

AMRC
ADVANCED MANUFACTURING
RESEARCH CENTRE



17th CIRP Conference on Modeling of Machining Operations

13th & 14th June 2019

Programme

The University of Sheffield
Advanced Manufacturing Research Centre
Sheffield, UK





Chair

Dr Erdem Ozturk
The University of Sheffield
Advanced Manufacturing Research Centre



Co-chair

Dr Tom Mcleay
Sandvik Coromant



Co-chair

Dr Rashid M'Saoubi
Seco Tools (UK) Ltd

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17th CIRP Conference
on Modeling of Machining Operations

13th & 14th June 2019

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We are pleased to welcome you to the 17th CIRP Conference on Modeling of Machining Operations (CIRP CMMO) at the University of Sheffield Advanced Manufacturing Research Centre (AMRC).

The 17th CIRP CMMO continues a long series of conferences, which was founded by our esteemed colleague Prof. I.S. Jawahir. The aim of the conference is to stimulate the development and use of models capable of qualitatively and quantitatively predicting the performance of metal cutting operations better adapted to the needs of the metal cutting industry. The conference is a great opportunity for experts from academia and industry in the field of modeling of machining operations to present and discuss their findings on a very high level, which stimulates and supports the knowledge in this field.

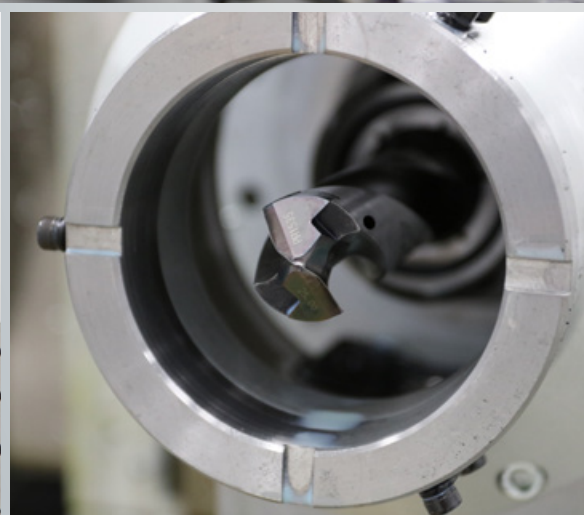
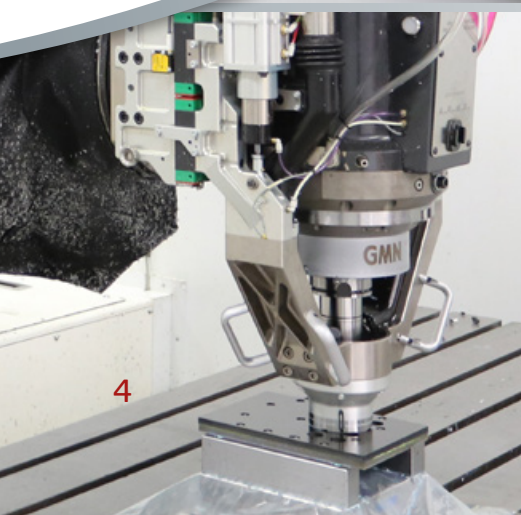
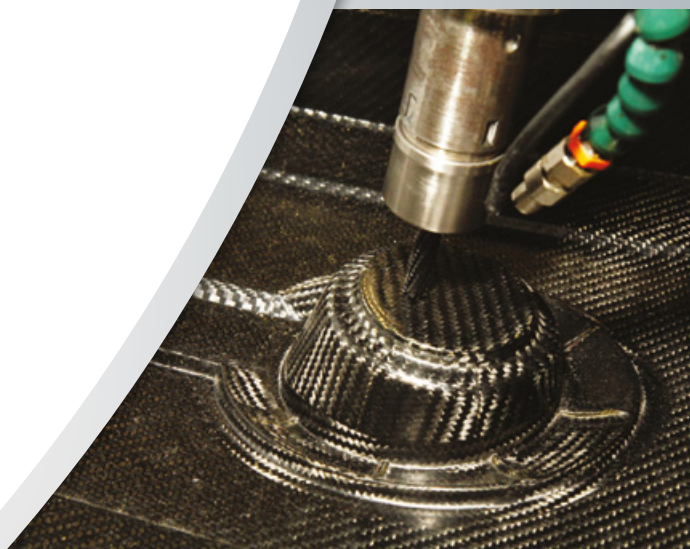
The AMRC is a world-class centre for advanced manufacturing. It helps manufacturers of any size to become more competitive by introducing advanced techniques, technologies and processes. The AMRC is developing knowledge based simulation tools and techniques that are aligned with the aims of this conference.

In the technical programme of the conference, we are going to have six new demonstrations on machine tools and robots, in addition to the scientific presentations, poster sessions and exhibitions from exhibiting companies.

We are looking forward to meeting you at the AMRC.

On behalf of the organising committee.

Dr Erdem Ozturk,
Conference Chair.



