GIANLUCA D'URSO
CURRICULUM VITAE

PERSONAL INFORMATIONS

Name	Gianluca D'Urso
Phone	035 2052330
Nationality	Italian
Date of birth	January 1st 1975
Place of birth	Bergamo - Italy

1. CURRENT ROLES AND POSITIONS AT THE UNIVERSITY OF BERGAMO

Associate Professor in the SSD ING-IND/16 - Technologies and Manufacturing Systems at the Department of Management, Information and Production Engineering (DIGIP) of the University of Bergamo (office held on January 1st 2018).

Deputy Director of the Department of Management, Information and Production Engineering (DIGIP) of the University of Bergamo, from 20th October 2020.

Director of the first level executive Master in "Smart Manufacturing Management e Digital Transformation" promoted by the University of Bergamo and Confindustria Bergamo (office held on June 21st 2019).

Member of the Board of SDM – Postgraduate School of Management of the University of Bergamo (office held on January 1st 2019).

AA 2017/18 – AA 2018/19 – AA 2019/2020

Member of the teaching board of the PhD School in Technology, Innovation and Management (TIM) University of Bergamo in agreement with the University Federico II of Naples.

2. PREVIOUS ROLES AND POSITIONS AT THE UNIVERSITY OF BERGAMO

Researcher in the SSD ING-IND/16 - Technologies and Manufacturing Systems at the University of Bergamo, from February 1st 2005, to January 31st 2018.

Member of the Board of Directors of AFIL - Lombardy Intelligent Factory Association (From May 29th 2018 to July 15th 2020).

Deputy Director of GITT, the University Center for the Management of Innovation and Technology Transfer of the University of Bergamo (office held from July 5th 2013 to December 31st 2018).

Membro of GITT, the University Center for the Management of Innovation and Technology Transfer of the University of Bergamo (office held from June 28th 2013 to September 30st 2018)**.**

3. EDUCATION

PhD degree in "Industrial Production Engineering" at the University of Padua with a thesis entitled "The influence of cutting parameters on surface hardening in turning processes"

Master Degree in Management Engineering at the University of Bergamo with a thesis entitled "Implementation of damage and fracture criteria in FEM codes: application to orthogonal cutting".

4. MAIN TEACHING ACTIVITIES

University teaching activities in numerous courses concerning the disciplinary sector ING-IND / 16, at the University of Bergamo and at other Italian universities (Polytechnic of Milan and University of Brescia).

Teaching activities within the PhD course in "Technology Innovation and Management" TIM (University of Bergamo - University of Naples), teaching activities within the PhD course in "Economics and Management of Technology" - DREAMT (University of Bergamo - University of Pavia).

The information on the main university teaching activities are summarized in Table 1, the teaching activities within the PhD courses are summarized in Table 2.

Table 1. Main University teaching activities

Academic Year	Course Title	Credits	Degree	University
2020-21	Simulation Techniques in Healthcare processes	6	Engineering and Management for Health	University of Bergamo
2020-21	Quality Management Systems	6	Engineering of health technologies	University of Bergamo
2020-21	Smart Manufacturing Technologies	6	Smart Technology Engineering	University of Bergamo
2019-20	Simulation Techniques in Healthcare processes	6	Engineering and Management for Health	University of Bergamo
2019-20	Quality Management Systems	6	Engineering of health technologies	University of Bergamo
2018-19	Simulation Techniques in Healthcare processes	6	Engineering and Management for Health	University of Bergamo
2018-19	Quality Management Systems	6	Engineering of health technologies	University of Bergamo
2017-18	Manufacturing Studies	6	Management Engineering and Mechanical Engineering	University of Bergamo
2016-17	Manufacturing	9	Management Engineering	University of Bergamo
2015-16	Manufacturing Studies	6	Management Engineering and Mechanical Engineering	University of Bergamo
2014-15	Manufacturing Studies	6	Management Engineering and Mechanical Engineering	University of Bergamo

2013-14	Manufacturing Studies	6	Management Engineering and Mechanical Engineering	University of Bergamo
2012-13	Manufacturing Studies	6	Management Engineering and Mechanical Engineering	University of Bergamo
2011-12	Manufacturing Studies	6	Management Engineering and Mechanical Engineering	University of Bergamo
2010-11	Manufacturing	9	Management Engineering	University of Bergamo
2009-10	Manufacturing	9	Management Engineering	University of Bergamo
2009-10	Plasticity and Formning Technolgies	5	Management Engineering	University of Brescia
2008-09	Manufacturing	7.5	Management Engineering	University of Bergamo
2008-09	Plasticity and Formning Technolgies	5	Mechanical Engineering	University of Brescia
2007-08	Manufacturing	7.5	Management Engineering	University of Bergamo
2006-07	Manufacturing	7.5	Management Engineering	University of Bergamo
2006-07	Manufacturing	5	Mechanical Engineering	Politecnic of Milan
2005-06	Manufacturing	7.5	Management Engineering	University of Bergamo
2005-06	Tecnologia Meccanica	5	Mechanical Engineering	Politecnic of Milan

Table 2. PhD Teaching Activities

PhD Course in Economics and Management of Technology - DREAMT (University of Bergamo – University of Pavia)	
Academic Year	**Course Title**
2014-15 XXX Cycle	Sustainable Materials and Technologies (Track: Innovation and Technology Management. Area: New Technologies for Sustainable Production and Services).
2015-16 XXXI Cycle	Sustainable Materials and Technologies (Track: Innovation and Technology Management. Area: New Technologies for Sustainable Production and Services).
2016-17 XXXII Cycle	Manufacturing Processes and Innovative Technologies (Foundation course).
2016-17 XXXII Cycle	Advanced course in Manufacturing Processes and Innovative Technologies (Track: Innovation and Technology Management. Area: Technology Innovation).
PhD Course in Technology, Innovation and Management - TIM (University of Bergamo – University of Naples, Federico II).	

