang, K. Chen, Y. Lin

Application of additive manufactured tungsten carbide-cobalt electrodes with interior flushing channels in EDM
E. Uhlmann, R. Bolz, M. Polte, A. Bergmann

Session: EDM 3 ➔ Q&A-session: January, 20th 2021 13:00

Fundamental research of applying tungsten carbide-cobalt as tool electrode material for sinking EDM
E. Uhlmann, R. Bolz, M. Polte

Die-sinking of super dielectric based electrical discharge machining using 3D printed electrodes
M. T. Islam, S. K. Anantharajan

Study on Particle Size Distribution of Debris in Electrical Discharge Machining of Deep Narrow Slots
R. Zhang, M. Chen, X. Xi, X. Yan, W. Zhao

Discharge Gap and Relative Discharge Ratio in Dry Electrical Discharge Machining. L. Li

Effects of discharge status in AE-EDM of 8YSZ ceramic
Y. Liu, Y. Guo, L. Wang, S. Cao, Y. Zhang, Y. Feng

Electrical discharge truing of a PCD blade tool on a dicing machine. K. Watanabe

Fabrication of tapered micro rods using twin static wire electrical discharge grinding process
M. Bellotti, Y. Wang, Z. Li, J. Qian, D. Reynaerts
Experimental Characterisation of a High Dynamic Piezo Module for Resource-efficient Electrothermal Precision Ablation
A. Martin, T. Berger, M. Herzig, M. Hackert-Oschätzchen, H. Schulze, O. Krönig, A. Schubert

High Entropy Alloy machining by EDM and ECM
A. Klink, S. Harst, M. Olivier, U. Tombul

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**PROCIR-D-19-00948** Method of Machining Diffusors in Inconel 718 Turbine Blades for Film Cooling using EDM Drilling and Shaping
M. Kliuev, K. Wegener

**PROCIR-D-19-00660** Feasibility of Drilling Holes on Thermal Barrier Coated Superalloy using Electrical-discharge Machining
C. Gao, Z. Liu, Y. Qiu, K. Zhao

**PROCIR-D-19-00944** High Entropy Alloy machining by EDM and ECM
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**PROCIR-D-19-00970** Experimental investigation on electrode wear of array holes machining in micro-EDM
S. Hou, J. Bai

**PROCIR-D-19-00905** Influence of discharge current pulse shape on machining characteristics in EDM
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**PROCIR-D-19-00931** Observation of EDM plasma behaviour influenced by parasitic working gap capacitance
T. Petersen, S. Ahmed, A. Klink, M. Kunieda

**PROCIR-D-19-01466** High aspect ratio micro hole drilling by Micro-EDM with different cross-section shape micro tools for flushing process
T. Huang, D. Sheu

**PROCIR-D-19-01016** The Electrical Gap Model of High Speed Wire Electrical Discharge Machining with Power-electronic-based Pulse Power Supply
S. Shi, F. Yang, D.Qin, D. Xu

**PROCIR-D-19-01045** Small-hole EDM using Grooved Pipe Electrode
T. Hideki

**PROCIR-D-19-00899** Investigations on EDM Plasmas Using Time and Spatial Resolved Emission Spectroscopy
M. Wiessner, C. Hollenstein, K.Wegener

**PROCIR-D-19-00940** Influence of discharge current pulse shape on machining characteristics in EDM
M. Shinohara, M. Kunieda

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PROCIR-D-19-00878 Elucidation of gap area phenomenon in micro EDM drilling through direct observation
G. Li, W. Natsu, Z. Yu

PROCIR-D-19-01055 Influence of external transverse magnetic field on the movement of plasma and molten pool in EDM
X. Yue, X. Yang

PROCIR-D-19-01029 Fundamental Study on Internal Space Forming by EDM
Y. Inaba, S. Li, A. Yamaguchi, A. Okada

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W. Xia, Z. Li, Y. Zhang, W. Zhao

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A. Hirao, H. Gotah, T. Tani

PROCIR-D-19-01044 Feasibility research on break-out detection using audio signal in drilling film cooling holes by EDM
W. Liang, H. Tong, Y. Li, B. Li