Prof. Yusuf Altintas

The University of British Columbia,
Manufacturing Automation Laboratory



Digital Twin in Machining Process Monitoring and Control

The aim of our research is to develop mathematical models of metal cutting operations, machine tool vibrations and control.

The science based digital models allow the virtual design, testing, optimization, monitoring and of control of machine tools and machining operations.

The model predicts the cutting forces, torque and power consumed in machining parts by considering CNC system, material properties, cutter geometry, structural flexibilities, and cutting conditions along the tool path. The simulation system predicts chatter free cutting conditions within the work volume of the machine tool, or detects the presence of chatter vibrations along the tool path. The dynamics of servo drive control systems, and trajectory generation as a function of jerk, acceleration and velocity profiles of machine tools are considered in simulating the machine tool behavior along the tool path. An in-house developed virtual and real time CNC system allows the design and analysis of any five axis machine tool controller. Current research includes digital twin approach, where virtual simulation and real time machine tool monitoring are integrated to achieve intelligent, self-adjusting machine tools.

The algorithms are published in open literature (Google Scholar h-82 with over 25000 citations), and packaged in industrial software tool box which can be used as a process planning tool by production engineers or as an analysis module by machine tool builders (over 250 companies and research centers world-wide).

Mikael Lundblad

Expert Metal Cutting & Knowledge and
Product Development, AB Sandvik Coromant



Modeling in cutting tool development

This presentation gives examples of how different types of modeling may be utilized in the development of new metal cutting tools to fulfil customer needs and assure robust performance.

Aiming to make design of new products more knowledge driven, modeling and analysis may be used to firstly enhance the building knowledge and insights in the cutting process on and how different parts in the cutting tool needs to perform together and secondly verify the developed solutions. Examples of modeling of different parts of the cutting tools are reviewed.

Wednesday 12th June

Evening reception at the Winter Garden Sheffield: 19:00 - 21:00

Thursday 13th June

Registration: 08:30 – 09:00

Opening session / Keynote presentations

AMRC Knowledge Transfer Centre	AMP Technology Centre	Nuclear AMRC	AMRC Factory of the Future
Numerical and Analytical Modeling. Chair: Ibrahim Jawahir	Dynamics and Stability of Machining. Chair: Yusuf Altintas	Monitoring and Diagnostics. Chair: Tom Mcleay	Optimisation of Machining Processes Chair: Andreas Klink

Lunch / Exhibition / Posters / Demos: 12:10 – 13:50

Numerical and Analytical Modeling. Chair: Rashid M'Saoubi	Dynamics and Stability of Machining. Chair: Erdem Ozturk	Robotic machining. Chair: Kevin Subrin	Machining of Complex Surfaces. Chair: Yigit Karpat
Numerical and Analytical Modeling. Chair: Tom Childs	Multiphysics and Multiscale Modeling. Chair: Nikolaos Tapoglou	Robotic machining. Chair: Taner Tunc	Machining of Complex Surfaces. Chair: Alborz Shokrani

Evening Meal at Cutlers' Hall: 19:00 – 23:00

Friday 14th June

Registration: 08:30 – 09:00

AMRC Knowledge Transfer Centre	AMP Technology Centre	Nuclear AMRC	AMRC Factory of the Future
Thermal Effects and Part Distortion. Chair: Orkun Ozsahin	Surface Integrity of Machined Components. Chair: Joel Rech	Material Behaviour and Tribological Aspects in Cutting. Chair: Gerard Poulachon	Grinding and Non-Conventional Processes. Chair: Hassan Ghadbeigi
Thermal Effects and Part Distortion. Chair: Neil Sims	Surface Integrity of Machined Components. Chair: Pedro Arrazola	Material Behaviour and Tribological Aspects in Cutting. Chair: Amir Malakizadi	Grinding and Non-Conventional Processes. Chair: David Curtis

Lunch / Exhibition / Posters / Demos: 12:20 – 14:00

Thermal Effects and Part Distortion. Chair: Sabino Ayvar Soberanis	High-Performance and Hard Machining. Chair: Luke Berglind	Material Behaviour and Tribological Aspects in Cutting. Chair: Guillaume Fromentin	Precision, Ultra-Precision and Micro-Machining. Chair: Anish Roy
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Close – 16:20

Venues

-  AMRC Knowledge Transfer Centre
-  AMRC Factory of the Future
-  AMP Technology Centre
-  Marquee
-  Nuclear AMRC