Academic Year	Course Title
2017-18 XXXIII Cycle	Methods and Tools for sustainability (Course Foundation II - Research applied methods II)
2018-19 XXXV Cycle	Methods and Tools for sustainability (Course Foundation II - Research applied methods II)
2019-20 XXXIV Cycle	Methods and Tools for sustainability (Course Foundation II - Research applied methods II)
2020-21 XXXVI Cycle	Methods and Tools for sustainability (Course Foundation II - Research applied methods II)

5. EXTRA-UNIVERSITY EDUCATIONAL ACTIVITIES

In the period 2005-2020, the writer held numerous extra-university training courses within ITS and IFTS projects, as well as specialization courses and seminars aimed at personnel of companies in the manufacturing sector.

6. RESEARCH ACTIVITIES AT THE UNIVERSITY OF BERGAMO

Since August 1st 2002, participation in the research activities of the Technology and Manufacturing Systems Group of the University of Bergamo.
In the period of participation in the group's activities, many researches were carried out in collaboration with various universities and research centres, both national and international; these collaborations have led to the publication of articles in international scientific journals and the presentation of memoirs at national and international conferences.

Coordinator of experimental research in the field of **micromachining** at the Laboratory of Technology and Manufacturing Systems of the University of Bergamo. The main research activities carried out at this laboratory concern micro-EDM technologies.

Coordinator of experimental research in the field of **forming technologies** at the Laboratory of Technology and Manufacturing Systems of the University of Bergamo. The main research activities carried out at this laboratory concern the FSW - Friction Stir Welding technologies.

Coordinator of experimental research in the field of **Additive Manufacturing technologies** at the Laboratory of Technology and Manufacturing Systems of the University of Bergamo. The main research activities carried out at this laboratory concern the FDM and SLA technologies.

Coordinator of the research activities of the **research fellows and doctoral students** belonging to the research group of Technologies and Manufacturing Systems of the University of Bergamo

Scientific director/coordinator of the following research grants.

- Micro-machining with EDM technology: performance analysis, optimization of process parameters and research of technological limits. Research fellow: Dr. Cristina Merla. Period: from 01/09/2014

to 30/04/2015.
- Analysis of the EDM (Electro Discharge Machining) micro-milling process for the realization of micrometric features. Research fellow: Dr. Mariangela Quarto. Period: from 01/05/2015 to 01/10/2015.
- Process and product performance in EDM micro-milling. Research fellow: dott. Rodrigue Djoko Noubissi. Period: from 01/09/2015 to 31/08/2016.
- Characterization through micro-X-ray tomography of micro-features for thermo-fluid-dynamic applications realized with micro-manufacturing techniques. Research fellow: PhD Stephanie Fest Santini. Period: from 01/12/2014 to 31/08/2017.
- Analysis of the influence of the process parameters on the mechanical and metallurgical characteristics of Friction Stir Welding joints on aluminum sheets in the 2000, 6000 and 7000 class. Research fellow: Dr. Sara Bocchi. Period: 01/08/2017 to 31/07/2018.

Scientific coordinator / tutor of the following doctoral students.
- Robert Haide - Technology, Innovation and Management - XXXIII Cycle. Project title: Characterization of multi-phase flow in porous media by means of X-ray micro computed tomography.
- Sara Bocchi - Technology, Innovation and Management - XXXIV Cycle. Project title: Manufacturing processes and technologies for processing innovative materials for engineering.
- Mattia Carminati - Technology, Innovation and Management - XXXV Cycle. Project title: Development of innovative powders, also from waste and / or recycled materials, to be used in the production of components using additive technologies.

Some research activities were carried out in collaboration with various universities and research centers both nationally and internationally. Among these, we wish to mention:
- University of Brescia - Prof.ssa Elisabetta Ceretti, Prof. Aldo Attanasio
- Cardiff University - School of Engineering - Dr. Samuel Bigot.
- DTU Technical University of Denmark - Department of Mechanical Engineering - Prof. Giuliano Bissacco.
- ISTEC-CNR Institute of Science and Technology of Ceramic Materials - Dr. Laura Silvestroni

7. RESEARCH TOPICS

The research activity is divided into various fields mainly concerning conventional and non-conventional processing technologies. These activities were carried out in collaboration with colleagues from the University of Bergamo Technologies and Manufacturing Systems group and in several cases with the collaboration of other national and international research centers and universities or private companies. The main research topics are summarized below. These activities led to the publication of articles in international journals and / or conference papers. It is important to remark that the themes n. 1 and 2 represent the main research topics of the writer.

1. Study of Friction Stir Welding (FSW) joining technologies with experimental and simulation methods.

2. Analysis of micromachining processes based on micro-EDM (Electro Discharge Machining) technology.

3. Workability of metal foams with conventional plastic deformation and chip removal technologies - experimental and FEM methods.

4. Analysis of the influence of cutting parameters on "surface integrity" in turning processes - experimental and FEM methods.

5. Study of the springback in sheet metal bending processes with experimental and FEM methods.

6. Experimental and numerical studies aimed at finding the conditions of solid state welding in extrusion processes with porthole dies.

7. Micromachining with LIGA technology.

8. Definition of a new test methods (based on forming) for the study of hydrogen embrittlement in cathodic protection

6.1 Study of Friction Stir Welding (FSW) joining technologies with experimental and simulation methods.

This theme concerns the study of FSW (Friction Srit Welding) joining technology; the research took into consideration both overlapping and butt joints, both continuous and point welds (FSSW). Friction Stir Welding technology is a solid state joining process particularly suitable for welding aluminum alloys and metals that are difficult to weld with conventional casting technologies. Welding by friction exploits the lowering of the yield strength of metallic materials as the temperature increases and the consequent increase in formability. The joining between two or more pieces is obtained by using a rotating tool that penetrates between the edges to be welded. FSW welding is currently widespread in the naval, aeronautical, automotive and aerospace sectors.

FSW of class 6000 aluminum alloys

The first phase of this research focused on the welding of aluminum alloys of class 6000 (AA6060-T6 and AA6082-T6) and in particular the influence of process parameters (rotation speed, feed rate, geometry and inclination of the tool) on the quality of the joints and on the forces required by the operation. Comparisons were made between the welds obtained with traditional, frustoconical and threaded tools. For this activity, numerous experimental investigation techniques have been used (tensile and fatigue tests, micro and macro structural analysis, microhardness tests, optical and electronic microscopy, etc.). The experimental activity was accompanied by some numerical studies aimed at defining a simulation model of the FSW process based on finite elements.