PROCIR-D-19-01034 Cutting force and tool wear in cutting Ti-6Al-4V using microstructure-based PCD turning tools
X. Wu, K. Jiang, B. Xu, J. Lei, L. Zhu, D. Guo, Y. Zhao

PROCIR-D-19-00659 Fabrication of microgrooves by EDM using a laminated disc electrode consisted of different material foils
X. Wu, J. Lei, B. Xu, L. Zhu, D. Guo, Y. Zhao, Z. Zhou

PROCIR-D-19-00760 Development of Process Chain for Micro-Injection Molding
H. Büttner, U. Maradia, M. Suarez

PROCIR-D-19-00987 Micro ball-ended stylus fabrication with pipe-electrode by micro-EDM process
T. Huang, D. Sheu

PROCIR-D-19-00971 A 3D Manufacturing Method for Micro Structures by Combining Galvanoplasty and EDM
L. Xu, Y. Zhang, J. Chen, W. Zhao

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PROCIR-D-19-01037 Towards a better EDM process control: Applications of a discharge location tracker in an industrial wire electrical discharge machining
M. Boccadoro, R. D’Amario, M. Baumeler

PROCIR-D-19-01848 Research on the process technique of electrical discharge machining based on dual-linear motors
H. Zhang, J. Liu, X. Gao, Y. Cai, L. Ding, J. Guo

PROCIR-D-19-01858 Development of novel gap control method for the Electrical Discharge Machining (EDM) of implant-supported dentures
T. M. Schimmelpfennig, G. Rübeling, L. M. Rickerts
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| PROCIR-D-20-01005        | The influence of energy input characteristics on surface integrity in wire EDM |
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PROCIR-D-19-01058 A Discharge Pulse Discrimination strategy for High Speed WEDM with Power-Electronic-based Pulse Power Generator
D. Qin, Y. Fei

PROCIR-D-19-00973 Ana-Hash Table Sorting Algorithm for Curve Objects in WEDM CAM
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The AM Network will be operating under the new name NTN Innovation Booster Additive Manufacturing (NTN IBAM)

Starting this year, the AM Network will be operating under the new name NTN Innovation Booster Additive Manufacturing or NTN IBAM for short. We will still be funded by Innosuisse for the years 2021 - 2024 and would be pleased to continue to work with you or to work with you for the first time.

In the signature below you will find our new contact details and the link to our new website https://www.ibam.swiss.

As a Swiss network that has already been active in the field of additive manufacturing for 4 years, our focus is shifting more towards promoting innovation. However, we will still be organising events together with you. As a member, we can also offer you advantageous conditions for events, courses and publication of content.

For the new focus on innovation promotion, we will send you invitations on the following 3 topics this year:

**Post processing of additive manufactured parts**
- Optimised processes
- New procedures
- Avoidance of labour-intensive processes

**Use of additive manufacturing for the food industry**
- Optimised production facilities
- New production processes
- Processes for novel foods

**Use of additive manufacturing in the field of environmental technology**
- Resource savings through lightweight construction
- Novel structures for various filter applications
- Life-prolonging repair techniques (build-up welding)
- Environmentally friendly production processes

If you would like to discuss other AM topics or the mentioned topics above in greater depth with interested and complementary partners, we will be happy to provide you with this opportunity on our innovation platform, which is currently being prepared. The NTN IBAM can support promising ideas with up to 25,000 CHF!

As soon as our innovation platform is operational, we will contact you again. In the meantime, please do not hesitate to contact us if you have any questions or suggestions, or if you would like to become a member.
VIRTUAL PRESENTATION OF IWF RESEARCH GROUPS

**Abrasive Processes Sawing and Grinding**

- **Glass grinding**
  A new process for edge grinding of glass with min. 50% increase in feed rate will be developed. With a holistic approach to the machine and its components, the new generation machine and tool will be introduced, while creating new business in grinding tools.

- **Coolant flow in grinding**
  Investigation of the impact of coolant flow on workpiece and tool from CFD simulations to cylindrical grinding experiments.

- **CO₂ - cooled tool grinding**
  Alternative to conventional flood cooling with oil. Design of suitable nozzles, analysis of dry ice jet, including cooling efficiency. Measurement and simulation of heat fluxes into wheel and workpiece.

