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Andrea Montalti

Nationality: Italian **Date of birth:** 12/12/1997 **Gender:** Male

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ABOUT ME

I have consistently demonstrated a strong interest in mechanics, driven by a curiosity to explore the inner workings of the objects that surround us. I am particularly intrigued by emerging technologies, such as 3D printing, which I believe will play a pivotal role in shaping the future.

EDUCATION AND TRAINING

PhD. Automotive for Intelligent Mobility

University of Bologna [01/11/2023 – Current]

City: Bologna | **Country:** Italy | **Website:** https://www.unibo.it/en/study/phd-professional-masters-specialisation-schools-and-other-programmes/phd/2024-2025/automotive-engineering-for-intelligent-mobility-1 | **Field(s) of study:** Engineering, manufacturing and construction | **Level in EQF:** EQF level 8 | **NQF Level:** NQF - 8 | **Thesis:** Hybrid 3D printing for automotive applications

Master Degree in Mechanical Engineer

University of Bologna [01/09/2020 – 03/02/2023]

City: Bologna | **Country:** Italy | **Website:** https://corsi.unibo.it/magistrale/IngegneriaMeccanica-Bologna | **Field(s) of study:** Engineering, manufacturing and construction | **Final grade:** 105/110 | **Level in EQF:** EQF level 7 | **NQF Level:** NQF - 7 | **Thesis:** Resin-based 3D printing systems based on the deposition principle

Bachelor Degree in Mechanical engineer

University of Bologna [01/09/2017 – 09/10/2020]

City: Bologna | **Country:** Italy | **Website:** https://corsi.unibo.it/laurea/IngegneriaMeccanica-Bologna | **Level in EQF:** EQF level 6

Technical Education in Mechanical and Mechatronics Engineering

Higher Education Institute Belluzzi – Fioravanti (BO) [2012 – 2017]

City: Bologna | **Country:** Italy | **Website:** https://belluzzifioravanti.edu.it/ | **Level in EQF:** EQF level 5

WORK EXPERIENCE

Research grant

University of Bologna [06/2023 – 10/2023]

City: Bologna | **Country:** Italy

Title: *Hybrid 3D printing for industrial applications*

Mechanical Designer

Tinarelli srl [10/2022 – 03/2023]

City: Bologna | **Country:** Italy

- Mechanical components design
- 3D modeling and CAD design

3D printing technician

[2017 – 2024]

City: Bologna | **Country:** Italy

- CAD design
- 3D printing components (FDM technology)

DIGITAL SKILLS

Shining 3D scanner / Faro 3D scanner / Revo 3D scanner / Electron microscope

Software

PTC Creo / Matlab / Geomagic Control X / Geomagic Design X / AutoCAD / Abaqus / SolidWorks / 3D printing slicer in general / Materialise Magics / Microsoft Office

Programming language

G-code / C / Python

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING B2 **READING** B2 **WRITING** B2

SPOKEN PRODUCTION B2 **SPOKEN INTERACTION** B2

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

ORGANISATIONAL SKILLS

Personal Skills

Autonomy: 8/10

Stress Management: 9/10

Teamwork: 8/10

Organization: 10/10

Flexibility / Adaptability: 8/10

Problem solving: 9/10

Precision: 9/10

HOBBIES AND INTERESTS

Finswimming
Competitive finswimmer at national and international level

Handicrafts

- repairing objects to extend their lifespan;
- recycling components for other projects;
- creating customized items using various materials.

