

Curriculum Vitae

INFORMAZIONI PERSONALI

Nome GIUSEPPE
Cognome INGARAO
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FORMAZIONE TITOLI

EDUCATION

- **23/03/2009 –PhD Thesis defense.**

PhD Course in Production Engineering (XX cycle: 01/01/2006-31/12/2008) - Department: Manufacturing Technology, Production and Management Engineering (DTMPIG) - Faculty of Engineering, University of Palermo.

PhD thesis title: *C.A.E. methods for design and control of metal forming processes.*

Tutor: Professor Di Lorenzo Rosa.

- **18/04/2005- Master Degree in Management Engineering.**

Final Mark 110/110 cum laude at University of Palermo.

Master degree thesis title: *Tube hydroforming optimization: a gradient based approach.*

ACADEMIC POSITIONS

- **20/12/2012-Present: Assistant professor of Manufacturing Technology (Ricercatore a t.d. (art. 24 comma 3-a L. 240/10)).**

Department of Industrial and Digital Innovation (DIID), University of Palermo.

Contract time: 3 years (2 years renewable)

- **01/10/2012-19/12/2012: Marie Curie Fellow.**

Department: Centre for Industrial Management/Traffic & Infrastructure- KULeuven, Belgium. Supervisor: Prof. Joost R. Duflou (<http://www.kuleuven.be/wieiswie/en/person/u0016263>)

- **29/06/2009-30/09/2012: Post-doctoral research contract.**

Contract time: 2+2 years.

Department: Industrial Engineering, University of Palermo.

Research Title: *Metal forming processes engineering: fracture issue analysis and optimization methodologies.*

Tutor: Professor Di Lorenzo Rosa

- **01/01/2006-31/12/2008: PhD Course (XX cycle) in Production engineering.**

Department: Manufacturing Technology, Production and Management Engineering (DTMPIG)-Faculty of Engineering, University of Palermo-Tutor: Professor Di Lorenzo Rosa

FELLOWSHIP

- **01/10/2012-19/12/2012: Marie Curie Fellowship.**

Department: Centre for Industrial Management/Traffic & Infrastructure- KULeuven, Belgium.

Research title: *Sustainability evaluation and modeling for energy efficient manufacturing: an environmental perspective on sheet metal forming technologies.*

Supervisor: Prof. Joost R. Dufloy

AWARDS

In **November 2014** Giuseppe Ingarao was awarded the Italian Scientific Qualification (Abilitazione Scientifica Nazionale) as Associate Professor (Professore di II Fascia) according to the article n. 16 of the Italian law n. 240/201, for the Macro Academic Fields (Macro Settore Concorsuale) 09/B1, Academic discipline: Manufacturing technology and systems (ING-IND/16).

ATTIVITA' DIDATTICA

COURSES HELD IN GRADUATE PROGRAMS

- **2015/2016-Lecturer of the course "Manufacturing Technologies Complements" (9CFU)**, for Master degrees in Mechanical engineering, University of Palermo, Italy.

- **2015/2016-Lecturer of the course "Sustainable manufacturing" (6CFU)**, for Master degrees in Mechanical engineering and Management engineering, University of Palermo, Italy.

- **2014/2015-Lecturer of the course "Sustainable manufacturing" (6CFU)**, for Master degrees in Mechanical engineering and Management engineering, University of Palermo, Italy.

- **2013/2014-Lecturer of the course "Non conventional manufacturing technologies" (6CFU)**, for Master degrees in Mechanical engineering and Management engineering, University of Palermo, Italy.

- **2012/2013- Lecturer of the course-"Manufacturing technologies" (6CFU)**, for Bachelor degree in Management and Computer science engineering, University of Palermo, Italy.

- **2006-2011-Teaching assistant of different courses:**
 - ü Manufacturing technology-held by professor Fabrizio Micari.

 - ü Manufacturing technology complements-held by professor Fabrizio Micari.

 - ü Manufacturing technology for the Aerospace sector-held by professor Livan Fratini.

 - ü Design of forming processes-held by professor Livan Fratini.

COURSES HELD IN POSTGRADUATE PROGRAMS

- 2014-Master course title: "Expert in Hospitals Operations Management " The Principal investigator held a 10 hour course titled: "optimization techniques"

- 2011-Master course title: "Innovative material and techniques for the building sector"; University of Palermo (Faculty of Engineering) and consortium UNISOM.