FSW of aluminum alloys class 2000, 5000, 7000 and Titanium

The research described in the previous point was then extended to other aluminum alloys of the 2000, 5000 and 7000 class (AA7075-T6 and AA2424-T3), analysing the mechanical and metallurgical properties of the joints obtained. Also in this case the relationships between the different process parameters and the quality of the joint in head-to-head configuration were evaluated. Mixed joints, AA7075 with AA2024 were also considered. Also in this case, the experimental analysis was accompanied by simulative research based on the use of a finite element code. The research, although only preliminary, has also been extended to the welding of grade 2 titanium alloys.

FSSW (Friction Stir Spot Welding)

As part of this project, various aspects of the FSSW (Friction Stir Spot Welding) welding process have also been studied. In particular, through the execution of joining tests on the AA6060 alloy, the relations between the process parameters and the thermal distribution in the welding area, the forces required by the process, the mechanical strength of the joint and the relative micro characteristics were examined in depth. Subsequently a simulative model based on the use of a finite element code was developed. Previously collected experimental data were used to fine-tune and validate the model. The FEM model developed is able to estimate (in a limited range of welding conditions, but nevertheless significant from the industrial point of view) the thermal distribution in the elements that

participate in the welding process, the forces exchanged between sheets and tool and in particular the mechanical strength of the joint (expressed as shear strength applied to the two overlapping sheets). Subsequently, the experimental and simulation study was extended to a class 7000 aluminum alloy. Finally, the experimental and simulative results were combined to define a model capable of describing some characteristics of the jointing process and of the joint itself as a function of the process parameters used.

Metallurgical analysis and corrosion behavior

Other research activities related to this project had the objective of analysing the metallurgical and corrosion behavior of FSW butt joints performed on aluminum sheets class 2000, 5000, 6000 and 7000; Attention was focused on the relationships between process parameters, mechanical characteristics of the joint and susceptibility to corrosion. The research also saw the combination of distinct materials (e.g. 7075-2024, 7075-6062, 2024-6062)

6.2 Analysis of micromachining processes with micro-EDM technology (Electro Discharge Machining)

The research activity in the field of micro-machining has mainly focused on machining with micro-EDM technology (micro-EDM), using a Sarix SX-200 machine equipped with both plunge and wire units. In particular, studies were carried out on the drilling process, analysing the effects that the process parameters have on the quality of the holes and on the process performance. In this regard, four indicators (two of geometric type and two related to process performance) were initially considered:

1. Diametral Overcut (DOC): represents the difference between the diameter of the hole obtained and the diameter of the electrode used for processing;

2. Taper Rate (TR): indicates the taper rate taken by the hole in relation to its depth;

3. Material Removal Rate (MRR): represents the quantity of material removed from the piece in the unit of time;

4. Tool Wear Ratio (TWR): represents the wear of the electrode in relation to the quantity of material removed from the piece.

Experimental research activities were carried out by working different materials, such as aluminum, different types of steel, titanium, tungsten carbide and ceramics. Different materials and different geometries were used for the tool; in particular, cylindrical and tubular electrodes with different diameters (from 100μm to 300μm) in tungsten carbide, copper and brass were used. From the point of view of the process parameters, the effects that the individual parameters and their combination have on the aforementioned indicators were been studied and analysed. The experimental campaigns were defined and conducted using DOE (Design of Experiment) techniques and the results were evaluated using appropriate statistical tools. The studies conducted in this area involved both holes with limited aspect ratios and very deep holes (with aspect ratios up to 100). The dimensional and morphological analysis of the holes was performed using optical microscopy, SEM, X-ray tomography and interferometry techniques.

In recent years, in addition to EDM micro-drilling, the focus of the research has shifted towards the EDM micro-milling process. In particular, the effects of the process parameters on the dimensional quality and surface finishing of the realized features were studied. In this case, the experiments were carried out by modifying the parameters and the waveforms of the process. The surface finishing was evaluated not only in relation to its average value (Sa) but other parameters were also considered, such as the asymmetry parameter (Ssk) and kurtosis (Sku), which allow to differentiate surfaces having the same average roughness value and to identify the differences in the distribution of peaks and valleys on the surface. Unlike drilling, the tools used are mainly in tungsten carbide and with a cylindrical shape; the processed materials range from the most widespread metallic materials

(stainless steel, aluminum, magnesium) to advanced ceramic materials, in particular the so-called Ultra High Temperature Ceramics (UHTCs), whose study was recently undertaken.

The objective of optimizing EDM processes is pursued not only through experimental tests, but also through the definition of models capable of supporting the selection of process parameters, aiming at the same time to reduce processing costs and optimize the performance of process. In particular, performance and cost indices have been defined based on the main process parameters (eg peak current, voltage and frequency) and / or the physical and thermodynamic characteristics of the piece and electrode materials. Through their minimization it is possible to obtain the optimal process parameters containing the TWR values and, at the same time, maximizing those of MRR.

During a micro-drilling or micro-milling process performed with a machine such as that supplied at the laboratories of the University of Bergamo, some important process parameters (such as the current) were defined as indices and therefore dimensionless and not directly correlated with the actual physical entity they represent. For this reason, in order to achieve a more accurate control of the erosion process, a system has been developed for acquiring the actual electrical parameters during processing. The detailed acquisition of the impulses produced during processing allowed to investigate several aspects of the EDM process.

Together with the experimental activities, studies were carried out for the definition of some simulation models able to simulate the micro-EDM process. One of these models is based on a software developed directly by the participants in the research project, a second model was developed using a commercial FEM code.

Finally, a study (at the preliminary stage) on the sustainability of the micro-EDM process was undertaken. In this context, tests were carried out with gaseous dielectrics (carbon dioxide, nitrogen, argon) to replace the more common kerosene. Furthermore, studies concerning the relationship between process parameters and overall energy consumption of the plant were carried out.