3D print and paint miniatures

DRIVING LICENCE

Driving Licence: A

Driving Licence: B

PUBLICATIONS

[2025]
3D-printed motorcycle seats: Replicating polymer foam performance for rapid prototyping and rider comfort
The development of prototypes prior to the market launch of final products requires adapting production components to reduce costs and increase flexibility for potential modifications. While the manufacturing of rigid or structural components is well-established and widely practiced, the production of expanded materials presents significantly greater challenges due to the final product's reliance on the specific process employed. Changing the process to lower costs necessitates reproducing the same mechanical behaviour and appearance to ensure validation in terms of both style and function. This study focuses on replicating the behaviour of expanded polyurethane foam, commonly used in motorcycle seat padding, using thermoplastic polyurethane (TPU). The aim is to create a prototype or a customised version of the foam. The internal stochastic closed-cell structure is designed using slicing software, and test specimens are subsequently fabricated through Material Extrusion (MEX) additive manufacturing and subjected to compression testing. The results emphasise the critical influence of material hardness and infill density on the force-displacement curves. An experimental map, derived from three parameters (material hardness, elastic modulus, and foam density) illustrates the behaviour of the specimens, with iso-lines representing constant density. This map serves as a valuable tool for accurately replicating desired foam properties, providing guidance on material selection based on force-displacement characteristics

Andrea Montalti, Patrich Ferretti, Fiammetta Spano, Alfredo Liverani - Advances in Industrial and Manufacturing Engineering

[2025]
Thermal simulation for enhanced control in innovative ironing processes on 3D-printed components
This study investigates an innovative surface finishing process for 3D-printed components using Material Extrusion (MEX). By applying controlled heating to the outer layer with a heated, semi-spherical tip, surface quality can be enhanced without adding material, effectively reducing imperfections caused by nozzle deposition. Using a prototype tool with distinct thermal properties, simulations were conducted to assess the optimal process parameters,

including tool temperature, movement speed, and depth of influence within the material. Thermal simulations of the tool were performed to analyse temperature distribution and efficiency, identifying potential heat losses. Additionally, interactions between the tool tip and the material were simulated, highlighting temperature distribution at various depths. The simulations reliably model the tool's performance, providing a solid foundation for precise process parameter calibration while minimising reliance on experimental testing. Analyses conducted on PLA, PETG, ABS, PEEK, and PEKK demonstrated a clear correlation between speed and temperature in achieving optimal results. For materials with a high glass transition temperature, either a lower speed or a higher tool temperature is required, depending on the material's thermal properties.

Andrea Montalti, Alessandro Ghini, Gian Maria Santi, Alfredo Liverani - International Journal of Thermofluids

[2025]

Enhancing ergonomic comfort: A study on customized cushion design using 3D scanning and additive manufacturing

This paper presents a method for designing a customized ergonomic office chair backrest aimed at improving user posture and long-term health. Given the importance of ergonomics in workplace settings, this study leverages 3D scanning and additive manufacturing to create personalized cushions that conform precisely to individual anatomical shapes, aligning with ergonomic standards. The process begins with high-resolution scans of both the user's back and a standard chair backrest, followed by cushion modeling in Blender to ensure exact fit and support. Additive manufacturing was selected for cushion fabrication, using a TPU material with an optimized internal structure to enhance comfort. Results indicate a notable improvement in posture alignment and comfort, verified through comparative scans before and after customization. The custom backrest also encourages proper posture through a postural retraining effect and provides a high level of hygiene due to its non-porous material. While this customization method is best suited for individual users rather than shared work environments, it offers a viable, cost-effective solution for ergonomic enhancements in office seating.

Curzio Pagliari, Andrea Montalti, Leonardo Frizziero, Alfredo Liverani - Results in Engineering

[2024]

Enhancing surface roughness of material extrusion additive manufacturing components via an innovative ironing process

Abstract: Extrusion-based 3D printing is widely used in various industries, enabling the rapid creation of prototypes and functional parts at a lower cost compared to traditional technologies. However, one limitation of this technology is the surface finish of the components, where the roughness is not optimal. This paper presents a solution to improve the surface finish of components by leveraging the principles of ironing and ball burnishing. The tool, appropriately heated and passed over the component, smooths out imperfections by uniforming the surface profile. Unlike the traditional ironing method, the use of this tool reduces processing times and enhances surface roughness with a simpler construction and control mechanism compared to a conventional hot-end. The average surface roughness obtained is Ra = 0.796 µm; these values are comparable to those obtained by grinding. The geometry of the tool tips can vary significantly based on specific applications.

