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**AMRC**  
Advanced Manufacturing  
Research Centre



# 9th CIRP Conference

## on High Performance Cutting

24th - 26th May 2021

| Monday 24th May 2020  |    |    |    |
|---|----|----|----|
| Logging into the conference   |    |    |    |
| Opening session-Dr Erdem Ozturk<br>Introduction to AMRC - Steve Foxley, AMRC                    |    |    |    |
| The future of global manufacturing and machine tool industry<br>KN1- Dr Masahiko Mori, DMG MORI |    |    |    |
| The Journey to Future Smart Machining Systems<br>KN2- Dr Donka Novovic, Rolls-Royce             |    |    |    |
| Theme presentations   |    |    |    |
| 1   | 5  | 9  | 13 |
| 2   | 6  | 10 | 14 |
| 3   | 7  | 11 | 15 |
| 4   | 8  | 12 | 16 |
| 17  | 21 | 25 | 29 |
| 18  | 22 | 26 | 30 |
| 19  | 23 | 27 | 31 |
| 20  | 24 | 28 | 32 |
| End of Day1   |    |    |    |

| Tuesday 25th May 2020  |    |    |    |
|--|----|----|----|
| Logging into the conference  |    |    |    |
| Opening session- David Curtis  |    |    |    |
| KN3- Prof Berend Denkena,<br>IFW, Leibniz University - On the path to autonomous machine tools   |    |    |    |
| Sponsored Technical Presentation<br>Stephen George, Kennametal - Studies of end mill flute geometry enhancements on specific cutting energy and chip formation |    |    |    |
| Theme presentations  |    |    |    |
| 33   | 37 | 41 | 45 |
| 34   | 38 | 42 | 46 |
| 35   | 39 | 43 | 47 |
| 36   | 40 | 44 | 48 |
| 49   | 53 | 57 | 61 |
| 50   | 54 | 58 | 62 |
| 51   | 55 | 59 | 63 |
| 52   |    | 60 | 64 |
| End of Day2  |    |    |    |

| Wednesday 26th May 2020  |    |    |    |
|--|----|----|----|
| Logging into the conference  |    |    |    |
| Opening session- Dr Hassan Ghadbeigi   |    |    |    |
| KN4 - Prof Susanne Norgren,<br>Sandvik Coromant - A contribution to the understanding of tool/workpiece interaction in high performance metal cutting.                     |    |    |    |
| Sponsored Technical Presentation<br>Nishant Saini, Thirdwave Systems - Using thermal turning to drive High Performance Cutting on production floors in Aerospace & Defense |    |    |    |
| Theme presentations  |    |    |    |
| 65   | 69 | 73 | 77 |
| 66   | 70 | 74 | 78 |
| 67   | 71 | 75 | 79 |
| 68   | 72 | 76 | 80 |
| 81   | 85 | 89 | 93 |
| 82   | 86 | 90 | 94 |
| 83   | 87 |    | 95 |
| 84   |    |    | 96 |
| End of the conference  |    |    |    |

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| Theme   |   | Topic   |
|---|---|---|
| Theme 1: Cutting Processes  | a | Machining of metallic materials                                   |
|   | b | Machining of difficult-to-cut, non-metallic materials, composites |
|   | c | Cutting tool materials, tool design and tool performance          |
|   | d | Residual stress and damage of finished surfaces due to cutting    |
| Theme 2: Sustainability and Digitalisation                                  | a | Sustainable manufacturing, environmental aspects of machining     |
|   | b | CAD / CAM systems and strategies for high performance cutting     |
|   | c | Cyber-physical approaches   |
|   | d | Intelligent tooling   |
| Theme 3: Mechanics, Dynamics and Machines                                   | a | Mechanics and dynamics of material removal processes              |
|   | b | Dynamics, monitoring and control of machining operations          |
|   | c | Machine design, structures and configurations                     |
|   | d | Control of multi-axis machine tools                               |
|   | e | Robotic machining   |
| Theme 4: Abrasive Processes, Electro-Physical-Chemical Processes, Metrology | a | Abrasive processes  |
|   | b | Hybrid machining  |
|   | c | Non-conventional machining  |
|   | d | Metrology and measurement   |