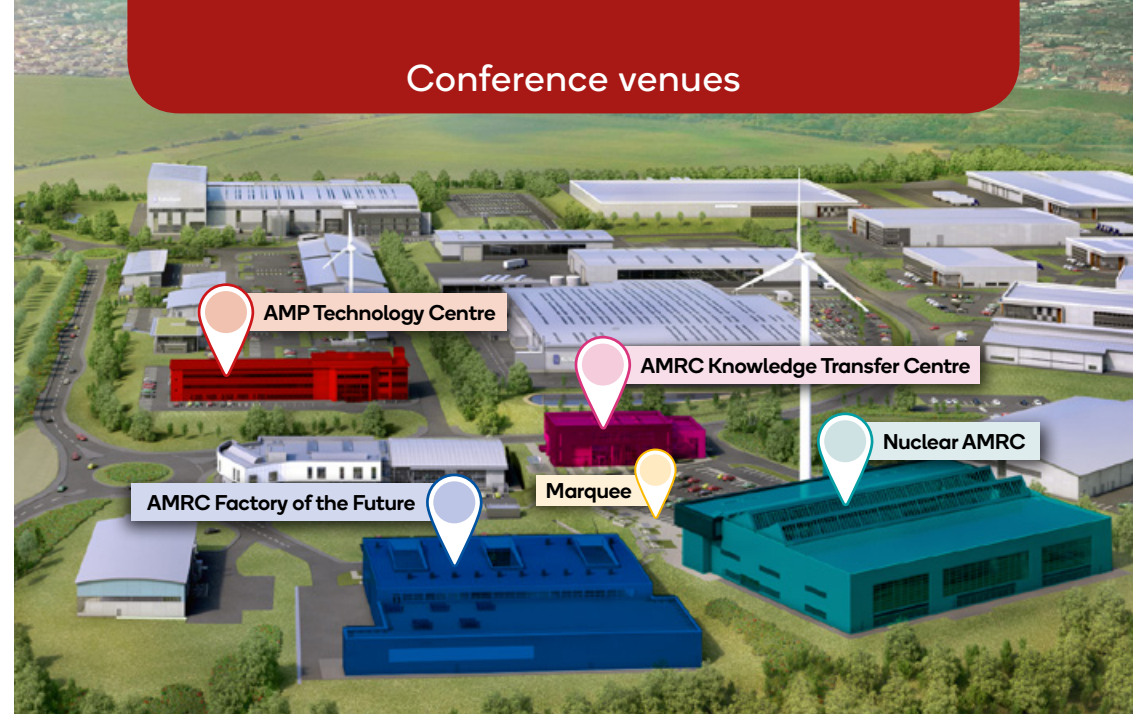
Conference venues

The conference is being held across the following five venues:

- AMRC Knowledge Transfer Centre
- AMRC Factory of the Future
- AMP Technology Centre
- Marquee
- Nuclear AMRC



Conference venues



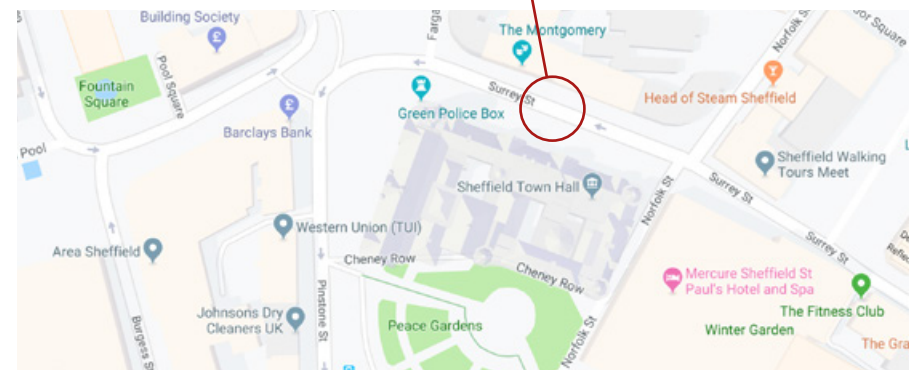
Address:

Advanced Manufacturing Research Centre,
Advanced Manufacturing Park,
Wallis Way, Catcliffe,
Rotherham, S60 5TZ

Shuttle bus:

For delegates staying in Sheffield city centre, we are providing a shuttle bus service to and from the AMRC. Buses will be picking delegates up from **Surrey Street (S1 2LG)** promptly at 07:50am. Please ensure you arrive in plenty of time in order to secure your place on a bus.

Return buses will leave the AMRC at the close of each day and will return delegates to the same pickup location, **Surrey Street (S1 2LG)**.



Taxis:

You can book **City Taxis** online or call them direct on **0114 239 3939** or travel using **UBER**.

Parking:

Parking is available at AMRC Castings / Cti, (marked 'P' on the map opposite). An attendant will be located at the entrance to direct you in.

Evening reception venue:

Wednesday 12th June
19:00 – 21:00

Winter Garden,

90 Surrey St, Sheffield, S1 2LH.

Suggested dress code:

Lounge suit / Cocktail dress.

By Road: Follow signs from all major routes to the city centre.

By Public Transport: Located in the city centre and easily accessible by all public transport.



