



Emiliano Votta

Associate Professore, Politecnico di Milano

ORCID: <https://orcid.org/0000-0001-7115-0151>

Address Politecnico di Milano, DEIB, Via Ponzio, 34/5, 20133 Milano (MI), Italy
Phone +39-0223993461
e-mail emiliano.votta@polimi.it
website www.biomech.polimi.it/people?id=43:votta&catid=34:bios

My Profile in a Nutshell

I have been an Associate Professor at Politecnico di Milano, in the Department of Electronics, Information and Bioengineering, since 2016, and have been developing research since 2001. I am a member of the Biomechanics Research Group (www.biomech.polimi.it) since 2005.

My main research interest is cardiovascular biomechanics, with a particular focus on heart valve biomechanics. Over the years, I hybridized my background in continuum mechanics and finite element modeling with competences in clinical imaging and image processing to develop image-based approaches to the quantification of heart valve, ventricular, and arterial biomechanics. The relevance of clinical imaging in my activities has been continuously increasing: most recently, I have been working on the in vivo quantification of cardiovascular biomechanics directly through the processing of imaging data, thus bypassing the need for numerical simulations. In this context, my main areas of academic focus include quantification of ventricular endocardial strains based on 3D ultrasound, and of intracardiac and vascular fluid-dynamics based on time-resolved three-dimensional phase contrast magnetic resonance (i.e., 4D flow CMR) imaging. These activities have always been driven by a strong translational spin - the ultimate goal being to develop tools to improve understanding of pathological mechanisms, and to support clinical decision making as well as the design of new devices and surgical techniques. Driven by this motivation, I helped developing the 3D and Computer Simulation Laboratory, which I currently coordinate; the laboratory, located in the premises of a hospital (IRCCS Policlinico San Donato), develops cutting-edge engineering approaches thanks to tight interaction between clinicians and engineers. I have published ~70 ISI journal papers (H-index 24, 1982 citations, source: Scopus).

Education

- May 2006 - PhD in Biomedical Engineering cum laude at Politecnico di Milano, Milano, Italy
- Nov. 2004-March 2005 and Nov. 2005-March 2006 - Visiting researcher at the Institute for Complex Engineered Systems (I.C.E.S.), Carnegie Mellon University, Pittsburgh, Pennsylvania, USA.
- April 2001 - Master of Science in Biomedical Engineering at Politecnico di Milano, Milano, Italy.

Current Position, Affiliations, Appointments, Memberships

Current Affiliations and Positions

- Politecnico di Milano, Department of Electronics, Informatics and Bioengineering, Milano, Italy, as Associate Professor
- IRCCS Policlinico San Donato, San Donato Milanese, Milano, Italy, as head of the [3D and Computer Simulation Laboratory](#)

Appointments

- Since 2017 - Coordinator of the International Exchange Programmes for the Biomedical Engineering Bachelor and Master tracks at Politecnico di Milano
- Since 2017 - Responsible for study transfers from other faculties or universities to the Biomedical Engineering Bachelor track at Politecnico di Milano

Memberships

- ESC Working Group on e-Cardiology
- ESB, European Society of Biomechanics
- GNB, Gruppo Nazionale di Bioingegneria

Teaching Activity

Current Courses as Professor at Politecnico di Milano

- Corso Progetto: Biomeccanica e Biomacchine (5 CFU), Biomedical Engineering Bachelor track
- Computational Biomechanics Laboratory (5 CFU), Biomedical Engineering Masters track
- Advanced Modeling Approaches for Cardiovascular Surgery [I.C.] (5 CFU), Biomedical Engineering Masters track

Activity as thesis supervisor or co-supervisor

- 8 PhD theses
- 60+ Master Theses
- 10+ Bachelor Theses

Research Activity

Participation to Funded Research Projects (last ten years)

- **2021-now EU Project** – Horizon2020; Project Title: “ARTERY: ARTERY” – Role: principal investigator and coordinator of the project, <https://www.artery-project.eu/>
- **2019-now Italian Project** – **Fondazione Cariplo and Regione Lombardia**; Project Title: SILKELASTOGRAFT - A novel compliance-matching silk fibroin/polyurethane graft for in situ vascular tissue engineering - Role: Collaborator
- **2015-2019 EU Project** – **Horizon2020**; Project Title: “MUSICARE: MultiSectoral Integrative approaches to Cardiac care” - Role: Collaborator
- **2015-2019 EU Project** – **Horizon2020**, Marie Skłodowska-Curie Research and Innovation Staff Exchange Programme; Project Title: “AMMODIT: Approximation Methods for Molecular Modelling and Diagnosis Tools” - Role: Collaborator
- **2012-2016 EU Project** - **2011 IRSES, PEOPLE EU 7th Framework Programme**; Project Title: “EUMLS: EU-Ukrainian Mathematicians for Life Sciences” - Role: Collaborator
- **2012-2015 Italian Project** – **Italian Health Ministry Programme 2009**; Project Title: “Multidisciplinary translational biomedics approach to bicuspid aortic valve-related aortopathy for the development of new clinical diagnostic and prognostic tools” - Role: Collaborator