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## Theme 1: Cutting Processes

|                      | Paper Ref   | Topic   | Paper Title  | Presenting Author   | Corresponding Author |
|----------------------|---|---|--|---------------------|----------------------|
| <b>Monday</b>        | 1 PROCIR-D-19-01725   | Machining of metallic materials   | Analysis and optimization of surface roughness in turning of AA6061-T6 under various environments and parameters   | Mahshad Javidikia   | Victor Songmene      |
|                      | 2 PROCIR-D-19-01731   | Machining of metallic materials   | Performance increase by process parameter variation during turning of AISI 4140  | Andreas Relard      | Andreas Relard       |
|                      | 3 PROCIR-D-19-01834   | Machining of metallic materials   | Anisotropy effect on Laser Powder Bed Fused Ti6Al4V machinability  | Lucia Lizzul        | Lucia Lizzul         |
|                      | 4 PROCIR-D-19-01741   | Machining of metallic materials   | Hardness and Orthogonal Cutting Analyses of a Wire and Arc Additive Manufactured (WAAM) Sample   | Sarah Eschelbacher  | Sarah Eschelbacher   |
|                      | 17 PROCIR-D-20-00430  | Machining of metallic materials   | Tool wear progression of SIALON ceramic end mills in five-axis high-feed rough machining of an Inconel 718 BLISK   | Richard Zimmermann  | Richard Zimmermann   |
|                      | 18 PROCIR-D-19-01755  | Machining of difficult-to-cut, non-metallic materials, composites   | The effect of cutting parameter changeover position on interface borehole quality in drilling of aerospace CFRP/Al stacks  | Andrea Pardo        | Robert Heinemann     |
|                      | 19 PROCIR-D-19-01819  | Machining of difficult-to-cut, non-metallic materials, composites   | Influence of different cooling strategies on the process temperatures and chip transport quality in one-shot drilling CFRP/Al-stacks   | Lukas Seeholzer     | Lukas Seeholzer      |
| 20 PROCIR-D-19-01820 | Machining of difficult-to-cut, non-metallic materials, composites | Influence of drilling parameters on thrust force and burr on fiber metal laminate (Al 2024-T3/glass fiber reinforced epoxy) | Eduardo Bonhin   | Eduardo Bonhin      |                      |
| <b>Tuesday</b>       | 33 PROCIR-D-19-01951  | Machining of difficult-to-cut, non-metallic materials, composites   | High performance machining of continuous metal fibers with cascaded multi-stage profile tools  | Uwe Teicher         | Uwe Teicher          |
|                      | 34 PROCIR-D-19-01960  | Machining of difficult-to-cut, non-metallic materials, composites   | Investigation of cutting mechanisms in the machining of Ceramic Matrix Composites (CMCs)   | Philipp Ganser      | Jannik Reisberg      |
|                      | 35 PROCIR-D-19-01974  | Machining of difficult-to-cut, non-metallic materials, composites   | Wear characteristics of micro-drill during ultra-high speed drilling multi-layer PCB consisting of copper foil and ceramic particle filled GFRPs                               | Huang Xin           | Lijuan Zheng         |
|                      | 36 PROCIR-D-19-01723  | Cutting tool materials, tool design and tool performance  | Wear behaviour of various CVD diamond thick film specifications during turning Ti-6Al-4V   | Danny Schröter      | Danny Schröter       |