Conference dinner venue:

Thursday 13th June
19:00 – 23:00

Cutlers' Hall,

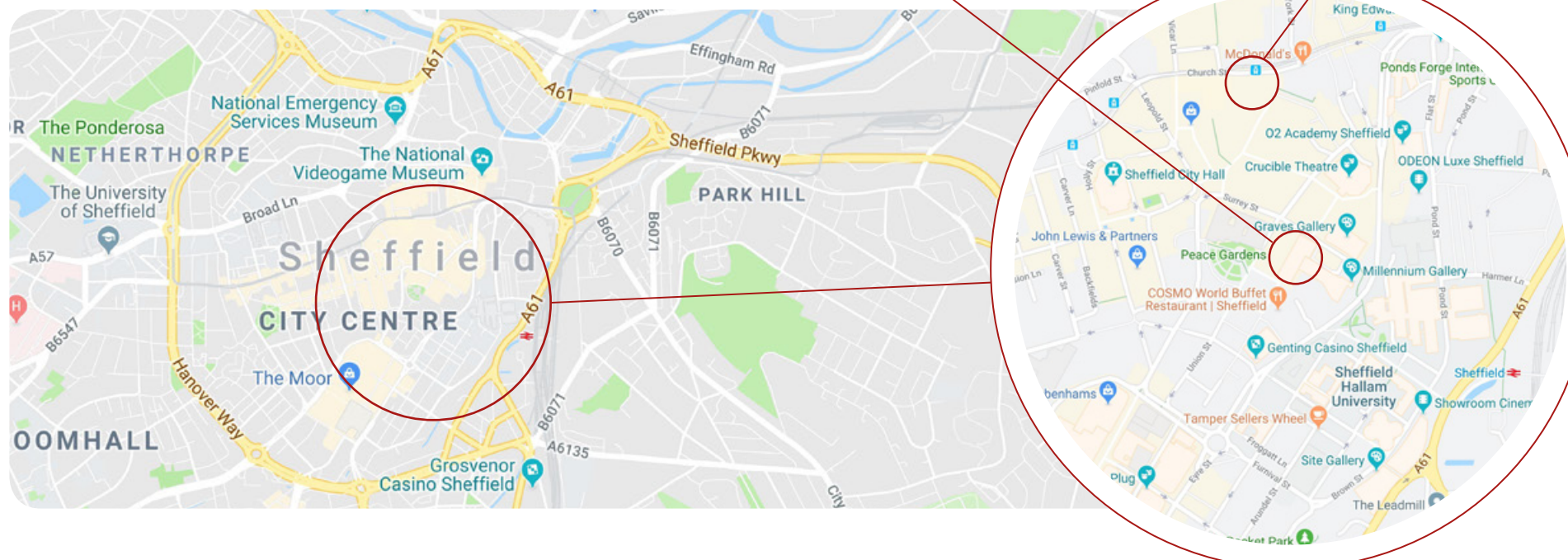
Church St, Sheffield, S1 1HG.

Suggested dress code:

Jacket & tie / Cocktail dress.

The Cutlers' Hall is located 800 metres from Sheffield's Railway Station, a short walk or taxi journey away.

The tram can also be boarded at Sheffield railway station which drops off directly in front of the hall. The nearest tram stop is Cathedral Station.





Known the world over as a Steel City, Sheffield was famed for its industry in the heyday of the 1900s and remains a city of innovation to this day.

However the smoking chimney stacks are no more and instead you'll find a green, modern cityscape set against the stunning backdrop of the Peak District National Park.

We have a friendly, independent and alternative spirit that you won't find in other cities, alongside a thriving cultural scene boasting award-winning theatre, beer, music, festivals, street art and so much more.

It's all here waiting for you: Welcome to Sheffield.

Travelling to Sheffield by Air:

With 4 international airports within less than an hour's drive, Sheffield is easy to reach from overseas destinations.

Manchester Airport, one of the UK's busiest, has a regular direct rail service to Sheffield. Robin Hood Doncaster Sheffield Airport is served by a number of European destinations with charter flight routes. Leeds Bradford Airport is also well served by European and long haul destinations. Sheffield can be reached by using a taxi service or bus to Leeds and then train to Sheffield.

Nottingham East Midlands receives routes from European and long haul destinations. Sheffield can be reached by road using a taxi service, or take the airport shuttle to East Midlands Parkway and take the train (operated by East Midlands Trains) to the centre of Sheffield.

To ensure your easy onward journey from your airport of choice, why not book your airport transfer in advance with one of the private hire taxi companies in Sheffield. You can book City Taxis online or call them direct on 0114 239 3939 or travel using UBER

Travelling to Sheffield by train:

If you are travelling from London, or on routes operated by East Midlands Trains, you might find our 'special event tickets' a value for money travel option.

The mainline station in Sheffield offers an impressive entry to the City, with fast direct links from London St Pancras International departing every 30 minutes from early morning to late at night. Coming in from Europe? The Eurostar link from Paris arrives at London St Pancras International - you can be in Sheffield in just 5 hours after leaving Paris.

The journey from London is now only 2hrs and 1mins, the service is operated by East Midlands Trains with both First and Standard Class seating available. There are also hourly fast trains from Manchester City Centre and direct services from Manchester International airport.






Regional Train Services:

Sheffield is so easy to reach by train, whether you're travelling from North, South, East or West. Take a look at the special offers from TransPennine Express or at the services provided by Northern Rail as great starting points to planning your visit.