The Principal investigator held a 13 hour course titled: "Sustainable manufacturing-industrial components".

LECTURES GIVEN IN SUMMER SCHOOLS FOR Ph.D STUDENTS

- 2013-Lecture within the A.I.Te.M. (Italian Association of Manufacturing Technology) Summer School for PhD students in manufacturing technology field. Title of the lecture: "Sustainability issues in manufacturing".
- 6/10/2014-Nuremberg (Germany) Lecture within the SMART (Sheet Metal Advanced Research & Teaching) School. Title of the lecture: "Sustainability".

RICERCHE FINANZIATE

- **01/10/2012-19/12/2012: Marie Curie Fellowship.**

Department: Centre for Industrial Management/Traffic & Infrastructure- KULeuven, Belgium.

Research title: *Sustainability evaluation and modeling for energy efficient manufacturing: an environmental perspective on sheet metal forming technologies.*

Supervisor: Prof. Joost R. Duflou

INCARICHI / CONSULENZE

REVIEWER ACTIVITY FOR SCIENTIFIC JOURNALS

- Journal of Cleaner Production
- International Journal of Advanced Manufacturing Technology
- Resource Conservation and Recycling
- International Journal of Material Forming
- International Journal of Mechanical Science
- Applied Mathematical Modeling
- Materials
- CIRP Journal of Manufacturing Science and Technology
- International Journal of Operations & Production Management
- International Journal of Production Economics

- Journal of Manufacturing Science and Engineering
- Journal of Manufacturing Processes

COMMISSIONS OF TRUST

- Reviewer for grant proposal evaluation for United Arab Emirates University, United Arab Emirates(UEA).
- Member of the KES-SDM-17 International Programme Committee (<http://sdm-17.kesinternational.org/cmsIPCdisplay.php>).

MEMBERSHIP OF SCIENTIFIC SOCIETIES

Member of Italian Association of Manufacturing Technology (A.I.Te.M.)

ASSOCIAZIONI SCIENTIFICHE

Member of Italian Association of Manufacturing Technology (A.I.Te.M.)

PUBBLICAZIONI

MAJOR INTERNATIONAL JOURNALS

[P.1] Priarone P C., **Ingarao G.** Towards criteria for sustainable process selection: on the modelling of pure subtractive versus additive/subtractive integrated manufacturing approaches. Journal of Cleaner Production, 2017; 144: 57-68.

[P.2] **Ingarao G.** Manufacturing strategies for efficiency in energy and resources use: the role of metal shaping processes, Journal of Cleaner Production, 2017; 142: 2872-2886.

[P.3] Priarone P.C., **Ingarao G.**, Settineri L., Di Lorenzo R. Influence of material-related aspects on energy consumption and carbon footprint of additive and subtractive Ti-6Al-4V manufacturing. Journal of industrial Ecology, 2016, In press. DOI 10.1111/jiec.12523

[P.4] **Ingarao G.**, Licata S., Sciortino M., Planeta D., Di Lorenzo R., Fratini L. Life cycle energy and CO₂ emissions analysis of food packaging: an insight into the methodology from an Italian case study perspective. International Journal of Sustainable Engineering, 2016, [In press. DOI: 10.1080/19397038.2016.1233296](https://doi.org/10.1080/19397038.2016.1233296).

[P.5] **Ingarao G.**, Deng Y, Marino R , Di Lorenzo R, Lo Franco A. Analysis on energy and CO₂ life cycle inventory issues for aluminum based components: the case study of a high speed train window panel. Journal of Cleaner Production, 2016; 126: 493-503.