6.3 Workability of metal foams with conventional technologies

The aim of this research activity was the study of conventional technological processes applied to the processing of parts made entirely or in part with aluminum metal foams. The processing technologies used were chip removal (mainly drilling and milling) and processes based on plastic deformation (mainly three-point bending). The experimental investigation concerning the three-point bending operations of sandwich panels (aluminum-foam-aluminum) was supported by the finite element simulation of the process. This research activity was initially outlined in a PRIN project and then continued with the conclusion of the project. From the point of view of chip removal processes, the research did not reveal any particular critical points. With regard to plastic deformation processes, extremely significant results were achieved; in particular, the bending operations on three points proved to be a useful tool both for the mechanical and technological characterization of Al foam products and for the "conformation" of sandwich panels (leather-foam-leather). During this research activity, a specific FEM model was developed to accurately predict the behavior of the foamed elements subjected to bending.

6.4 Influence of cutting parameters on surface integrity in turning processes

Surface hardening induced by chip removal operations is one of the parameters that contribute to the definition of "surface integrity" (a general concept that includes all the geometric and mechanical characteristics that influence the functionality of a product component). This concept is considered increasingly important, both in the field of research and in the field of industrial applications. By way of a simple example, although very relevant, it is worth remembering the fatigue behavior of

mechanical components, which results to depend on roughness and a set of superficial mechanical alterations such as residual tensions, microcracks and superficial hardening. Some of these characteristics can even improve the performance of the component (for example, a state of compression effort and a local improvement of the mechanical characteristics can increase the fatigue limit).

The research on the surface properties of machined components by chip removal has traditionally focused on some extremely important aspects. Many authors have debated on the attribution of superficial alterations to thermal rather than mechanical effects and, although most of their observations relate to residual stresses, there is no lack of studies concerning surface hardening.

The present research topic is composed of an experimental investigation and a numerical investigation (FEM), both aimed at studying the phenomena of surface hardening related to machining by chip removal. The experimental investigation was based on the study of an orthogonal cutting process, as it was considered easier to analyse and to model through the use of a FEM code. Surface hardening was evaluated by Vickers microhardness tests. In the numerical field, a finite element model has been developed that can reproduce the different experimental conditions and support the experiment in the evaluation of the effects that the different cutting parameters manifest in terms of work surface hardening. In this context, two distinct materials have been studied: C40 steel and 304 stainless steel. Subsequently, the effects of wear and shear forces were also introduced in the survey.

6.5 Study of the elastic return in sheet metal bending processes with experimental methods and FEM

The three pint bending process is one of the most economical and widespread techniques for bending a sheet along a straight line; since using a single set of tools and simply changing the stroke of the punch it is possible to obtain a wide "range" of bending angles this technique is also particularly flexible. The final bend angle is however conditioned by a series of parameters linked both to the geometry of the process and to the properties of the processed material and cannot be separated from the elastic recovery (springback) which occurs after unloading.

In this context, a semi-empirical algorithm was studied to establish, during the bending process, the amount of "overlapping" to be imposed on the sheet in order to compensate for the elastic return. This algorithm, based on a very limited set of parameters that can be acquired during the bending press set-up (sheet thickness and tool geometry) or directly during the process (force-stroke relationship in the initial bending phases), provides the value of punch overtravel through which to compensate for the elastic return. In this context, through various experimental studies, the effects that the properties of the material and the characteristics of the sheets have on the elastic return following bending was also studied in depth.

Once a first algorithm was defined and a first experimentation was carried out using a bending press made available by an industrial partner, an instrumented press was then created with which to deepen the actual predictive ability and reliability of the proposed method.

6.6 Experimental numerical study aimed at finding the conditions of solid state welding in extrusion processes with bridge matrices

The present work was focused on the study of boundary conditions of solid state weldability in porthole dies for extrusion processes. The study was mainly based on the execution of rolling tests and on the corresponding simulations using a FEM code. Numerous pairs of aluminum plates (AA6060 and AA6082) have been rolled by varying the pressure (lamination ratio) and temperature conditions. From the combination of the experimental results and FEM it was possible to derive a law for the prediction

of the conditions of weldability according to the Piwnik and Plata model. This law was then implemented in a finite element code with which it was possible to simulate the solid state welding process in extrusion processes with porthole dies. The present research took also into account the mechanical characterization (by burst tests) of aluminum tubular elements obtained by extrusion with porthole dies. These results allowed to provide information about the optimal conditions for achieving the "solid state bonding" conditions in terms of extrusion pressure and temperature and geometric characteristics of the extrusion chamber.

6.7 Micromachining with LIGA electron beam technology

A system for micro-processing based on LIGA electron beam technology (EBL - Electron Beam Lithography) was developed. The system is able to engrave, through the electron beam of a SEM microscope, a photosensitive "resist" (PMMA) deposited on a silicon substrate. Once the desired profile is engraved, the sample is developed and attached with a series of chemical reagents to transfer the geometry onto the silicon substrate. Subsequently, with the use of metal evaporation or electrochemical deposition techniques, the engraved silicon substrate is used to obtain components of a predetermined shape and size. A software was developed to define and control the desired engraving profile starting from a graphic representation in traditional format (eg dwg, dxf, iges) and the integrated system is now in the calibration phase. This research activity has led to the creation of simple micro-components with dimensions in the order of tens of micrometers. Moreover, it has been possible to use this technological solution to realize micro-electrodes to be used in micro-EDM (EDM) plunge machining.

6.8 Definition of a new test methodology for the study of hydrogen embrittlement in cathodic protection

The traditional SSR (slow strain rate) techniques based on the tensile test have different limits in the evaluation of the onset of hydrogen embrittlement phenomena in cathodic protection. These limits are related to the characteristics of the tensile test and to the impossibility of deforming the material beyond certain values (generally rather limited) without incurring the striction phenomena that make the results difficult to be interpreted. In this regard, a new methodology of investigation based on three-point bending tests with which to determine the limit values of deformation beyond which a specific material can be more susceptible to the problem of hydrogen embrittlement has been developed. The study carried out on both the experimental and numerical fields (FEM simulations), allowed to define a reliable test methodology applicable to the most common pipeline steels; this technique also has the advantage of being able to be used on samples directly extracted from the tube (such as for example the curved portion of a tube) without requiring particular preparatory work.

Description of some less relevant research topics

The results of these studies, although they have led to some publications, should be considered as minor themes (in the context of the research activity of the writer) with respect to those previously mentioned.