Thursday 13th June – Morning session






Venues

-  AMRC Knowledge Transfer Centre
-  AMP Technology Centre
-  Nuclear AMRC
-  AMRC Factory of the Future
-  Marquee

8:30 - 9:00	Registration and Coffee			
9:00 - 9:10	Opening Session, Dr Erdem Ozturk, Conference Chair			
9:10 - 9:20	Colin Sirett, Chief Executive Officer, AMRC			
9:20 - 9:50	Keynote Presentation – Prof. Yusuf Altintas (see page 6)			
9:50 - 10:20	Keynote Presentation – Mikael Lundband (see page 7)			
10:20 - 10:50	Coffee Break / Exhibition / Posters			
	AMRC Knowledge Transfer Centre	AMP Technology Centre	Nuclear AMRC	AMRC Factory of the Future
	Numerical and Analytical Modeling. Chair: Ibrahim Jawahir	Dynamics and Stability of Machining Chair: Yusuf Altintas	Monitoring and Diagnostics. Chair: Tom Mcleay	Optimisation of Machining Processes Chair: Andreas Klink
10:50 - 11:10	Mechanistic modeling of worn drill cutting forces with drill wear effect coefficients. C. Han, M. Luo, D. Zhang, B. Wu	Convergence Analysis of the Multi-Frequency Approach around a Variable-Helix Instability Island L. Ureña, E. Ozturk, N. Sims	Ensemble Kalman filtering for force model identification in milling. M. Schwenzer, S. Stemmler, M. Ay, T. Bergs, D. Abel	Optimization of complex cutting tools using a multi-dexel based material removal simulation. O. Pape, T. Grove, B. Denkena
11:10 - 11:30	A Three Dimensional Calculation Approach for the Heat Flux Density Distribution in Face Milling. L. Langenhorst, M. Cihan, J. Sölter	Numerical Investigation of Orthogonal Cutting Processes with Tool Vibration of Ti6Al4V Alloy. W. Ma, F. Shuang	A hybrid approach using machine learning to predict the cutting forces under consideration of the tool wear. B. Peng, T. Bergs, D. Schraknepper, F. Klocke, B. Döbbeler	A 5-axis pocket roughing strategy reducing the remaining material volume. B. Jousselein, Y. Quinsat, C. Tournier
11:30 - 11:50	Revisiting flow stress modeling for simulating chip formation of carbon and low alloy steels. Thomas H.C. Childs	Characterization of Machine Tool Vise Using Operational Modal Analysis. K. Ringgaard, N. Knudsen, J. Jensen, M. Ørum Ørhem Juul, O. Balling	An adaptive chatter signal enhancement approach for early fault diagnosis in machining process. X-M Zhang, L. Cao	Optimization-based procedure for the determination of the constitutive model coefficients used in machining simulations. W. Cheng, J. Outeiro, J-P. Costes, R. M'Saoubi, Habib Karaoui, S. Dietrich, B. Marcon, P. Rosa
11:50 - 12:10	Development of a Hyperelastic Constitutive Model Based on the Crystal Plasticity Theory for the Simulation of Machining Operations. H.E.B. Boubaker, C. Mareau, Y. Ayed, G. Germain, F. Guerrin	Prediction of form error during face turning on flexible Inconel 718 workpiece. B.F. Toubhans, G. Fromentin, F. Viprey, H. Karaoui	Quantitative analysis of chip segmentation in machining using an automated image processing method. A. Hrechuk, V. Bushlya, R. M'Saoubi, J-E. Ståhl	Optimization of corner micro end milling by finite element modeling for machining thin features. A. Davoudinejad, D. Li, Y. Zhang, G. Tosello
12:10 - 12:50	Lunch			
12:50 - 13:50	Exhibition / Posters / Demonstrations (Group 1, Group 2)			

Thursday 13th June – Afternoon session






Venues

-  AMRC Knowledge Transfer Centre
-  AMP Technology Centre
-  Nuclear AMRC
-  AMRC Factory of the Future
-  Marquee