- [P.6] **Ingarao G.**, Priarone P.C., Di Lorenzo R., Settineri L. A methodology for evaluating the influence of batch size and part geometry on the environmental performance of machining and forming processes. *Journal of Cleaner Production*, 2016; 135: 1611–1622.
- [P.7] **Ingarao G.**, Priarone Paolo C., Gagliardi F., Di Lorenzo R., Settineri L. Subtractive versus mass conserving metal shaping Technologies: an environmental impact comparison. *Journal of Cleaner Production*, 2015; 87: 862-873.
- [P.8] **Ingarao G.**, Vanhove H., Kellens K., Duflou J. R. A comprehensive analysis of electric energy consumption of single point incremental forming processes. *Journal of cleaner Production*, 2014; 67, 173–186.
- [P.9] **Ingarao G.**, Di Lorenzo R. A contribution on the optimization strategies based on moving least squares approximation for sheet metal forming design. *International Journal of Advanced Manufacturing Technology*, 2013; 411-425.
- [P.10] **Ingarao G.**, Ambrogio G., Gagliardi F., Di Lorenzo R. A sustainability point of view on sheet metal forming operations: material wasting and energy consumption in incremental forming and stamping processes. *Journal of Cleaner Production*, 2012; 29-30: 255-268.
- [P.11] **Ingarao G.**, Di Lorenzo R., Micari F. Sustainability issues in sheet metal forming processes: an overview. *Journal of Cleaner Production*, 2011; 19: 337-347.
- [P.12] **Ingarao G.**, Di Lorenzo R. Optimization methods for complex sheet metal stamping computer aided engineering. *Structural and multidisciplinary optimization*, 2010; 42 (3): 459-480.
- [P.13] Marretta L., **Ingarao G.**, Di Lorenzo R. Design of sheet stamping operations to control springback and thinning: a multi-objective stochastic optimization approach, *International Journal of Mechanical Science*, 2010; 52: 914–927.
- [P.14] **Ingarao G.** Di Lorenzo R. A new progressive design methodology for complex sheet metal stamping operations: coupling spatially differentiated restraining forces approach and multiobjective optimization. *Computers & Structures* 2010; 88: 625–638.
- [P.15] Di Lorenzo R., **Ingarao G.**, Chinesta F. Integration of gradient based and response surface methods to develop a cascade optimization strategy for y-shaped tube hydroforming process design. *Advances in Engineering Software* 2010; 41:336-348.
- [P.16] **Ingarao G.**, Di Lorenzo R. Design of complex sheet metal forming processes: a new computer aided progressive approach. *International Journal of Material Forming* 2010; 3(1):21-24.
- [P.17] **Ingarao G.**, Di Lorenzo R., Micari F. Analysis of stamping performances of dual phase steels: a multi-objective approach to reduce springback and thinning failure. *Materials & Design*, 2009; 30:4421-4433.
- [P.18] **Ingarao G.**, Di Lorenzo R., Micari F. Internal pressure and counterpunch action design in Y-shaped tube hydroforming processes: a multi objective optimizations approach. *Computers & Structures*, 2009; 87: 591-602.

- [P.19] Di Lorenzo R., **Ingarao G.**, Micari F., Chinesta F. A Pareto optimal design approach for simultaneous control of thinning and springback in stamping processes. *International Journal of Material Forming* 2009; 2(1): 801–804.
- [P.20] Di Lorenzo R., **Ingarao G.**, Chinesta F. A gradient based decomposition approach to optimise pressure path and counter punch action in Y-shaped tube hydroforming operations. *International Journal of Advanced Manufacturing Technology*, 2009; 44:49-60.
- [P.21] Di Lorenzo R., **Ingarao G.**, Gagliardi F., Filice L. Experimental validation of optimization strategies in hydroforming of T-shaped tubes. *International Journal of Material Forming*, 2008; 1: 323-326.
- [P.22] Skjoedt M., Bay N., Endelt B., **Ingarao G.** Multi Stage Strategies for Single Point Incremental Forming of a Cup. *International Journal of Material Forming* 2008; 1: 1199-1202.
- [P.23] Fratini L., **Ingarao G.**, Micari F. On the springback prediction in 3D sheet metal forming processes. *Steel Research International*, 2008; 1: 77-84.
- [P.24] Di Lorenzo R., **Ingarao G.**, Micari F. On the use of artificial intelligence tools for fracture forecast in cold forming operations. *Journal of Material Processing Technology*, 2006; 177: 315-318.