Study on the wear of cutting blades used in band saws

The present work focused on the study of the wear of the blades in the cutting process with band sawing machine. An experimental campaign was performed using a semi-automatic tilting band saw;

three different types of blades were examined (different for material and geometry). Multiple cuts were made on tubular samples in API80 steel. The wear lip of three different triads of teeth (straight tooth, right tooth and left tooth) for each blade was measured at regular intervals in order to assess the evolution of different tool wear. Through the measurement of cutting forces it was possible to calculate the specific cutting energy and correlate it with the degradation of the blades.

Test methods and procedures for automatic multi-position measuring machines

This work was carried out in collaboration with a leading company in the metrological field and originated from a business need. In the field of automatic measuring machines, mainly destined for the automotive sector, following the internationalization of customers, difficulties in agreeing on how to carry out testing of the systems classifiable as multi-position have emerged ever more pressingly. In fact, even if it must be recognized that the international regulations and the technical specifications drawn up by each client actually converge, with the exception of slight differences; in the prescription of some tests and in the calculation of some acceptability indices, a fundamental problem emerges deriving from the fact that multi-position machines introduce in a singular way the (systematic and random) variation of the measure according to the positioning and the literature does not prescribe any rule scheduling in the execution of the various tests. In such a context, with regard to the interpretation relating to the order of loading of the pieces under examination, the supplier and the customer are brought, each according to their own interest, to propose different specifications that can lead to incompatible results.

The purpose of the study was to conduct simulations (of a statistical nature) aimed at highlighting, in the cases considered most significant, the differences in results obtainable in the various tests, varying the loading rules and at the same time trying to bring out a application methodology that guarantees the user the correct functionality of the machine and does not oblige the manufacturer to carry out expensive automatic verification cycles to find the most critical condition for its operation.

Characterization of a measurement probe for CNC machines

This study was carried out with the aim of verifying the quality of the measurements that can be obtained through a system developed to perform "measurements in the machine", ie a system for which it is possible to perform the measurement of the workpiece directly inside the machine tool who produced it. The system taken into consideration consists of a Marposs contact measurement probe and a 3-axis CNC machining centre.

Although in the literature there are numerous works of characterization of "touch trigger" probes, these are generally carried out using coordinate measuring machines (CMMs), ie machines dedicated exclusively to dimensional measurement and therefore able to perform such operations with high accuracy. A different argument requires instead the measurement operations within a work center, or rather a non-dedicated system that operates in an environment that is not ideal for performing precision measurements. However, this solution has advantages linked to the possibility of performing measurements immediately after processing, without transferring the part to another machine and without repositioning it. In this study, several aspects were taken into consideration: accuracy and repeatability of the measurements performed by the aforementioned system, effects related to the direction of contact, the length of the stylus, the speed of approach, etc.

New FMEA approach based on availability and costs

This research topic concerns the definition of a new FMEA approach that uses, in addition to the traditional indices, two new parameters related to availability and costs. The parameters introduced

during this study made it possible to make the traditional methodology of fault analysis much more customer-oriented. The study was carried out in collaboration with one of the largest national manufacturers of machine tools.

Analysis and optimization of production plants using simulation systems

In this context, some studies have been carried out with the aim at analysing and optimizing production plants through the use of commercial software based on the scheduling of events. These studies were carried out in two distinct sectors: the production of mechanical components for diecasting and the machining of automotive components for chip removal.

8. THESIS SUPERVISOR

He has been supervisor of students for degree thesis and doctoral theses. In the last 15 years he has been supervisor of more than 100 degree theses, for bachelor and master degree courses in Mechanical Engineering, Management Engineering, Engineering and Management for Health.

9. PARTICIPATION IN RESEARCH PROJECTS

From 2006 to 2020
Participation in the following research projects

Project PRIN 2006
Title: TILAS
Innovative Metal Foam Processing Technologies.
Workability of metal foam components with conventional technologies: chip removal and plastic deformation.
Local responsible: Prof. Giancarlo Maccarini.
Start date: 09/02/2007. Duration: 24 months.

Project PRIN 2008
Title: EXTR-CHAIN
Definition of experimental tests for the identification of limit welding conditions; development and implementation of numerical welding models and experimental evaluation of the deformability of the extruded products.
Local responsible: Prof. Claudio Giardini.
Start date: 22/03/2010. Duration: 30 months.

Project INDUSTRIA 2015
Title: MICHELANGELO
Increase in the level of automation, self-diagnosis, precision and functional integration of Italian machine tools through artificial cognitive systems that carry out perception-decision processes.
Local responsible: Prof. Claudio Giardini.
Duration: from 01/09/2010 to 28/02/2014.

Lombardy Region Project

Title: REMS - Lombard Network of Excellence for Instrumental Mechanics and Extended Laboratory
Local responsible: Prof. Giancarlo Maccarini.
Duration: from 01/02/2011 to 31/07/2013

Project H2020 JTI-CS2-2015-CFP02-SYS-03-01
Title: REPRISE - Reliable Electromechanical actuator for PRImary SurfacE with health monitoring
Local responsible: Prof. Fabio Previdi.
Duration: from 01/07/2017 to 31/12/2019

Lombardy Region Project
Title: IoB - Internet of Beauty
Local responsible: Prof. Fabio Previdi.
Duration: from 01/01/2018 to 31/10/2019

Lombardy Region Project
Title: Smart Living 4 All
Local responsible: Prof. Fabio Previdi.
Duration: from 01/01/2018 to 31/10/2019

Lombardy Region Project
Title: SMART4CPPS - Smart solutions for Cyber-Physical Production systems
Local responsible: Prof. Fabio Previdi.
Duration: from 01/04/2018 to 31/12/2020

10. RESEARCH COLLABORATIONS WITH PRIVATE COMPANIES

From 04/30/2008 to 11/17/2019
Carrying out of contracted collaboration activities (as scientific director) with the following companies. The total amount of the contracts is greater than 400,000 Euros.