|                      | 49 PROCIR-D-19-01728  | Cutting tool materials, tool design and tool performance  | Influence of the thickness of nanolayers in wear-resistant layer of Ti-TiN-(Ti,Cr,Al)N coating on the tool life and wear pattern of the carbide cutting tools in steel turning | Alexey Vereschaka   | Alexey Vereschaka    |
|                      | 50 PROCIR-D-19-01739  | Cutting tool materials, tool design and tool performance  | Boron-doped monocrystalline diamond as cutting tool for temperature measurement in the cutting zone  | Toni Hocke          | Toni Hocke           |
|                      | 51 PROCIR-D-19-01758  | Cutting tool materials, tool design and tool performance  | cBN-based cutting tools with niobium compounds as a binder phase.  | Kateryna Slipchenko | Kateryna Slipchenko  |
| 52 PROCIR-D-19-01791 | Cutting tool materials, tool design and tool performance          | Study of new solid end mill for side milling of Ti-6Al-4V with improved cooling efficiency                                  | Raghuveer Gaddam   | Raghuveer Gaddam    |                      |
| <b>Wednesday</b>     | 65 PROCIR-D-19-01792  | Cutting tool materials, tool design and tool performance  | Tool lifetime when drilling Inconel 718 in dependence of the cooling channel design – Influence of the clearance angle, the channel diameter, number and shape                 | Daniel Müller       | Daniel Müller        |
|                      | 66 PROCIR-D-19-01837  | Cutting tool materials, tool design and tool performance  | Application of Cr,Mo-(Cr,Mo)N-(Cr,Mo,Zr,Nb,Al)N multilayered composite multicomponent coating to increase the cutting tool life in turning steel                               | Alexey Vereschaka   | Alexey Vereschaka    |
|                      | 67 PROCIR-D-19-01844  | Cutting tool materials, tool design and tool performance  | A study of the lubrication regimes of the contact surfaces of laser textured CVD coated cutting tools  | Paul Butler-Smith   | Paul W. Butler-Smith |
|                      | 68 PROCIR-D-19-01631  | Residual stress and damage of finished surfaces due to cutting  | Simulation of the coupling effect of bulk and induced residual stresses on machining distortion  | Ravi Bilkhu         | Ravi Bilkhu          |
|                      | 81 PROCIR-D-19-01972  | Residual stress and damage of finished surfaces due to cutting  | Working point determination of 3MA micromagnetic NDT-technique for production integrated detection of white layer during turning of AISI4140                                   | David Böttger       | David Böttger        |
|                      | 82 PROCIR-D-19-01975  | Residual stress and damage of finished surfaces due to cutting  | Prediction of near surface residual stress states for hard turned specimens using data driven nonlinear models   | Christopher Schott  | Christopher Schott   |
|                      | 83 PROCIR-D-19-02219  | Residual stress and damage of finished surfaces due to cutting  | Comparative Analysis of Residual Stress and Dislocation Density of Machined Surface during Turning of High Strength Steel  | Jiang Hongwan       | Hongwan Jiang        |
| 84 PROCIR-D-20-00066 | Residual stress and damage of finished surfaces due to cutting    | Residual stress characterization for ribbed geometries using On-machine Layer Removal method                                | Maria Aurrekotxea  | Maria Aurrekotxea   |                      |