Current Collaborations with Italian Partners

- IRCCS Policlinico San Donato, San Donato Milanese, Italy
- Cardiac Surgery Division of San Raffaele Hospital IRCCS, Milano, Italy
- Department of Cardiothoracic and Respiratory Sciences, Second University of Naples, Napoli, Italy
- Luigi Sacco Hospital, Milano, Italy

Current Collaborations with International Partners

- Department of Electrical and Computer Engineering - Biomedical Engineering at Aarhus University, Aarhus, Denmark
- Leiden University Medical Centre, Leiden, Netherlands
- Weill Cornell Medical College, Cornell University, New York, NY, USA
- SIMULIA, Dassault Systèmes, Johnston Rhode Island, US

Publication Activity

Main Figures

- **1982** Citations, h-index **24** (Source: [Scopus](#))
- **5** Full papers under review in international peer reviewed journals
- **70+** Full papers accepted or published in international peer reviewed journals
- **5** Chapters in international books

- 3 Chapters in Italian books
- 3 Short Communications on International Peer Reviewed Journals
- 78 Contributions to international conferences
- 9 Contributions to Italian conferences

Selected Publications by Topic (last five years)

Fluid-structure interaction modelling for cardiovascular biomechanics

- Pozzi S, Domanin M, Forzenigo L, Votta E, Zunino P, Redaelli A, Vergara C. A surrogate model for plaque modeling in carotids based on Robin conditions calibrated by cine MRI data. *Int J Numer Method Biomed Eng.* 2021 May;37(5):e3447.
- Meskin M, Dimasi A, Votta E, Jaworek M, Fusini L, Muratori M, Montorsi P, Zappa E, Epifani I, Pepi M, Redaelli A. A novel multiparametric score for the detection and grading of prosthetic mitral valve obstruction in cases with different disc motion abnormalities. *Ultrasound Med Biol.* 2019 Jul;45(7):1708-1720.

4DFlow-based quantification of in vivo blood fluid dynamics

- Riva A, Sturla F, Pica S, Camporeale A, Tondi L, Saitta S, Caimi A, Giese D, Palladini G, Milani P, Castelvechchio S, Menicanti L, Redaelli A, Lombardi M, Votta E. Comparison of Four-Dimensional Magnetic Resonance Imaging Analysis of Left Ventricular Fluid Dynamics and Energetics in Ischemic and Restrictive Cardiomyopathies. *J Magn Reson Imaging.* 2022 Jan 24. doi: 10.1002/jmri.28076. Online ahead of print.
- Saitta S, Pirola S, Piatti F, Votta E, Lucherini F, Pluchinotta F, Carminati M, Lombardi M, Geppert C, Cuomo F, Figueroa CA, Xu XY, Redaelli A. Evaluation of 4D flow MRI-based non-invasive pressure assessment in aortic coarctations. *J Biomech.* 2019 Sep 20;94:13-21.
- Gaudino M, Piatti F, Lau C, Sturla F, Weinsaft JW, Weltert L, Votta E, Galea N, Chirichilli I, Di Franco A, Francone M, Catalano C, Redaelli A, Girardi LN, De Paulis R. Aortic flow after valve sparing root replacement with or without neosinuses reconstruction. *J Thorac Cardiovasc Surg.* 2018 Jul 27. pii: S0022-5223(18)32026-9.
- Piatti F, Pirola S, Bissell M, Nesteruk I, Sturla F, Della Corte A, Redaelli A, Votta E. Towards the improved quantification of in vivo abnormal wall shear stresses in BAV-affected patients from 4D-flow imaging: benchmarking and application to real data. *J Biomech.* 2017 Jan 4;50:93-101.

Ultrasound-based quantification of ventricular function

- Castelvechchio S, Frigelli M, Sturla F, Milani V, Pappalardo OA, Citarella M, Toso A, Menicanti L, Votta E. Elucidating the mechanisms underlying left ventricular function recovery in ischemic heart failure patients undergoing surgical remodelling: a 3D ultrasound analysis. *Journal of Thoracic and Cardiovascular Surgery,* 2021.
- Pappone C, Mecarocci V, Manguso F, Ciconte G, Vicedomini G, Sturla F, Votta E, Mazza B, Pozzi P, Borrelli V, Anastasia L, Micaglio E, Locati E, Monasky M, Lombardi M, Calovic Z, Santinelli V. New Electro-Mechanical Substrate Abnormalities in High-Risk Patients with Brugada Syndrome. *Heart Rhythm.* 2020 Apr;17(4):637-645.