	Start date	**End date**	**Research Title**	**Company**
1	19/09/2007	18/03/2008	Study of the upsetting of a cylinder bottom without welding	Tenaris Spa
2	30/04/2008	28/02/2009	Study of tool life and workability of mold steels	Lucchini Sidermeccanica Spa
3	02/09/2008	01/03/2009	In-depth study of the upsetting of the cylinder bottoms without welding	Tenaris Spa

4	04/05/2012	03/12/2012	Experimentation in the field of corrosion and materials	Gruppo Cimbali Spa
5	04/05/2012	03/11/2012	New Inox Cimbali boiler project	Gruppo Cimbali Spa
6	08/08/2012	07/12/2012	Thickness optimization of the new 600cc boiler system	Gruppo Cimbali Spa
7	08/08/2012	07/12/2012	Production feasibility study of a Cimbali / Faema boiler using hydroforming technologies	Gruppo Cimbali Spa
8	08/08/2012	07/12/2012	Comparative analysis of coffee filters currently employed by Cimbali and the search for an alternative technology for their realization	Gruppo Cimbali Spa
9	11/09/2012	15/12/2012	Study of the coffee panel in Cimbali machines	Gruppo Cimbali Spa
10	22/10/2012	23/11/2012	Technical and metallurgical study related to the construction of a new stainless steel boiler	Gruppo Cimbali Spa
11	20/05/2013	25/11/2013	Deepening of CFD analysis of cimbal boilers - copper-stainless steel comparative analysis	Gruppo Cimbali Spa
12	16/04/2015	15/10/2015	Reconfiguration of the factory lay-out, analysis and optimization of the manufacturing processes of the VITART plant	Vitart srl
13	05/10/2015	04/04/2016	Analysis and development of a new capsule for instant beverages	Gruppo Gimoka
14	28/10/2015	28/10/2016	Analysis and development of a new capsule for coffee compatible with Dolce Gusto system	Gruppo Gimoka

15	29/04/2016	28/12/2016	Study of the reorganization and optimization of the coffee capsule production plants	Gruppo Gimoka
16	30/09/2016	30/07/2017	Analysis and research of solutions for product and process improvement in the production of coffee capsules and instant beverages	Gruppo Gimoka
17	08/06/2017	07/10/2017	Development of a system of indicators for assessing the productivity of human resources within a generic manufacturing company	Confindustria Bergamo
18	14/11/2017	13/09/2018	Development of a new closed system, capsule coffee machine, for the production of coffee and instant drinks and implementation of new procedures for product and process qualification.	Gruppo Gimoka
19	19/12/2018	17/11/2019	Analysis and optimization of the technical and functional characteristics of new systems based on domestic coffee machines and compatible capsules.	Gruppo Gimoka
20	04/04/2019	01/11/2019	Analysis of some companies in the engineering sector of the province of Bergamo for the identification of identifiable common aspects as strengths and best practices.	Confindustria Bergamo
21	20/02/2020	19/09/2020	Analysis of coffee capsules affected by the detachment of plastic particles.	Beyers Koffie

11. PATENTS

International patent
Inventor: D'Urso Gianluca Danilo
Title: A capsule for producing a beverage
Patent number: EP 3 419 917 B1
Proprietor: Gruppo Gimoka s.r.l. 20090 Trezzano sul Naviglio
Date of publication and mention of the grant of the patent: 25/12/2019 (Bulletin 2019/52)
Application number: 17717228.5
Date of filling: 27/02/2017
Date of publication of application: 02/01/2019 (Bulletin 2019/01)
International application number: PCT/IB2017/051141
International publication number: WO2017145135 (31/08/2017 Gazette 2017/35)
Priority: 26/02/2016 ITUB20161103
Published as: EP3419917A1; EP3419917B1; WO2017145135A1; ITUB20161103A1; US2019055084A1

National patent
Inventors: D URSO GIANLUCA; FEST STEPHANIE; SANTINI MAURIZIO
Title: Utensile per la formazione e il distacco di gocce di fluido in condizioni supercritiche
Application number: 2013
Date of publication: 2015
Application: IT2013MI00424 20130320
Patent number: 1416638
Proprietor: Università degli studi di Bergamo

12. PROMOTION AND DISSEMINATION OF SCIENTIFIC RESULTS

Contribution in the promotion and dissemination of scientific results at national and international level.
Referee of various international scientific journals (the main ones are: International Journal of Advanced Manufacturing Technology, Material and Design, Precision Engineering, Journal of Manufacturing Processes, International Journal of Fatigue, Materials, Applied Sciences).

Member of the editorial board of the "International Journal of Mechatronics and Manufacturing Systems".
Guest editor of the scientific journal "Materials" for a special issue entitled "Finite Element Analysis and Models of Sustainable Manufacturing Processes".
Guest editor of the scientific journal "Applied Sciences" for a special issue entitled "micro-EDM drilling".

Session Chairman of the following international conferences:
- International Conference on Extrusion and Benchmark (ICEB 2011), Bologna, Italy, October 3-5, 2011.
- 11th International Conference on Micro Manufacturing Orange County, California, USA, 29-31 March 2016.

Member of the Organizing Committee of the "13th International ESAFORM Conference on Material Forming", Brescia 7-9 April 2010.

13. SCIENTIFIC PUBLICATIONS

13.1 Papers on International Journals

1. Bocchi Sara, D'Urso Gianluca, Giardini Claudio. The effect of heat generated on mechanical properties of friction stir welded aluminum alloys. International Journal of Advanced Manufacturing Technology, 2021, 112(5-6), pp. 1513–1528.
2. Quarto Mariangela, Bissacco Giuliano, D'Urso Gianluca. Study on ZrB2-based ceramics reinforced with SiC fibers or whiskers machined by micro-electrical discharge machining. Micromachines, 2020, 11(11), 959.
3. Quarto Mariangela, D'Urso Gianluca, Giardini Claudio. Energy consumption model for cutting operations in a stochastic environment. International Journal of Advanced Manufacturing Technology, 2020, 110(9-10), pp. 2743–2752.