	AMRC Knowledge Transfer Centre	AMP Technology Centre	Nuclear AMRC	AMRC Factory of the Future
	Numerical and Analytical Modeling. Chair: Rashid M'Saoubi	Dynamics and Stability of Machining. Chair: Erdem Ozturk	Robotic machining. Chair: Kevin Subrin	Machining of Complex Surfaces. Chair: Yigit Karpat
13:50 - 14:10	Numerical simulation and validation of material loadings during electrical discharge machining. T. Bergs, S. Schneider, S. Harst, A. Klink	A New Type Of Impact Damper With Long Overhangs In The Internal Turning Of Hardened Materials. W.T. Alves Da Silva, A. E. Diniz, R. Pederiva, D.I. Suyama, M. V. Albuquerque	Form Error Prediction in Robotic Assisted Milling. C. Sun, P. Kengne, A. Barrios, S. Mata, E. Ozturk	Effective usage of model based data in turbine engine component machining. G. Kappmeyer, M. Lieder, A. Mantle
14:10 - 14:30	A mechanistic model to predict cutting force on orthogonal machining of Aluminum 7475-T7351 considering the edge radius. A. Sela, G. Ortiz-de-Zarate, I. Arrieta, D. Soriano, P.X. Aristimuño, B. Medina-Clavijo, P.J. Arrazola	Identification of spindle dynamics by receptance coupling for non-contact excitation system. O. Ozsahin, M. Ritou, E. Budak, C. Rabreau, S. Le Loch	Model-based Planning of Machining Operations for Industrial Robots. F. Schnoes, M.F. Zaeh	Numerical Modeling of Cutting Forces in Gear Skiving. B. Rossi de Meneses Varga, M. Zapf, J. Klose, F. Zanger, V. Schulze
14:30 - 14:50	Modeling orthogonal and oblique cutting via discontinuity layout optimization. T. Pritchard, C. Smith, H. Ghadbeigi, M. Galindo-Fernandez, M. Gilbert, S. Ayvar-Soberinas	Modeling the dynamics of a large damped boring bar in a lathe. D. Östling, M. Magnevall	Improved stable conditions in robotic milling by kinematic redundancy. B. Gonul, O. Faruk Sapmaz, L. Taner Tunc	A geometrical and mechanical generalized model for complex shape broaching of super alloy. C. Legrand, G. Fromentin, G. Poulachon, R. Chatain, M. Rancic
14:50 - 15:10	A Comparative Study of the Influence of the Strain-Hardening in Chip Formation Simulations using Different Software Packages. N. Wielki, S. Kuschel, J. Sölter	Pocket milling strategies using combined-mode and feed-direction-dependent stability criteria. M. Gaur, M. Law	Effect of axial vibrations on regenerative chatter in robotic milling. Y. Mohammadi, K. Ahmadi	Modeling of surface formation mechanism during burnishing of aluminium. R. Stöckmann, M. Putz
15:10 - 16:10	Coffee Break / Exhibition / Posters (Group 3, Group 4)			
	Numerical and Analytical Modeling. Chair: Tom Childs	Multiphysics and Multiscale Modeling. Chair: Nikolaos Tapoglou	Robotic machining. Chair: Taner Tunc	Machining of Complex Surfaces. Chair: Alborz Shokrani
16:10 - 16:30	Finite element simulations of cutting force, torque, and temperature in drilling of Inconel 718. N. Ucak, A. Çiçek, E. Oezkaya, K. Aslantas	Improving technological machining simulation by tailored workpiece models and kinematics. V. Boess, B. Denkena, B. Breidenstein, M-A Dittrich, H.N. Nguyen	Chatter Suppression in Robotic Milling by Control of Configuration Dependent Dynamics. H. Celikag, N. Sims, E. Ozturk	Using model based analytic cutting force prediction in CAM toolpath generation. S. Braun, M. Storchak, H-C Möhring
16:30 - 16:50	A new constitutive model for cutting simulation of 316L austenitic stainless steel. A. Malakzadi, J Nils Oberbeck, M. Magnevall, P. Krajnik	Evaluation of Machine Tool Digital Twin for machining operations in industrial environment. M. Armendia, F. Cugnon, L. Berglind, E. Ozturk, G. Gil, J. Selmi	Digital chain development for sanding application with a kinematically redundant robotic system. K. Subrin, S. Garnier, T. Bressac, B. Furet	Analysis and modeling of trochoidal milling in Inconel 718. E. Ducroux, P. David, F. Viprey, G. Fromentin, A. D'Acunto
16:50 - 17:10	FE modeling of CFRP machining: prediction of the effects of cutting edge rounding. N. Duboust, C. Pinna, S. Ayvar-Soberanis, H. Ghadbeigi, A. Collis, K. Kerrigan, R. J. Scaife	Implementation of the Machine Tool-Specific Current and Voltage Control Characteristics in Multiphysics Simulation of Electrochemical Precision Machining. I. Schaarschmidt, M. Hackert-Oschätzchen, G. Meichsner, M. Zinecker, A. Schubert	Cutting force prediction in robotic machining. E. Rivière-Lorphèvre, H. Nam Huynh, F. Ducobu, O. Verlinden	An Intelligent Metrology Informatics System based on Neural Networks for Multistage Manufacturing Processes. M. Papananias, T. McLeay, M. Mahfouf, V. Kardirkamanathan
17:10 - 17:30	Evaluation of different flow stress laws coupled with a physical based ductile failure criterion for the modeling of the chip formation process of Ti-6Al-4V under broaching conditions. G. Ortiz-de-Zarate, A. Sela, F. Ducobu, D. Soler, M. Saez-de-Buruaga, T. Childs, P.J. Arrazola	Multiphysics Simulation of Oxide Layer Growth in Localized Anodization of Aluminum Applying a Free-Surface Electrolyte Jet. M. Hackert-Oschätzchen, R. Paul, A. Schubert	Offline tool trajectory compensation for cutting forces induced errors in a portable machine tool. A. Checchi, G. Dalla Costa, G. Bissacco, C. Hastrup Merrill, H. Nørgaard Hansen	
17:30 - 17:50	Transportation to City Centre			
19:00 - 23:00	Evening Meal at Cutlers' Hall			

Friday 14th June – Morning session

Venues






-  AMRC Knowledge Transfer Centre
-  AMP Technology Centre
-  Nuclear AMRC
-  AMRC Factory of the Future
-  Marquee