Patient-specific finite element modeling modeling

- Caimi A, Pasquali M, Sturla F, Pluchinotta FR, Giugno L, Carminati M, Redaelli A, Votta E. Prediction of post-stenting biomechanics in coarcted aortas: A pilot finite element study. *J Biomech.* 2020 May 22;105:109796. doi: 10.1016/j.jbiomech.2020.109796.
- Pappalardo OA, Sturla F, Onorati F, Puppini G, Selmi M, Luciani G, Faggian G, Redaelli A, Votta E. Mass-spring models for the simulation of mitral valve function: looking for a trade-off between reliability and time-efficiency. *Med Eng & Phys.* 2017 Sep;47:93-104.
- Sturla F, Vismara R, Jaworek M, Votta E, Romitelli P, Pappalardo OA, Lucherini F, Antona C, Fiore GB, Redaelli A. In vitro and in silico approaches to quantify the effects of the Mitraclip® system on mitral valve function. *J Biomech.* 2017 Jan 4;50:83-92.
- Votta E, Presicce M, Della Corte A, Dellegrottaglie S, Bancone C, Sturla F, Redaelli A. A novel approach to the quantification of aortic root in vivo structural mechanics. *Int J Numer Meth Biomed Eng.* 2017 Sep;33(9).

Activity as Reviewer

- Reviewer for 15+ international peer reviewed scientific journals

Technology transfer

Collaborations with Industries

- Tecnomare SpA (Gruppo Eni, Italy) – numerical simulations for the design of a novel probe for soil analysis
- Sorin Group (Italy) – development of modelling tools for the design and optimization of mitral annuloplasty devices
- CID (Carbostent & Implantable Devices) – numerical simulation of in vitro tests on coronary stents
- Edwards Lifesciences (USA) – mitral valve numerical modelling
- CUBE Srl (Italy) – analysis of mitral annulus local tensions for the development of a novel annuloplasty device
- Valtech Cardio Ltd (Israel) - numerical simulations for the refinement of the Cardioband Annuloplasty System for percutaneous annuloplasty procedures
- Epygon sas (France/Italy) – numerical simulations to develop of a novel trans-catheter prosthetic mitral valve

Role in companies

- Since 2019, co-founder and scientific advisor of [Artiness srl](#), an innovative start-up company located in Milan (Italy) and devoted to the development of holographic technologies to support the planning and the execution of percutaneous procedures, as well as to support highly specialized medical education and procedural training.

Honors and Awards

Awards for authored or co-authored manuscripts

- **2017** – CVET Most Cited Article Award by Cardiovascular Engineering and Technology
- **2017** – included in the Lab on a Chip 2016 Most Downloaded Articles as one of the top 25 most downloaded articles published in the journal in 2016.
- **2016** - Elsevier Highly Cited Research Certificate

Awards for authored or co-authored contributions at international conferences

- **2019** - EMEA & Global Winner of the Mimics® Innovation Award, 30th ESB Conference.
- **2018** - ESB Student Award for three different contributions, 8th World Congress of Biomechanics
- **2018** – judged in the top 5% of submitted abstracts at the AATS Aortic Symposium.
- **2016** - ESB Travel Award, 22nd International Congress of the ESB
- **2015** - semi-finalist for the Rosanna Degani Young Investigators' Award, Computing in Cardiology (CINC) 42nd Annual Conference
- **2015** - Honorable Mention for the Best Poster Award, 21th International Congress of the ESB
- **2012** – International CAE Poster Award in the Academy category, 2012 International CAE Conference
- **2012** – first prize in The Young Investigators Abstract Awards, 2nd Annual ISNVD Scientific Meeting
- **2010** – SIMULIA® Travel Award for Bioengineering Researchers and Students, 2010 ESB Conference
- **2001** – Best Poster Award in the Cardiovascular Mechanics Session, ASME 2001 Summer Bioengineering Conference

Personal Awards

- **2008** - Rosanna Degani Young Investigator's Award for the best oral and written presentation in the "Young Investigators Competition", Computers in Cardiology 2008
- **2001** - Rosanna Degani Award for the best Master Thesis in biomedical engineering and medical informatics applied to cardiovascular applications, academic year 1999/2000.

Invited podium presentations at international conferences

- 2020, 30th Annual Meeting of the SSRCTS – Scandinavian Society for Research in CardioThoracic Surgery, February 6th-8th, Geilo, Norway. Invited Keynote Talk.
- 2019, 4th 4DFlow MRI Workshop, June 17th-18th, 2019, York, UK
- 2018, 6th International Meeting on Aortic Diseases, September 12th-14th, 2016, Liège, Belgium
- 2018, INdAM Workshop "Mathematical and Numerical Modeling of the Cardiovascular System", April 16th-19th, 2018, Roma, Italy
- 2016, 5th International Meeting on Aortic Diseases, September 15th-17th, 2016, Liège, Belgium
- 2016, 8th Bio-fluid Symposium, February 11th-14th 2016, Pasadena, CA, US
- 2015, 1st International Congress Innovations in Cardiology, October 15th-17th, 2015, Fermo, Italy
- 2014 World Congress of Biomechanics, July 6th-11th 2014, Boston, MA, US