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## Theme 2: Sustainability and Digitalisation

|                  | Paper Ref            | Topic   | Paper Title  | Presenting Author          | Corresponding Author  |
|------------------|----------------------|---|--|----------------------------|-----------------------|
| <b>Monday</b>    | 5 PROCIR-D-19-01647  | Sustainable manufacturing, environmental aspects of machining | Effect of various cooling lubricant strategies on turning Inconel 718 with different cutting materials                                       | Nicolai Ostrowicki         | Daniel Gross          |
|                  | 6 PROCIR-D-19-01788  | Sustainable manufacturing, environmental aspects of machining | High-speed milling Inconel 718 using Electrostatic Minimum Quantity Lubrication (EMQL)   | Andrea De Bartolomeis      | Andrea De Bartolomeis |
|                  | 7 PROCIR-D-19-01808  | Sustainable manufacturing, environmental aspects of machining | Sustainable machining of Ti-6Al-4V using cryogenic cooling: an optimized approach  | Ahmed Damir                | Ahmed Damir           |
|                  | 8 PROCIR-D-19-01828  | Sustainable manufacturing, environmental aspects of machining | Sub-zero metalworking fluids for high performance cutting of difficult to cut materials  | Stephan Basten             | Stephan Basten        |
|                  | 21 PROCIR-D-19-01841 | Sustainable manufacturing, environmental aspects of machining | Economic and ecological evaluation of high-pressure cutting fluid supply in milling of Ti-6Al-4V   | Thomas Lakner              | Thomas Lakner         |
|                  | 22 PROCIR-D-19-01998 | Sustainable manufacturing, environmental aspects of machining | Thermal analysis in MQL end milling operations   | Alborz Shokrani            | Alborz Shokrani       |
|                  | 23 PROCIR-D-19-02008 | Sustainable manufacturing, environmental aspects of machining | Milling of aerospace alloys using supercritical CO <sub>2</sub> assisted machining   | Nikolaos Tapoglou          | Nikolaos Tapoglou     |
|                  | 24 PROCIR-D-19-02011 | Sustainable manufacturing, environmental aspects of machining | Correlation between tool life and cutting force coefficient as the basis for a novel method in accelerated MWF performance assessment        | Matthew Broderick          | Matthew Broderick     |
| <b>Tuesday</b>   | 37 PROCIR-D-19-01754 | CAD / CAM systems and strategies for high performance cutting | Optimised process planning for re-contouring of repair-welded tool moulds by using a specific force model                                    | Klaas Heide                | Klaas Heide           |
|                  | 38 PROCIR-D-19-01763 | CAD / CAM systems and strategies for high performance cutting | New mechanistic model to predict machining time for milling free form geometries using 4-axis milling  | Felipe Marin               | Adriano Souza         |
|                  | 39 PROCIR-D-19-01770 | CAD / CAM systems and strategies for high performance cutting | New algorithm identifies the best set of cutting tools to mill cavities  | Rodrigo Berretta Käsemödel | Adriano Souza         |