4. D'Urso Gianluca, Giardini Claudio, Lorenzi Sergio, Sciti Diletta, Silvestroni Laura. Micro-EDM milling of zirconium carbide ceramics. Precision Engineering, 2020, 65, pp. 156–163
5. Cabrini Marina, Bocchi Sara, D'Urso Gianluca, Testa Christian, Pastore Tommaso. Effect of load on the corrosion behavior of friction stir welded AA 7075-T6 aluminum alloy. Materials, 2020, 13(11), 2600.
6. Cabrini Marina, Bocchi Sara, D'Urso Gianluca, Testa Christian, Pastore Tommaso. Stress corrosion cracking of friction stir-welded AA-2024 T3 alloy. Materials, 2020, 13(11), 2610.
7. Bocchi Sara, Cabrini Marina, D'Urso Gianluca, Giardini Claudio, Lorenzi Sergio, Pastore Tommaso. Stress enhanced intergranular corrosion of friction stir welded AA2024-T3. Engineering Failure Analysis, Volume 111, April 2020, 104483.
8. Quarto Mariangela, D'Urso Gianluca, Giardini Claudio, Maccarini Giancarlo. FEM model development for the simulation of a micro-drilling EDM process. Int J Adv Manuf Technol (2020). https://doi.org/10.1007/s00170-019-04750-7.
9. Bocchi Sara, D'Urso Gianluca, Giardini Claudio, Maccarini Giancarlo. Effects of cooling conditions on microstructure and mechanical properties of friction stir welded butt joints of different aluminum alloys. Applied Sciences (Switzerland) Volume 9, Issue 23, 1 December 2019, Article number 5059.
10. Quarto Mariangela, Bissacco Giuliano, D'Urso Gianluca. Machinability and energy efficiency in micro-EDM milling of zirconium boride reinforced with silicon carbide fibers. Materials, Volume 12, Issue 23, 1 December 2019, Article number 3920.
11. D'Urso Gianluca, Ravasio Chiara. Investigation on the effects of exchanged power and electrode properties on micro EDM drilling of stainless steel (2019) Manufacturing Technology, 19 (2), pp. 337-344.
12. Bocchi Sara, Cabrini Marina, D'Urso Gianluca Danilo, Giardini Claudio, Lorenzi Sergio, Pastore Tommaso (2018) The influence of process parameters on mechanical properties and corrosion behavior of friction stir welded aluminum joints. Journal of Manufacturing Processes 35 (10), pp. 1-15.
13. D'Urso Gianluca, Giardini Claudio, Ravasio Chiara. Effects of Electrode and Workpiece Materials on the Sustainability of Micro-EDM Drilling Process (2018) International Journal of Precision Engineering and Manufacturing, 19 (11), pp. 1727-1734.
14. D'Urso Gianluca Danilo, Giardini Claudio, Quarto Mariangela (2018) Characterization of surfaces obtained by micro-EDM milling on steel and ceramic components. International Journal of Advanced Manufacturing Technology 97 (5-8), PP. 2077-2085. DOI: 10.1007/s00170-018-1962-5
15. D'Urso Gianluca, Quarto Mariangela, Pellegrini Giuseppe., Ravasio Chiara. Towards the prediction of micro-EDM drilling performance on WC varying the hole depth (2018) Manufacturing Technology, 18 (6), pp. 1041-1047.
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20. D'Urso Gianluca Danilo, Maccarini Giancarlo, Ravasio Chiara (2016) Influence of electrode material in micro-EDM drilling of stainless steel and tungsten carbide. International Journal of Advanced Manufacturing Technology, 85 (9-12), pp. 2013-2025. DOI: 10.1007/s00170-015-7010-9. ISSN: 02683768.
21. D'Urso Gianluca Danilo, Ravasio Chiara (2016) The effects of electrode size and discharged power on micro-electro-discharge machining drilling of stainless steel. Advances in Mechanical Engineering, 8 (5), pp. 1-12. DOI: 10.1177/1687814016648646. ISSN: 16878132.
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27. Baragetti Sergio, D'Urso Gianluca Danilo (2014) Aluminum 6060-T6 friction stir welded butt joints: Fatigue resistance with different tools and feed rates. Journal of Mechanical Science and Technology, 28 (3), pp. 867-877. DOI: 10.1007/s12206-013-1152-1. ISSN: 1738494X.
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33. D'Urso Gianluca Danilo, Pellegrini Giuseppe, Maccarini Ginacarlo (2007) Surface alteration induced by machining. International Journal of Materials and Product Technology, 30 (1-3), pp. 52-66. ISSN: 02681900.

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1. D'Urso Gianluca Danilo, Giardini Claudio, Longo Michela, Segatori Antonio (2015) Microstructural evaluation of solid state welds obtained by means of flat rolling process. Metallurgia Italiana, 107 (2), pp. 31-37. ISSN: 00260843.
2. D'Urso Gianluca Danilo, Longo Michela, Giardini Claudio (2013) Microstructural analysis of AA6060-T6 friction stir welded joints: Correlation between process parameters grain size [Analisi microstrutturale di giunzioni friction stir welding in alluminio AA6060-T6: Correlazione tra parametri di processo e dimensione dei grani]. Metallurgia Italiana, 105 (6), pp. 23-30. ISSN: 00260843.

13.3 Chapter of Books

1. Quarto Mariangela, Bissacco Giuliano, D'Urso Gianluca. µEDM Machining of ZrB2-Based Ceramics Reinforced with SiC Fibres or Whiskers. Lecture Notes in Mechanical Engineering, 2021, pp. 61–74.
2. Cabrini Marina, D'Urso Gianluca Danilo, Pastore Tommaso (2008) Evaluation of the resistance to hydrogen embrittlement by the slow bending test. Environment-Induced Cracking of Materials, pp. 493-502. DOI: 10.1016/B978-008044635-6.50085-6. ISBN: 9780080446356.

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1. D'Urso Gianluca, Giardini Claudio, Maccarini Giancarlo, Quarto Mariangela, Ravasio Chiara (2018) Analysis of the surface quality of steel and ceramic materials machined by micro-EDM. International Conference of the European Society for Precision Engineering and Nanotechnology, EUSPEN 2018; Venice; 4-8 June.
2. Marina Cabrini, Sergio Lorenzi, Tommaso Pastore, Sara Bocchi, Gianluca D'Urso, Claudio Giardini, Electrochemical and environmental assisted cracking behavior of AA2024 T3 and AA7075 T6 welded by means of FSW, ECI conference, Stress-Assisted Corrosion Damage V, Hernstein, Austria, 2018.