8:30 - 9:00	Registration and Coffee			
	AMRC Knowledge Transfer Centre	AMP Technology Centre	Nuclear AMRC	AMRC Factory of the Future
	Thermal Effects and Part Distortion. Chair: Orkun Ozsahin	Surface Integrity of Machined Components. Chair: Joel Rech	Material Behaviour and Tribological Aspects in Cutting. Chair: Gerard Poulachon	Grinding and Non-Conventional Processes. Chair: Hassan Ghadbeigi
9:00 - 9:20	The influence of structured flank faces on cooling performance when drilling. D. Mueller, B. Kirsch, J.C. Aurich	Finite element simulations of chip serration in titanium alloy cutting by considering material failure. S.R. Shah, G. Liu, T. Özel	Modeling of friction coefficient when drilling titanium TiAl6V4. R. Lorain, L. Olivier, A. Poggi, F. Valiorgue, J. Rech	3D Multiphysics Simulation of Jet Electrochemical Machining of Intersecting Line Removals. R. Paul, M. Hackert-Oschätzchen, I. Danilov, M. Yahyavi Zanjani, A. Schubert
9:20 - 9:40	Development of a 3D hybrid modeling of residual stresses induced by grooving. J. Rech, G. Methon, F. Valiorgue, M. Dumas, A. Van-Robaëys, U. Masciantonio, A Brosse, H. Karaouni	On the surface integrity of Electron Beam Melted Ti6Al4V after machining. R. Bertolini, L. Lizzul, S. Bruschi, A. Ghiotti	Using Digital Image Correlation Measurements for the Inverse Identification of Constitutive Material Parameters applied in Metal Cutting Simulations. B.P. Thimm, J. Steden, M. Reuber, H-J. Christ	Simulation of laser ablation mechanism of silicon nitride by ultrashort pulse laser. B. Soltani, F. Hojati, A. Daneshi, B. Azarhoushang
9:40 - 10:00	Thermal errors in milling: Comparison of displacements of the machine tool, tool and workpiece. M. Braeunig, A. Wenzel, J. Regel, M. Putz	Machining induced damage in orthogonal cutting of UD composites: FEA based assessment of Hashin and Puck criteria. F. Cepero, V. Phadnis	Determination of friction coefficient in cutting processes: comparison between open and closed tribometers. L. Sterle, F. Pušavec, M. Kalin	An analytical study of wheel regeneration in surface grinding. M. Toth, N. Sims, D. Curtis
10:00 - 10:20		FVPM simulation of scratching induced by a spherical indenter. C. Euzenat, S. Lavernhe, C. Tournier	Effect of cutting edge radius and cooling strategies on surface integrity in orthogonal machining of Ti-6Al-4V alloy. G. Chen, S. Chen, J. Caudill, I.S. Jawahir	Analysis of the Interaction of the Honing Tool in Relation to the Gimbal in Precision Honing by Simulation. S. Klein, M. Greulich, D. Bähre
10:20 - 11:20	Coffee Break / Exhibition / Posters (Group 1, Group 2)			
	Thermal Effects and Part Distortion. Chair: Neil Sims	Surface Integrity of Machined Components. Chair: Pedro Arrazola	Material Behaviour and Tribological Aspects in Cutting. Chair: Amir Malakizadi	Grinding and Non-Conventional Processes. Chair: David Curtis
11:20 - 11:40	Machining Distortion in Asymmetrical Residual Stress Profiles. R. Bilkhu, S. Ayvar-Soberanis, C. Pinna, T. McLeay	Computationally efficient, multi-domain hybrid modeling of surface integrity in machining and related thermomechanical finishing processes. J.M. Schoop, D. Adeniji, I. Brown	Tribology of metal cutting: Newly formed underside of chip. A. Gregorio, T. Santos, R. Rossi, A.M.P. Jesus, J.C. Outeiro, P.A.R. Rosa	Concepts for Advancing the Use of Process Data in Electrical Discharge Machining. M. Holsten, A. Klink, T. Bergs
11:40 - 12:00	Comparison of bone temperature elevation in drilling of human, bovine and porcine bone. M.F. Ali Akhbar, A.R. Yusoff	Material behaviour at low temperatures for calibrating cryogenic machining numerical simulations. R. Bertolini, S. Bruschi, A. Ghiotti, G. Haugou, H. Morvan, L. Dubar	Coupled Eulerian-Lagrangian (CEL) simulation for modeling of chip formation in AA2024-T3. F. Ducobu, E. Rivière-Lorphèvre, M. Galindo-Fernandez, S. Ayvar-Soberanis, P.-J. Arrazola, H. Ghadbeigi	Hybrid machining of metal-matrix composite. J.W. Kim, W. Bai, A. Roy, L.C. Jones, S. Ayvar-Soberanis, V.V. Silberschmidt
12:00 - 12:20	On-machine Characterization of Bulk Residual Stresses on Machining Blanks. I. Llanos, M. Aurrekoetxea, A. Agirre, L.N. Lopez de Lacalle, O. Zelaieta	Physics based modeling of machining Inconel 718 to predict surface integrity modification. S. Rinaldi, S. Imbrogno, G. Rotella, D. Umbrello, L. Filice	Microstructure-based approach to predict the machinability of the ferritic-pearlitic steel C60 by cutting operations. M. Abouridouane, G. Laschet, V. Kripak, J. Dierdorf, U. Prah, G. Wirtz, T. Bergs	Smoothed particle hydrodynamics (SPH) simulation and experimental investigation on the diamond fly-cutting milling of zirconia ceramics. B. Deng, M. Yang, L. Zhou, H. Wang, R. Yan, F. Peng
12:20 - 13:00	Lunch			
13:00 - 14:00	Exhibition / Posters / Demonstrations (Group 3, Group 4)			