INTERNATIONAL JOURNALS

- [P.25] **Ingarao G.**, Priarone Paolo C., Gagliardi F., Di Lorenzo R. and Settineri L. Environmental comparison between forming and conventional machining processes through a Life Cycle Assessment approach. *Key Engineering Materials*, 2014; 622-623:103-110.
- [P.26] **Ingarao G.**, Kellens K., Behera A. K., Vanhove H., Ambrogio G. and Joost R. Duflou. Electric energy consumption analysis of SPIF processes. *Key Engineering Materials* 2013; 549: 547-554.
- [P.27] **Ingarao G.**, Gagliardi F., Ambrogio G., Di Lorenzo R. An experimental campaign to investigate sustainability issues in Single Point Incremental Forming processes. *Steel Research International*, 2012; 451-454.
- [P.28] Buffa G., Fratini L., **Ingarao G.**, Di Lorenzo R. Arregi B., Penalva M., An Optimization Procedure for the Friction Stir Welding FEM Model of Corner Fillet Joints. *Steel Research International*, 2012; 567-570.
- [P.29] **Ingarao G.**, Marretta L., Di Lorenzo R. A comparison between three meta-modeling optimization approaches to design a tube hydroforming process. *Key Engineering Materials*, 2012; 504-506: 607-612.
- [P.30] **Ingarao G.**, Ambrogio G., Di Lorenzo R., Micari F. On the sustainability evaluation in sheet metal forming processes, *Key Engineering Materials* 2011; 473 :824-829.
- [P.31] Anghinelli O., Ambrogio G., Di Lorenzo R., **Ingarao G.** Environmental Costs of Single Point Incremental Forming. *Steel Research International*, 2011; 525-530.

- [P.32] **Ingarao G.**, Gagliardi F., Anghinelli O., Di Lorenzo R. A sensitivity analysis on environmental sustainability in sheet metal forming. *Steel Research International* 2011; 531-536.
- [P.33] Buffa G., **Ingarao G.**, Fratini L., Micari F. Shape Distortion and Thickness Distribution during SPIF Processes: Experimental and Numerical Analysis. *Key Engineering Materials*, 2011; 473: 913-918.
- [P.34] Di Lorenzo R., **Ingarao G.**, Marretta L., Micari F. Deep drawing process parameter design: a multi objective optimization approach. *Key Engineering Materials*, 2009; 410: 601-608.
- [P.35] Di Lorenzo R., **Ingarao G.**, Micari F. A sensitivity analysis on Artificial Neural Networks fracture predictions in sheet metal forming operations. *Computer Methods in Materials Science*, 2008; 8: 103-110.
- [P.36] Di Lorenzo R., **Ingarao G.**, Micari F. An Intelligent Tool to Predict Fracture in Sheet Metal Forming Operations. *Key Engineering Materials*, 2007; 344: 841-846.
- [P.37] Di Lorenzo R., **Ingarao G.**, Micari F. Optimization strategies to determine process parameters in tube hydroforming. *Computer Methods in Materials Science*, 2007; 7: 337-346.

INTERNATIONAL CONFERENCES PROCEEDINGS

- [P.38] Priarone P. C., **Ingarao G.**, Settineri L., Di Lorenzo R.. On the impact of recycling strategies on energy demand and CO₂ emissions when manufacturing Al-based components. *Procedia CIRP*, 2016; [48](#) : 194–199
- [P.39] Kellens K., Dewulf W., **Ingarao G.**, Duflou J.R.. Energy Efficiency of Sheet Metal Working Processes Where do we stand today? Int. Conference on New Developments in Sheet Metal Forming Stuttgart date:12-14 May 2014.(In German)
- [P.40] Ambrogio G., **Ingarao G.**, Gagliardi F., Di Lorenzo R. Analysis Of Energy Efficiency Of Different Setups Able To Perform Single Point Incremental Forming (SPIF) Processes. *Procedia CIRP*, 204; 15: 111-116.
- [P.41] **Ingarao G.**, Vanhove H., Kellens K., Behera A.K., Micari F., Duflou J.R. Energy consumption analysis of robot based SPIF. 11th Global Conference on Sustainable Manufacturing, GCSM 2013, 136-141, Berlin, Germany.
- [P.42] **Ingarao G.**, Kellens K., Renaldi R., Dewulf W., Duflou J.R. Electrical energy analysis and potential environmental improvements of sheet metal punching processes. *Green Design, Materials and Manufacturing Processes-Proceedings of the 2nd International Conference on Sustainable Intelligent Manufacturing, SIM 2013*; 131-136,Lisbon, Portugal.
- [P.43] **Ingarao G.**, Di Lorenzo R., Micari F. Moving Least Squares Innovative Strategies For Sheet Forming Design. The 14th International ESAFORM Conference on Material Forming AIP Conf. Proc. Belfast 2011; 1353, 59-64