- **Diamond wire sawing**
  Kinematic process analysis and modelling, investigation of material removal of hard and brittle materials such as silicon.

- **Process simulation**
  Geometric-kinematic, particle method and CFD simulation of a wide range of abrasive processes and base materials.

**Electric Discharge Machining**

- **Micro EDM**
  Research goals are the minimizing of structure size, maximizing the aspect ratio and the guarantee of high quality. High quality stands for no burr formation, low roughness and high form accuracy. Example: Micro-connectors.

- **EDM Drilling & Shaping**
  Due to the entry angles and difficult to machine aerospace materials, EDM finds opportunity as a potential machining process for cooling holes.

- **EDM Fundamentals**
  Discharge and plasma analysis by optical emission spectroscopy (OES) and high-speed imaging. Plasma parameters estimation and synthetic plasma spectra simulation.

- **Process Simulation**
  Geometric simulation that simulates the stochastic characteristics of the process, considering the geometric attributes of the electrodes and the different energy pulses.
Meshfree Methods in Machining Simulation

**Cutting Simulation**
Without mesh restrictions, particle methods accurately predict chip formation and other physical parameters.

**Tool development**
Graphic Processing Unit (GPU) enhanced algorithms largely shorten the computational time, and thus provide with possibility of fast development of cutting tools.

**Material Modeling**
Through reduced simulation time, inverse parameter identification of constitutive model and friction model at extreme conditions can be achieved.

**Laser Drilling**
Based on the successful thermal modeling, optimization of process parameters can be achieved with higher efficiency.

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Machine Tool Analysis
Simulation - Optimization - Metrology

**MORe Simulation Tool**
Mechanical, mechatronic, thermal, and thermo-mechanical simulation of machine tools brought to this point.

**Static Optimization**
Design and correction methods for high-precision machine tools under gravity loads.

**Dynamic Optimization**
Optimal control parametrization and structure design for high-dynamics machine tools.

**Machine Tool Testing**
Measurement of precision and dynamics. Geometric, kinematic and dynamic testing of machine tools.

**Face Gear Application**
Development of software tools for parameter studies and laser ablation process development.
Laser Ablation using Pulsed Laser Sources

**Cutting tools**

**Grinding tools**

**Surface adjustment**

**Parameter studies**

**Software development**
Development of software tools for parameter studies and laser ablation process development.

Additive Manufacturing with Deposition Welding

**Direct Metal Deposition**
Welding of layered geometries with laser and metal powder for build up of coatings, geometries and repairs.

**Wire Arc AM**
Highly productive process with a electric arc and wire feedstock for build up of simple medium to large-scale metallic structures.

**Laser Hardfacing**
Hard surfacing with metal matrix composites. Application: Wear protection of tribologically stressed components.

**DMD and Milling**
Combines the high build-up rate of DMD with the accurate surface finish of milling in an alternating process and with a single clamping setup.

**Micro structure simulation**
Microstructure simulations in AM help to understand the solidification process and the evolution of crystals more in detail.
**Powder Bed Additive Manufacturing of Metals**

- **AM material systems**: Alloys and advanced material systems for SLM. Example: SLM-processed metal matrix composites with diamond particles.

- **Powder qualification**: Powder qualification methods and quantitative requirements for SLM.


- **AM-Machines**: Advanced AM machine concepts and machine component optimization.

- **Intelligent applications**: Industrial AM-applications with integrated sensors. Example: high pressure H2 valve with integrated sensors for condition monitoring.

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**Powder Bed AM of Polymers and Ceramics**

- **Materials research**: Development of new Additive Manufacturing (AM) powders (polymers and ceramics) in a close collaboration with industry and research.

- **Powder Qualification**: Understanding the process behavior of AM powders by particle powder properties analyses, thread tools and knowledge.

- **Process Development**: Process development for new polymer powders in a close to industry approach on commercial machine set-ups. Laser sintering of ceramics with post processing steps.

- **Applications**: Acceleration sensor integration in polymer parts during running Selective Laser Sintering (SLS) process.

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2013: ISEM XVII - Leuven, Belgium
2016: ISEM XVIII - Tokyo, Japan
2018: ISEM XIX - Bilbao, Spain
2020: ISEM XX - Zürich, Switzerland