Montalti, A., Galiè, G., Pignatelli, E., & Liverani, A. (2024), Virtual and Physical Prototyping

[2024]

A Cost-Effective Approach for Quality Control in PLA-Based Material Extrusion 3D Printing Using 3D Scanning

Abstract: In this article, our aim is to underscore the importance of verifying that components produced through material extrusion additive manufacturing exhibit geometric and dimensional conformity with the STL (Standard Tessellation Language) model. Currently, the business world is heavily investing in additive technologies, but it is crucial to obtain feedback on the accuracy of the printed component without excessive economic expenditure. For this reason, we have opted to utilize a mid-range 3D scanner (Revopoint Mini with an accuracy of 0.02 mm) to investigate any disparities in print results using PLA material. Each model has been scanned and compared with the initial mesh to qualitatively and quantitatively assess the present errors. The analysis has revealed that the majority

of features can be effectively controlled, while the remaining ones either fall within the tool's precision or necessitate a higher-quality scan. Particularly in the analysed case, flat surfaces, profiles of complex geometries, and holes have demonstrated dimensional and geometric controllability. However, details of reduced dimensions or those difficult to reach by the scanner do not allow for adequate comparison due to excessive standard deviation in the error. The analysed layer heights do not exhibit a significant impact on component accuracy.

Andrea Montalti, Patrich Ferretti, Gian Maria Santi - Journal of Industrial Information Integration

[2023]

Design and development of a peristaltic pump for constant flow applications

Abstract: In wide-ranging areas, including hydraulics, biomedical, automotive, and aerospace, there is often a need to move a fluid with a constant flow rate. This is difficult to achieve with any type of pump and usually other elements are inserted to regularize the output. This study focused on the peristaltic pump because there are few studies on it and it has some interesting features, such as extreme simplicity, a small number of components, and the extreme compactness of the whole system. The first part of this study is focused on analyzing the classical geometry of the peristaltic pump to understand the origin of the discontinuity in the flow rate; the second part proposes a new geometry that mitigates the flow irregularity by more than 200%. In this way, it is possible to use it in all the sectors where a constant flow rate is required but where insulation between the fluid and the machine is required. Together with the flow study, an analysis of how the main geometric parameters affect the operation of the pump is provided, complete with explanatory graphs and tables. A prototype made through additive manufacturing technologies is also proposed.

P. Ferretti, C. Pagliari, A. Montalti, A. Liverani

[2023]

FDM Technology: Overhangs versus Layer Height Printability Performance Correlation

Abstract: FDM (Fused Deposition Modelling) is the most popular 3D printing technology worldwide due to its simplicity and low costs. One of the key points of FDM is the need for supporting material to realize the overhanging features. In general, however, both in the case of printing supports with the same material as the part and in the case of printing with soluble supports, there is a high waste of material and a significant increase in the printing time to get the finished part.
One of the fundamental parameters for generating supports within the slicer software is the so-called “support overhang angle”, which consists of the maximum achievable angle beyond which the slicer generates supports. The other key parameter in FDM printing is the “layer height”, which directly determines both the quality of the final part, its strength, and the printing time itself.
This paper will therefore attempt to investigate the relationship present between “layer height” and “support overhang angle”, bringing some examples of how with proper layer height one can significantly reduce support generation, wasted material and in some cases also printing time.

Giampiero Donnici, P. Ferretti, A. Montalti, D. Francia & Alfredo Liverani

[2024]

From CAD to G-code: Strategies to minimizing errors in 3D printing process

Abstract: In this study, an analysis was conducted to quantify errors in the additive manufacturing process, with a focus on comparing data files. The primary objective was to minimise the reliance on physical testing of produced components by favouring verification within a virtual environment. The initial focus was on the conversion from the CAD (Computer-Aided Design) model to the STL (Standard Tessellation Language) file, where discrepancies between the two formats were identified. To achieve optimal meshing, it is crucial to configure conversion parameters effectively, avoiding both detail loss and the handling of excessively large files. Following this, a comparison between STL files and reconstructed G-code files was conducted, uncovering further approximations introduced by the most commonly used slicers. In conclusion, the analysis highlights that both the quality of the mesh and the slicing phase

significantly impact the final component. Understanding these factors is essential for achieving an optimal print outcome.

A. Montalti, P. Ferretti, G. Santi - CIRP Journal of Manufacturing Science and Technology

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Bologna, 31/03/2025

Andrea Montalti