- [P.44] **Ingarao G.**, Di Lorenzo R., Micari F. Energy and Resource efficient Forming Processes. Proc. of 1st International Colloquium of the Cluster of Excellence eniPROD, Chemnitz 2010; 717-745.
- [P.45] **Ingarao G.**, Di Lorenzo R. On the Moving Least Squares (MLS) approximation effectiveness in a T-Shaped tube hydroforming design. Proc. of 10th COMPLAS International Conference, Barcelona 2009.
- [P.46] Di Lorenzo R., **Ingarao G.**, Micari F. Numerical analysis for formability boundaries definition in sheet metal forming operations. Proc. of 7th numisheet International Conference, Interlaken 2008; 285-290.
- [P.47] Borsetto F., Ghiotti A., Bruschi S., **Ingarao G.**, Fratini L. Assessment of dimensional accuracy of cold forged components through accurate modeling of the forming process chain, Proc. of 40th ICFG Plenary Meeting, Padova 2007.
- [P.48] Fratini L., **Ingarao G.**, Micari F. On the springback prediction in industrial air bending sequences. Proc. of the 4th DIES & MOLDS International Conference, Izmir 2007; 57-64.
- [P.49] Fratini L., **ingarao G.**, Micari F., Lo Franco A. On the effectiveness of numerical prediction of elastic springback: an industrial case study. Proc. of International Automotive Body Congress, Berlin 2007; 140-150.
- [P.50] Ambrogio G., Filice L., Fratini L., **ingarao G.**, Manco L. Measuring of geometrical precision of some parts obtained by asymmetric incremental forming process after trimming, Proc. of 9th NUMIFORM Conference, Porto 2007; 431-436.
- [P.51] Fratini L, **ingarao G.**, Micari F, Lo Franco A. Numerical prediction of elastic springback in an automotive complex structural part. Proc. of 9th NUMIFORM, Porto
2007; 425-430.
- [P.52] Di Lorenzo R., **Ingarao G.**, Fonti V. Statistical tools and artificial intelligence approaches to predict fracture in bulk metal forming processes. Proc. of 9th NUMIFORM Conference, Porto 2007; 1249-1254.
- [P.53] Di Lorenzo R., **Ingarao G.**, Micari F. Process parameters calibration in 3D tube hydroforming processes. Proc. of 10th International Esaform Conference on Material Forming; Zaragoza 2007; 411-416.
- [P.54] Di Lorenzo R., **Ingarao G.**, Micari F. On the use of artificial neural networks to predict ductile fracture for different materials. Proc. of Conference on Intelligent Computation in Manufacturing Engineering, Ischia 2006; 55-60.
- [P.55] Di Lorenzo R., **Ingarao G.**, Micari F. A gradient based approach for the design of the shape of the blank in deep drawing of rectangular boxes. Proc. of the IDDRG06 Conference, Porto 2006; 371-378.

[P.56] Di Lorenzo R., **Ingarao G.**, Micari F. Internal pressure and material feeding optimization in tube hydroforming. Proc. of 9th International Esaform Conference on Material Forming, Glasgow 2006; 383-386.

ITALIAN JOURNALS

[P.57] **Ingarao G.**, Di Lorenzo R., Micari F. L'impatto ambientale dei processi di formatura della lamiera. L'Ammonitore n.7, Settembre 2012.

[P.58] **Ingarao G.**, Di Lorenzo R., Micari F. Quanto inquina il settore della lavorazione dei materiali metallici? LAMIERA, Febbraio 2012 (issn:0391-5891)

[P.59] **Ingarao G.**, Di Lorenzo R., Micari F. Nuove tecnologie di lavorazione e lubrificazione. LAMIERA, Marzo 2012 (issn:0391-5891)

[P.60] **Ingarao G.**, Di Lorenzo R., Micari F. Ottimizzazione dell'impatto ambientale nelle lavorazioni di formatura. LAMIERA, Aprile 2012 (issn:0391-5891)

[P.61] **Ingarao G.**, Di Lorenzo R., Micari F. Prevedere della frattura duttile nello stampaggio a freddo. LAMIERA 2010 (issn:0391-5891)