3. Marina Cabrini, Sergio Lorenzi, Sara Bocchi, Tommaso Pastore, Gianluca D'Urso, Claudio Giardini, Evaluation of corrosion behavior of AA2024 T3 welded. 20th International Corrosion Congress & Process Safety Congress, Prague; 2017.
4. D'Urso Gianluca Danilo, Giardini Claudio, Lorenzi Sergio, Cabrini Marina, Pastore Tommaso. (2017). The influence of process parameters on mechanical properties and corrosion behaviour of friction stir welded aluminum joints. In Proceedings of the International Conference on the Technology of Plasticity, ICTP 2017; Cambridge - United Kingdom; 17-22 September 2017. Procedia Engineering Volume 207, 2017, Pages 591-596.
5. D'Urso Gianluca Danilo, Giardini Claudio, Lorenzi Sergio, Cabrini Marina, Pastore Tommaso. (2017). The Effects of Process Parameters on Mechanical Properties and Corrosion Behavior in Friction Stir Welding of Aluminum Alloys. In: Proceedings of the 17th International Conference on Sheet Metal, SHEMET 2017, Palermo 10-12 April 2017. Procedia Engineering Volume 183, 2017, Pages 270-276.
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7. D'Urso Gianluca Danilo, Ravasio Chiara, Quarto Mariangela. (2016). Material-Technology Index to evaluate micro-EDM drilling process. In: Proceedings of the 11th International Conference on Micro Manufacturing Orange County, California, USA, 29-31 March 2016. DOI: 10.1016/j.proeng.2017.04.038.
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10. Bigot Samuel, Surleraux Anthony, Pernot Jean Philippe, D'Urso Gianluca Danilo, Merla Cristina, Peyoutet Jeremy (2014). Estimating the exchanged energy distribution in micro-EDM. In: Proceedings of the 9th International Conference on MicroManufacturing, ICOMM 2014, Singapore, March 25-28, 2014. Singapore, March 26-28, 2014.
11. D'Urso Gianluca Danilo, Giardini Claudio (2014). Simulative model for the evaluation of thermo-mechanical effects in Friction Stir Spot Welding (FSSW) of Aluminum sheets. In: Metal Forming 2014. KEY ENGINEERING MATERIALS, vol. 622-623, p. 557-566, Zurich:Trans Tech Publications, ISBN: 978-3-03835-193-1, ISSN: 1013-9826, Palermo (Italy), 21-24 September 2014, doi: 10.4028/www.scientific.net/KEM.622-623.557.

12. D'Urso Gianluca Danilo, Maccarini Giancarlo, Merla Cristina, Ravasio Chiara (2014). Studio dell'influenza del materiale e della geometria elettrodo nella foratura con tecnologia micro-EDM. In: Atti del 3° CONGRESSO NAZIONALE DEL COORDINAMENTO DELLA MECCANICA ITALIANA Napoli 30 Giugno - 1 Luglio 2014 Napoli Università Napoli Federico II COORDINAMENTO DELLA MECCANICA ITALIANA. ISBN: 8890209623, Napoli (ITA), 30 Giugno – 1 Luglio 2014.
13. Baragetti Sergio, D'Urso Gianluca Danilo, Giardini Claudio, Villa Francesco (2014). Saldature di testa friction stir welding su lega di alluminio 6060-T6: resistenza a fatica al variare degli utensili e della velocità di avanzamento. In: Atti del 3° CONGRESSO NAZIONALE DEL COORDINAMENTO DELLA MECCANICA ITALIANA Napoli 30 Giugno - 1 Luglio 2014 Napoli Università Napoli Federico II COORDINAMENTO DELLA MECCANICA ITALIANA. ISBN: 8890209623, Napoli (ITA), dal 30 Giugno al 1 Luglio 2014.
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15. D'Urso Gianluca Danilo, Merla Cristina, Maccarini Giancarlo (2013). EDM drilling of high aspect ratio micro holes. In: Proceedings XI AITeM Conference - Enhancing the Science of Manufacturing. ISBN: 978-88-906061-1-3, San Benedetto del Tronto (AP) - ITA, 9-11 Settembre 2013.
16. D'Urso Gianluca Danilo, Longo Michela, Giardini Claudio (2013). Friction stir spot welding (FSSW) of aluminum sheets: experimental and simulative analysis. In: Sheet Metal 2013. vol. 549, p. 477-483, Trans Tech Publications, ISBN: 978-3-03785-671-0, Belfast (UK), 25-27 March 2013, doi: 10.4028/www.scientific.net/KEM.549.477.
17. D'Urso Gianluca Danilo, Merla Cristina, Maccarini Giancarlo (2013). The downsizing effect in EDM drilling of micro holes. In: Sheet Metal 2013. KEY ENGINEERING MATERIALS, vol. 549, p. 503-510, ISSN: 1013-9826, Belfast (UK), 25-27 March 2013, doi: 10.4028/www.scientific.net/KEM.549.503.
18. D'Urso Gianluca Danilo, Longo Michela, Giardini Claudio, Ceretti Elisabetta (2012). A Combined Experimental Simulative Method for Studying the Material Bonding of Different Aluminum Alloys. In: Proceedings of NAMRI/SME 2012. vol. Vol. 40(2012), p. 795-804, ISBN: 978-0-87263-873-1, South Bend (USA), June 4-8, 2012.
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ENGINEERING MATERIALS, vol. 488-489, p. 343-346, Durnten-Zurich:Trans Tech Publications, ISBN: 978-3-03785-218-7, ISSN: 1013-9826, Dubrovnik (Croatia), 19 – 21 September, 2011, doi: 10.4028/www.scientific.net/KEM.488-489.343.

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22. D'Urso Gianluca Danilo, Maccarini Giancarlo, Merla Cristina, Ravasio Chiara (2012). Micro EDM machining of small features on magnesium plates. In: Proceedings of the 1st International Conference on Design and PROcesses for MEdical Devices. Brescia (Italy), dal 2 al 4 maggio 2012.
23. D'Urso Gianluca Danilo, Gallus Enrico, Maccarini Giancarlo, Merla Cristina, Ravasio Chiara (2012). Micro holes on different materials: a comparison between micro EDM and micro laser technologies. In: Proceedings of the 8th International Workshop on Microfactories. ISBN: 978-952-15-2936-8, Tampere (Finland), June 18th-20th 2012.
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