|                  | 40 PROCIR-D-19-01789 | CAD / CAM systems and strategies for high performance cutting | New algorithm to calculate the cutter location points (CL) optimizing the chordal tolerance for 2 1/2 axis milling of free form surfaces     | Nicolas Severino           | Adriano Souza         |
|                  | 53 PROCIR-D-19-01790 | CAD / CAM systems and strategies for high performance cutting | Optimization of Tool Axis Orientations in Multi-Axis Toolpaths to Increase Surface Quality and Productivity                                  | Michal Stejskal            | Michal Stejskal       |
|                  | 54 PROCIR-D-19-01949 | CAD / CAM systems and strategies for high performance cutting | Production technology research – Building blocks for competitiveness and solution for future challenges in aerospace component manufacturing | Gregor Kappmeyer           | Gregor Kappmeyer      |
|                  | 55 PROCIR-D-19-02004 | CAD / CAM systems and strategies for high performance cutting | Process planning for the machining of Ti-6Al-4V near-net shaped components   | Christina Fuchs            | Christina Fuchs       |
| <b>Wednesday</b> | 69 PROCIR-D-19-01726 | Cyber-physical approaches                                     | A prediction model for high efficiency machining conditions based on machine learning  | Kengo Kawai                | Kengo Kawai           |
|                  | 70 PROCIR-D-19-01753 | Cyber-physical approaches                                     | Comparison of Machine Learning Methods for Quality Prediction of Drilled and Reamed Bores Based on NC-Internal Signals                       | Sebastian Schorr           | Sebastian Schorr      |
|                  | 71 PROCIR-D-19-01766 | Cyber-physical approaches                                     | The Concept of Digital Twin and Digital Shadow in Manufacturing  | Thomas Bergs               | Thorsten Augspurger   |
|                  | 72 PROCIR-D-19-01772 | Cyber-physical approaches                                     | A statistics based Digital Twin for the combined consideration of heat treatment and machining for predicting distortion                     | Kareema Hilton             | Kareema Hilton        |
|                  | 85 PROCIR-D-19-01724 | Intelligent tooling   | Real time monitoring of cutting edge temperature by a fiber-optic two-color pyrometer and its effect on tool wear                            | Jinghui Han                | Guanglan Liao         |
|                  | 86 PROCIR-D-19-01748 | Intelligent tooling   | Wear-resistant thin-film sensors on cutting tools for in-process temperature measurement   | Marcel Plogmeyer           | Marcel Plogmeyer      |
|                  | 87 PROCIR-D-19-02218 | Intelligent tooling   | Real-time compensation of tool deflection using a sensor embedded boring bar with wireless signal feedback to the machine tool controller    | Dan Östling                | Dan Östling           |



