Luca Colombo, PhD

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SUMMARY

Doctor of Philosophy (PhD) in the field of Micro Electro-Mechanical Systems (MEMS) with a focus on Radio Frequency (RF) piezoelectric MEMS for ultra-low-power and high-sensitivity Wake-Up Radio Receivers (WuRx) for Internet of Things (IoT) and 5G applications.

EDUCATION

Carnegie Mellon University — Pittsburgh, PA
PhD in Electrical Engineering, GPA 3.96 — Sep 2019
Dissertation: "High Performance Lithium Niobate Resonators for Passive Voltage Amplification in Radio Frequency Applications"
Advisor: Prof. Gianluca Piazza (Carnegie Mellon University)

Politecnico di Milano — Milan, Italy
MSc in Mechanical Engineering, GPA 4.0, Summa Cum Laude — May 2015
Dissertation: "Identification of the Main Factors Affecting Micromilling Accuracy and Development of Industry-oriented Procedures to Reduce their Effects"
Advisors: Prof. Massimiliano Annoni (Politecnico di Milano)
Supervisor: Prof. Burak Ozdoganlar (Carnegie Mellon University)

Politecnico di Milano — Milan, Italy
BSc in Mechanical Engineering, GPA 3.3 — Feb 2013

EXPERIENCE

Northeastern University — Nov 2019 – Now
Postdoctoral Research Associate — Boston, MA

- Demonstration of ultra-low-power receivers for novel Internet of Things (IoT) applications in collaboration with InterDigital
- Development of Lithium Niobate (LN) based voltage-boosted pMUTs for intrabody and underwater communication
- In-house fabrication and characterization of novel Scandium Aluminum Nitride thin films for Radio Frequency (RF) applications

Carnegie Mellon University — Oct 2015 – Sep 2019
PhD Student in Electrical and Computer Engineering — Pittsburgh, PA

- Analytical and numerical optimization for the dimensioning of an innovative Resonant Micromechanical Receiver (RMR) in the framework of the Defense Advanced Research Project Agency (DARPA) N-ZERO program
- Analytical and numerical optimization of MEMS-based matching networks for passive voltage amplification in innovative WuRx architectures
- Experimental investigation of 20% Scandium-doped Aluminum Nitride (AlN) Lamb Wave Resonators for filtering applications in collaboration with Intel
- COMSOL® Multiphysics FEA modeling, design, fabrication and experimental investigation in atmosphere, vacuum and cryogenic conditions of piezoelectric MEMS Laterally Vibrating Resonators (LVRs) made of X and Y cut Lithium Niobate (LN) for IoT applications
- Demonstration of LN MEMS resonators with record-breaking Figure of Merits (FoMs) compared to the state-of-the-art and investigation of the main factors limiting their performance
- Developing of fabrication process for the machining of LN and Scandium-doped AlN thin films

Carnegie Mellon University — Nov 2014 – Mar 2015
Visiting Student in Mechanical Engineering — Pittsburgh, PA

- Micromachining of hardened stainless-steel (AISI 420C) molds for biomedical applications
- Microscopy and quality inspection of machined surfaces for process optimization

Politecnico di Milano — Sep 2012 – Apr 2015
Master Student in Mechanical Engineering — Milan, Italy

- Analytical and FEA simulation, design and machining of a self-centering extrusion head in hardened stainless steel for the making of biomedical devices, in collaboration with Enki Srl (Concesio, Italy) in the framework of the Muprod European Project
- Identification and characterization of the main factors affecting geometrical and dimensional accuracy in micromilling processes

- Developing of an industry-oriented Ishikawa diagram for the machining of sub-μm features on a wide range of materials
- Writing of technical reports for Sandvik Coromant, Mikron Tools, and Uddeholm
- Micromachining of ultra-precise benchmark samples for the Collège International pour la Recherche en Productique (CIRP, Paris, France)
- Analytical and FEA simulation and design of an high speed fan for vineyards treatment in collaboration with Caffini SpA (Palù, Italy)

TECHNICAL SKILLS

Research and Development
Analytical and numerical modeling, optimization, design, layout, tape-out, fabrication, testing and characterization of piezoelectric RF MEMS for IoT and 5G applications; design of experiment (DOE) and data analysis; fabrication processes development and characterization

Simulation, Design and Data Analysis Tools
COMSOL Multiphysics, Abaqus, Keysight ADS, LTSpice, MATLAB, CADENCE, K-Layout, Eagle PCB, SolidWorks, SolidEdge, Inventor, and MiniTab