Friday 14th June – Afternoon session

Venues

	AMRC Knowledge Transfer Centre	AMP Technology Centre	Nuclear AMRC	AMRC Factory of the Future
	Thermal Effects and Part Distortion. Chair: Sabino Ayvar Soberanis	High-Performance and Hard Machining. Chair: Luke Berglind	Material Behaviour and Tribological Aspects in Cutting. Chair: Guillaume Fromentin	Precision, Ultra-Precision and Micro-Machining. Chair: Anish Roy
14:00 - 14:20	Simulation of Thermal Induced Microstructure Evolution within the Heat Affected Zone. T. Bergs, M. Mohammadnejad, R. Hess, S. Harst, A. Klink	FEM modeling of hard turning 42CrMoS4 steel. M. Saez-de-Buruaga, L. Gainza, P. Aristimuno, D. Soler, G. Ortiz-de-Zarate, O. Aizpuru, R. Mielgo, P.J. Arrazola	Influence of anisotropy of additively manufactured AlSi10Mg parts on chip formation during orthogonal cutting. E. Segebade, M. Gerstenmeyer, S. Dietrich, F. Zanger, V. Schulze	Simulation-based design of an ultrasonic-assisted air bearing spindle for micro machining. S. Greco, A. Lange, B. Kirsch, J.C. Aurich
14:20 - 14:40	Deterministic modeling and simulations of the internal cooling of end mills. J.R. Rance, J. Flynn, V. Dhokia, A. Shokrani	Analysis of mechanisms for chip formation simulation of hardened steel. A. Zabel, M. Tiffe, J. Saelzer	Validation of the slip-line model for serrated chip formation in orthogonal turning under dry and MQL conditions. A. Uysal, I.S. Jawahir	Investigating microstructure effects of heat-treated commercially pure titanium (cp-Ti) based on mechanistic modeling of micro milling. A. Aksin, Y. Karpat
14:40 - 15:00	Effects of toolpath and clamping strategies in machining distortion of stainless-steel parts. I. Cherif, J. Outeiro, D. Cotton, G. Poulachon, G. Charrondiere, A. Brosse	Influence of supercritical CO2 cooling on tool wear and cutting forces in the milling of Ti-6Al-4V. K. Kamil Wika, O. Gurdal, P. Litwa, C. Hitchens	A predictive model to estimate tool-chip friction in orthogonal machining. A. Saini, A. Dhar Jayal	FEM simulation of micromilling of CuZn37 brass considering tool run-out. A. Abeni, E. Ceretti, T. Özel, A. Attanasio.
15:00 - 15:20	Thermomechanically coupled numerical simulation of cryogenic orthogonal cutting. B. Stampfer, P. Golda, F. Zanger, R. Schießl, U. Maas, V. Schulze	Numerical Modeling of Cutting Forces and Temperature Distribution in High Speed Cryogenic and Flood-cooled Milling of Ti-6Al-4V. J. Caudill, J. Schoop, I.S. Jawahir	FEM-based comparison of models to predict dynamic recrystallization during orthogonal cutting of AISI4140. G. González, E. Segebade, F. Zanger, V. Schulze	Orthogonal cutting of alloy steel 4340 with micro-grooved cutting tools. K. Patel, S. Shah, T. Özel
15:20 - 15:50	Coffee Break / Exhibition / Posters			
15:50 - 16:20	Closing session Professor I.S. Jawahir – University of Kentucky Proposal to organise the 18th CIRP CMMO in 2021 Dr Erdem Ozturk, Conference Chair			

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On-Machine Demonstrations

1. Online Simulation
2. Live Data Monitoring in Machining
3. Hybrid Machining
4. 6-Axis Waterjet
5. Robots in Machining
6. CO2 Assisted Machining

Posters

- **Mechanical characterization of a aluminium cast alloy under complex stress states for metal cutting simulation.**
– Tiago Fraga Silva, S. Gain, D. Pinto, A.M.P. Jesus, J. Xavier, P.A.R. Rosa, A. Reis.
- **Strategies for Controlled Depth Multi-Axis Abrasive Water Jet Milling.**
– Yigit Ozcan, Lutfi Taner Tunc.
- **Force Control for Robotic Assisted Milling.**
– Patrick Ludwig Fenou Kengne, Chao Sun, Erdem Ozturk.

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