[P.62] Fratini L., **Ingarao G.**, Micari F., Lo Franco A. Ritorno elastico in processi di formatura della lamiera. LAMIERA, Agosto 2007 (issn:0391-5891)

[P.63] Fratini L., **Ingarao G.**, Micari F. Processi di formatura di lamiere in acciaio alto resistenziale: la temperatura come parametro di processo, LAMIERA, Agosto 2006 (issn:0391-5891)

[P.64] Fratini L., **Ingarao G.**, Micari F. Materiali innovativi nella lavorazione di formatura delle lamiere nel settore automobilistico. LAMIERA Gennaio 2006 (issn:0391-5891)

ITALIAN CONFERENCES PROCEEDINGS

[P.65] **Ingarao G.**, Priarone Paolo C., Gagliardi F., Di Lorenzo R. and Settineri L. A methodology for the environmental comparison of metal shaping technologies: an in-depth analysis on recycling related issues. Paper accepted for 12th A.I.Te.M. Conference, Palermo 2015.

[P.66] Ambrogio G, Di Lorenzo R , Filice L, Gagliardi F, **Ingarao G.** Single point incremental forming :analysis of the sustainability of the process through an experimental approach. Proc. of the 11th A.I.Te.M. Conference, Pescara, September 2013.

[P.67] Certa A, **Ingarao G.**, Di Lorenzo R, Galante G. Tecniche di ottimizzazione multi-obiettivo e metodologie di supporto alle decisioni per la progettazione di processi di stampaggio di lamiere. Atti del Primo Congresso del Coordinamento della Meccanica Palermo, 2010.

[P.68] **Ingarao G.** A multi-objective Pareto design approach for simultaneous control of thinning

and springback in complex stamping operations. Proc. of the 9th A.I.Te.M. Conference ,Torino, 2009.

[P.69] **Ingarao G.**, Di Lorenzo R., Fracture Prediction in sheet metal forming operations: an artificial neural networks based approach. Proc. of the 8th A.I.Te.M. Conference. Montecatini, 2007.

[P.70] Di Lorenzo R., Corona V., **Ingarao G.**, Micari F. Optimisation of a tube hydroforming process by gradient techniques. Proc. of the 7th A.I.Te.M. Conference, Lecce, 2005.

ATTIVITA' SCIENTIFICHE

Over the last years Giuseppe Ingarao has been developing research in the domain of sustainable manufacturing. Specifically, he dealt with the following topics: sheet metal forming environmental assessment-design of energy and resource efficient metal shaping processes-methods and techniques for Life Cycle Assessment of metal based component-Life Cycle Inventory techniques for manufacturing approaches comparison.

Besides the environmental analysis of manufacturing processes,, he has worked also on forming design methodologies developing some innovative design methods by utilizing FEM (implicit and explicit codes) and optimization techniques (gradient based and response surface methods; robust design and stochastic simulations; multi-objective optimization and AI tools). Different metal forming processes have been analyzed: stamping, bending, hydroforming, incremental forming, forging and sheet blanking. Manufacturing processes were applied to both non ferrous light-alloys (Mg and Al alloys) and to advanced high strength steels. The developed research aimed at finding the best process parameters configuration for metal forming process design minimizing the computational/experimental effort.

AMBITI DI RICERCA

Over the last years Giuseppe Ingarao has been developing research in the domain of sustainable manufacturing. Specifically, he dealt with the following topics: sheet metal forming environmental assessment-design of energy and resource efficient metal shaping processes-methods and techniques for Life Cycle Assessment of metal based component-Life Cycle Inventory techniques for manufacturing approaches comparison.

Besides the environmental analysis of manufacturing processes,, he has worked also on forming design methodologies developing some innovative design methods by utilizing FEM (implicit and explicit codes) and optimization techniques (gradient based and response surface methods; robust design and stochastic simulations; multi-objective optimization and AI tools). Different metal forming processes have been analyzed: stamping, bending, hydroforming, incremental forming, forging and sheet blanking. Manufacturing processes were applied to both non ferrous light-alloys (Mg and Al alloys) and to advanced high strength steels. The developed research aimed at finding the best process parameters configuration for metal forming process design minimizing the computational/experimental effort.