Programming
C++, MATLAB, CADENCE Skill Code, and HTML

Languages
- Fluent/native in English and Italian
- Basic knowledge of Spanish

PUBLICATIONS

1. Abhay Kochhar, Mary E. Galanko, Mazen Soliman, Hoda Abdelsalam, **Luca Colombo**, Yi-Chung Lin, Gabriel Vidal-Álvarez, Tamal Mukherjee, Jeffrey Weldon, Jeyanandh Paramesh, Gary K. Fedder, and Gianluca Piazza, "Resonant Microelectromechanical Receiver", *Journal of Microelectromechanical Systems,* Vol. 28, pp. 327-343, 2019
2. **Luca Colombo**, Abhay Kochhar, Gabriel Vidal-Álvarez, and Gianluca Piazza, "X-Cut Lithium Niobate Series-Parallel Resonator Configuration Boosts Passive Voltage Amplification for Wake-Up Receivers to 46 V/V", *2019 IEEE Microelectromechanical Systems (MEMS)*, pp. 1-3, Seoul (South Korea), January 2019
3. **Luca Colombo**, Abhay Kochhar, Gabriel Vidal-Álvarez, and Gianluca Piazza, "Investigations on the Quality Factor of Lithium Niobate Laterally Vibrating Resonators with Figure of Merit Greater than 1,500", *2018 International Ultrasonic Symposium (IUS)*, pp. 1-3, Kobe (Japan), October 2018
4. **Luca Colombo**, Abhay Kochhar, Gabriel Vidal-Álvarez, and Gianluca Piazza, "X-Cut Lithium Niobate Laterally Vibrating Resonator With Figure of Merit of 1560", *Journal of Microelectromechanical Systems,* Vol. 27, pp. 602-604, 2018
5. **Luca Colombo**, Abhay Kochhar, Gabriel Vidal-Álvarez, Zachary Schaffer, Pietro Simeoni, and Gianluca Piazza, "Comparison between diferent MEMS Laterally Vibrating Resonator Technologies for Passive Voltage Amplification in an RF Front-End System", *2018 IEEE MTT-S International Microwave Workshop Series on Advanced Materials and Processes for RF and THz Applications (IMWS-AMP)*, pp. 1-4, Ann Arbor (Michigan, USA), July 2018
6. Zachary Schaffer, **Luca Colombo**, Abhay Kochhar, Gianluca Piazza, Sergey Mishin, and Yury Oshmyansky, "Experimental Investigation of Damping Factors in 20% Scandium-doped Aluminum Nitride Laterally Vibrating Resonators", *2018 IEEE Microelectromechanical Systems (MEMS)*, pp. 1-4, Belfast (United Kingdom), January 2018
7. Abhay Kochhar, Gabriel Vidal-Álvarez, **Luca Colombo**, and Gianluca Piazza, "Top Electrode Shaping for Harnessing High Coupling in Thickness Shear Mode Resonators in Y-cut Lithium Niobate Thin Films", *2018 IEEE Microelectromechanical Systems (MEMS)*, pp. 1-4, Belfast (United Kingdom), January 2018
8. **Luca Colombo**, Mary E. Galanko, Hoda Abdelsalam, Abhay Kochhar, Gabriel Vidal-Álvarez, Tamal Mukherjee, Jeyanandh Paramesh, Jeffrey Weldon, Gary K. Fedder, and Gianluca Piazza, "Ultra-low-power and High Sensitivity Resonant Micromechanical Receiver", *2017 IEEE Sensors,* pp. 1-3, Glasgow (United Kingdom), October 2017
9. **Luca Colombo**, Abhay Kochhar, Changting Xu, Gianluca Piazza, Sergey Mishin, and Yury Oshmyansky, "Investigation of 20% Scandium-doped Aluminum Nitride Films for MEMS Laterally Vibrating Resonators", *2017 IEEE International Ultrasonic Symposium (IUS)*, pp. 1-4, Washington D.C. (United States), September 2017

10. Abhay Kochhar, Gabriel Vidal-Álvarez, **Luca Colombo**, and Gianluca Piazza, “High Coupling Two-Port Lithium Niobate MEMS Resonators Using Capacitive Ground Concept”, *2017 IEEE International Ultrasonic Symposium (IUS)*, pp. 1-4, Washington D.C. (United States), September 2017
11. Abhay Kochhar, Gabriel Vidal-Álvarez, **Luca Colombo**, and Gianluca Piazza, “Integration of Bottom Electrode in Y-cut Lithium Niobate Thin Films for High Electromechanical Coupling and High Capacitance per Unit Area MEMS Resonators”, *2017 IEEE Microelectromechiancal Systems (MEMS)*, pp. 1-4, Las Vegas (United States), January 2017
12. Alessandro Banfi, **Luca Colombo**, Francesco Cacciatore, Lara Rebaioli, and Massimiliano Annoni, “Improvements of Procedures for High Accuracy Micromilling of Flat Surfaces”, *4M/ICOMM2015 Conference*, pp. 145-148, Milan (Italy), 2015

Publications updates on Google Scholar: https://scholar.google.com/citations?user=9VpcNMUAAAAJ&hl=en