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## Theme 3: Mechanics, Dynamics and Machines

|                  | Paper Ref | Topic             | Paper Title  | Presenting Author   | Corresponding Author        |                             |
|------------------|-----------|-------------------|--|---|-----------------------------|-----------------------------|
| <b>Monday</b>    | 9         | PROCIR-D-19-01722 | Mechanics and dynamics of material removal processes     | Simulation of metal cutting with cutting fluid using the Finite Pointset Method   | Enrico Barth                | Enrico Barth                |
|                  | 10        | PROCIR-D-19-01740 | Mechanics and dynamics of material removal processes     | Application of machine drive oscillations for chip breaking in heavy duty turning operations  | Asier Astarloa              | Jokin Munoa                 |
|                  | 11        | PROCIR-D-19-01823 | Mechanics and dynamics of material removal processes     | Logistic classification for tool life modeling in machining   | Jaydeep Karandikar          | Jaydeep Karandikar          |
|                  | 12        | PROCIR-D-19-01824 | Mechanics and dynamics of material removal processes     | Comparative analysis of cutting forces and stability of standard and non-standard profiled serrated end mills                               | Pritam Bari                 | Mohit Law                   |
|                  | 25        | PROCIR-D-19-01830 | Mechanics and dynamics of material removal processes     | Description of the Kinematics based on a Simulation Tool and Analysis of the Interaction of the Gimbal in Precision Honing                  | Murat Güner                 | Sven Klein                  |
|                  | 26        | PROCIR-D-19-01833 | Mechanics and dynamics of material removal processes     | Surface form error prediction for 3-axis milling operations   | Lorenzo Morelli             | Niccolò Grossi              |
|                  | 27        | PROCIR-D-19-01842 | Mechanics and dynamics of material removal processes     | Improvement of material databases for cutting force prediction in finishing conditions of A-356 aluminium alloy                             | Xabier Lazkano              | Xabier Lazkano              |
|                  | 28        | PROCIR-D-19-01855 | Mechanics and dynamics of material removal processes     | Comparative study of stability predictions in micro-milling by using cutting force models and direct cutting force measurements             | Shukri Afazov               | Shukri Afazov               |
| <b>Tuesday</b>   | 41        | PROCIR-D-19-01961 | Mechanics and dynamics of material removal processes     | Clamping modeling in automotive flexible workpieces machining   | Philippe Lorong             | Philippe Lorong             |
|                  | 42        | PROCIR-D-19-01982 | Mechanics and dynamics of material removal processes     | Experimental study on macroscopic force modelling for surface grinding processes in aerospace industry                                      | Adina Grimmert              | Adina Grimmert              |
|                  | 43        | PROCIR-D-19-02015 | Mechanics and dynamics of material removal processes     | Regenerative instabilities of spring-guided circular saws   | Mohit Law                   | Mohit Law                   |
|                  | 44        | PROCIR-D-19-01832 | Machine design, structures and configurations            | Effect of expansion coefficient difference between machine tool and workpiece to the thermal deformation induced by room temperature change | Kotaro Mori                 | Kotaro Mori                 |
|                  | 57        | PROCIR-D-19-01987 | Control of multi-axis machine tools                      | Synchronization motion accuracy measurement method for coordinated five-axis machine tools  | Xu Kun                      | Qingzhen Bi                 |
|                  | 58        | PROCIR-D-19-01635 | Robotic machining  | Postprocessor for Verification of Robot Movements with Additional Axis after Toolpath Optimization  | Tomas Kratena               | Petr Vavruska               |
|                  | 59        | PROCIR-D-19-01733 | Robotic machining  | Configuration optimization through redundancy angle and tool posture by force induced error index in robot ball-end milling                 | Zepeng Li                   | Fangyu Peng                 |
|                  | 60        | PROCIR-D-21-00035 | Robotic machining  | Integration and demonstration of force controlled support in pocket milling   | Patrick Ludwig Fenou Kengne | Patrick Ludwig Fenou Kengne |
| <b>Wednesday</b> | 73        | PROCIR-D-19-01730 | Dynamics, monitoring and control of machining operations | Improvement of machining accuracy by measurement and adjustment of dynamic runout of endmill  | Atsushi Matsubara           | Kaito Nakatani              |
|                  | 74        | PROCIR-D-19-01793 | Dynamics, monitoring and control of machining operations | Determination of the process damping coefficient using plain cutting tests  | Lars Ellersiek              | Lars Ellersiek              |
|                  | 75        | PROCIR-D-19-01803 | Dynamics, monitoring and control of machining operations | Increasing Part Geometric Accuracy in High Speed Machining using Cascade Iterative Learning Control   | Rob Ward                    | Rob Ward                    |
|                  | 76        | PROCIR-D-19-01810 | Dynamics, monitoring and control of machining operations | Design optimization of tool holder extension for enhanced chatter stability by using component mode tuning method                           | Gamze Karataş               | Gamze Karataş               |
|                  | 89        | PROCIR-D-19-01968 | Dynamics, monitoring and control of machining operations | Flank face interaction in high magnitude chatter investigation in time domain   | Guskov Mikhail              | Guskov Mikhail              |
|                  | 90        | PROCIR-D-19-01991 | Dynamics, monitoring and control of machining operations | An adaptive fixture for suppress vibrations and measuring workpiece deformation of thin-walled casings                                      | Chai Shilin                 | Qingzhen Bi                 |



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## Theme 4: Abrasive Processes, Electro-Physical-Chemical Processes, Metrology

|                  | Paper Ref            | Topic                      | Paper Title  | Presenting Author   | Corresponding Author    |
|------------------|----------------------|----------------------------|--|---------------------|-------------------------|
| <b>Monday</b>    | 13 PROCIR-D-19-01735 | Abrasive processes         | Pendulum and creep feed grinding of additively manufactured AISI 316L  | Benjamin Kirsch     | Hendrik Hotz            |
|                  | 14 PROCIR-D-19-01742 | Abrasive processes         | An investigation of additively manufactured coolant nozzles for cylindrical grinding applications and progression to high stock removal                            | Erica Smith         | Erica Smith             |
|                  | 15 PROCIR-D-19-01773 | Abrasive processes         | High performance grinding of titanium alloys with electroplated diamond wheels   | Zhongde Shi         | Zhongde Shi             |
|                  | 16 PROCIR-D-19-01805 | Abrasive processes         | Effect of the grinding process on the wear of a cemented tungsten carbide cutting insert during turning  | Carlos Ventura      | Carlos Ventura          |
|                  | 29 PROCIR-D-19-01812 | Abrasive processes         | Integration of process monitoring and machine condition diagnostics to improve quality prediction in grinding  | Muhammad Ahmer      | Muhammad Ahmer          |
|                  | 30 PROCIR-D-19-01813 | Abrasive processes         | Tool wear behavior of alumina abrasive wheels during grinding FGH96 powder metallurgy nickel-based superalloy  | Li Benkai           | Wenfeng DING            |
|                  | 31 PROCIR-D-19-01814 | Abrasive processes         | Micro-analysis of the contact zone between vitrified bonded CBN segment and diamond grit during the dressing process   | Li Min              | Wenfeng DING            |
|                  | 32 PROCIR-D-19-01954 | Abrasive processes         | An investigation into the challenges of the point grinding machining process   | Nikita Pietrow      | Nikita Pietrow          |
| <b>Tuesday</b>   | 45 PROCIR-D-19-01985 | Abrasive processes         | The influence of contact force variation on surface topographies within high precision cutlery fine grinding   | Max Radetzky        | Max Radetzky            |
|                  | 46 PROCIR-D-19-02223 | Abrasive processes         | Pressure conditions during the immersed tumbling process   | Yves Kuche          | Yves Kuche              |
|                  | 47 PROCIR-D-19-01721 | Hybrid machining           | Binder influence on green ceramic machining by means of milling and laser machining  | Anthonin Demarbaix  | Anthonin Demarbaix      |
|                  | 48 PROCIR-D-19-01769 | Hybrid machining           | Understanding the Influence of Chemical and Thermal Loads on the Productivity for Processing 42CrMo4 Steel and Titanium via Laser-Induced Thermochemical Machining | Andreas Klink       | Andreas Klink           |
|                  | 61 PROCIR-D-19-01818 | Hybrid machining           | Ultrasonic assisted drilling of cemented carbide   | Falk Protz          | Falk Protz              |
|                  | 62 PROCIR-D-19-01831 | Hybrid machining           | Hybrid Manufacturing Processes: an experimental machinability investigation of DED produced parts  | Thanassis Souflas   | Panagiotis Stavropoulos |
|                  | 63 PROCIR-D-19-01963 | Hybrid machining           | Prediction of the depth of dynamically recrystallized microstructure during hard turning of AISI 4140  | Berk Tekkaya        | Berk Tekkaya            |
|                  | 64 PROCIR-D-19-01751 | Non-conventional machining | Experimental investigation of abrasive properties in waterjet machining  | Manuel Schüler      | Manuel Schüler          |
| <b>Wednesday</b> | 77 PROCIR-D-19-01762 | Non-conventional machining | Automotive hybrid design production and effective end machining by novel abrasive waterjet technique   | Manuel Schüler      | Manuel Schüler          |
|                  | 78 PROCIR-D-19-01775 | Non-conventional machining | Process Performance of High Energy Wire EDM  | Ugur Küpper         | Ugur Küpper             |
|                  | 79 PROCIR-D-19-01992 | Non-conventional machining | Experimental Study on the Correlation of Cutting Head Vibrations and Kerf Characteristics during Abrasive Waterjet Cutting of Titanium Alloy                       | Angelos Markopoulos | Angelos Markopoulos     |
|                  | 80 PROCIR-D-19-01752 | Metrology and measurement  | Investigation on probe positioning errors affecting on-machine measurements on ultra-precision turning machines  | Marco Buhmann       | Marco Buhmann           |
|                  | 93 PROCIR-D-19-01779 | Metrology and measurement  | Integration of On-machine Surface Measurement into Fast Tool Servo Machining   | Wenbin Zhong        | Wenbin Zhong            |
|                  | 94 PROCIR-D-19-01800 | Metrology and measurement  | Pneumatic non-contact measuring system for in-process dimensions measurements.   | Mohamed Damir       | Mohamed DAMIR           |
|                  | 95 PROCIR-D-19-01802 | Metrology and measurement  | Evaluating tool point dynamics using smartphone-based visual vibrometry  | Mohit Law           | Mohit Law               |
|                  | 96 PROCIR-D-20-00012 | Metrology and measurement  | On-machine ultrasonic thickness measurement and compensation of thin-walled parts machining on a CNC lathe   | Wang Jianghan       | Qingzhen Bi             |