

## CV FRANCESCO MIGLIAVACCA

### A. Personal Details

Date of Birth:  
Place of Birth:  
Nationality:

### B. Education

1997 "Dottorato di Ricerca" (PhD) in Bioengineering at the Dept. of Bioengineering of the Politecnico di Milano, Milan, Italy. Thesis: 'Haemodynamic Optimisation for Surgical Procedures in the Treatment of Complex Congenital Heart Disease'.

1992 Master Degree in Mechanical Engineering, sub-speciality Bioengineering, at the Politecnico di Milano, Milan, Italy. Thesis: 'Model Study of the Growth of the Atherosclerotic Plaque'.

### C. Positions and Honors.

#### Professional Experience

2005 Assistant Professor of Industrial Bioengineering, Politecnico di Milano, Italy  
2006-2013 Associate Professor of Industrial Bioengineering, Politecnico di Milano, Italy.  
2013-present Full Professor of Industrial Bioengineering, Politecnico di Milano, Italy.  
2007-2018 Director of the Laboratory of Biological Structure Mechanics of the Politecnico di Milano, Italy.  
2018-2019 - Research Affiliate, Medical Engineering and Science (IMES), Center for Biomedical Engineering, Massachusetts Institute of Technology, MA, Boston, USA

#### Main Honors and Awards

1999 Young Investigators Award Project 1999 – Politecnico di Milano: “ *Structural computational and experimental analyses of endovascular stents in pathological arteries: comparison between metallic and shape memory alloy stents.*”  
2001: Medal from the President of the Italian Republic  
2001: Medal "Le Scienze" (Italian edition of the journal 'Scientific American') for the outstanding accomplishments in the study of haemodynamics after paediatric cardiac surgery by means of mathematical modelling  
2004: European Society of Biomechanics S.M. Perren Award (Recipient Author).  
2008 Duncan Dowson Innovation Prize awarded by the Medical Engineering Division of the Institution of Mechanical Engineers for the paper “*Use of rapid prototyping models in planning of percutaneous pulmonary valved stent implantation*” judged as best publication of the 2007 in the journal *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine*.

### D. Research Support (main projects).

#### **CNR (Italian National Research Council)**

1996

*Programma di scambi internazionali per la mobilità, di breve durata, di studiosi/ricercatori di istituzioni di ricerca italiane e di studiosi stranieri*” Circolare CNR Pos. 125.11. Role: PI

#### **Italian Ministry of University**

2003-2004

Incentivi a favore della mobilità di docenti italiani e stranieri impegnati all'estero – DD.MM.13 e 14 del 26 e 27 gennaio 2001”. *Fluid dynamics in 3-D realistic bioreactors for tissue engineering cartilage*”. Role: PI

#### **Italian Ministry of Education, Research and University** 2006-2008

*Active microactuators and shape memory alloy devices for biomedical applications*. Role: Local PI

#### **Fondazione Cassa di Risparmio di Trento e Rovereto (Italy)**

2008-2010

*Magnesium degradable alloys for biomedical applications. Fondazione Cariplo (Milan, Italy)Fondazione Politecnico (Milan, Italy) Italian Ministry of Education, Research and University Istituto Italiano Tecnologia (Genoa, Italy) Istituto Italiano Tecnologia (Genoa, Italy)overeto (Italy)* Role: PI

**Fondation Leducq: Transatlantic Networks of Excellence** Program Multi-scale modeling of single ventricle hearts for clinical decision support’. With Great Ormond Street Hospital for Children, London (UK) Medical University of

South Carolina, Charleston, SC, (USA) University of Michigan, Ann Arbor (USA), Clemson University, SC, (USA), University of California, San Diego (USA), University College London Institute of Child Health (UK), Institut National de Recherche en Informatique et en Automatique, Paris (FRANCE). Role: Associate Member 2010-2014

**FP7-ICT-2009-4: Project RT3S “Real Time Simulation for Safer vascular Stenting”** 2011-2013  
Role: Work Package Leader

**International program Italy-Quebec** 'Experimental and numerical optimization of biomaterials for repair and regeneration of vascular tissues' in collaborazione con il Laboratorio de Biomateriaux et Bioingénierie de l'Université Laval in Quebec City. Role: PI 2011-2012

**INSIST - IN-Silico trials for treatment of acute Ischemic STroke.** Call: H2020-SC1-2016-2017. Topic: SC1-PM-16-2017. Type of action: RIA. Role: local PI 2017-2020

#### **E. Peer-reviewed publications (in chronological order, 2016-2018).**

1. Zunino P, Tambača J, Cutri E, Čanić S, Formaggia L, Migliavacca F. **Integrated stent models based on dimensional reduction. Review and future perspectives.** *Annals of Biomedical Engineering*. 44: 604-617, 2016.
2. Wu W, Pott D, Mazza B, Sironi T, Dordoni E, Chiastra C, Petrini L, Pennati G, Dubini G, Steinseifer U, Sonntag S, Kuetting M, Migliavacca F. **Fluid-structure interaction model of a percutaneous aortic valve: comparison with an in vitro test and feasibility study in a patient-specific case.** *Annals of Biomedical Engineering*. 44: 590-603, 2016.
3. Petrini L, Trotta A, Dordoni E, Migliavacca F, Dubini G, Lawford PV, Gosai JN, Ryan DM, Testi D, Pennati G. **Computational approach for the prediction of fatigue behaviour in peripheral stents: application to a clinical case.** *Annals of Biomedical Engineering*. 44: 536-547, 2016.
4. Biffi B, Bosi GM, Lintas V, Jones R, Tzamtzis S, Burriesci G, Migliavacca F, Taylor AM, Schievano S, Biglino G. **Numerical model of a valvuloplasty balloon: in vitro validation in a rapid-prototyped phantom.** *BioMedical Engineering OnLine*. 2016, 15:37 doi: 10.1186/s12938-016-0155-4.
5. Vorobtsova N, Chiastra C, Stremmer MA, Sane DC, Migliavacca F, Vlachos P. **Effects of vessel tortuosity on coronary hemodynamics: an idealized and patient-specific computational study.** *Annals of Biomedical Engineering*. 44:2228-39, 2016. doi: 10.1007/s10439-015-1492-3.
6. Chiastra C, Wu W, Dickerhoff B, Aleiou A, Dubini G, Otake H, Migliavacca F, LaDisa J.F.Jr. **Computational replication of the patient-specific stenting procedure for coronary artery bifurcations: from OCT and CT imaging to structural and hemodynamics analyses.** *Journal of Biomechanics*. 49:2102-11, 2016. doi: 10.1016/j.jbiomech.2015.11.024.
7. Bosi GM, Biffi B, Biglino G, Lintas V, Jones R, Tzamtzis S, Burriesci G, Migliavacca F, Khambadkone S, Taylor AM, Schievano S. **Can finite element models of ballooning procedures yield mechanical response of the cardiovascular site to overexpansion?** *Journal of Biomechanics*. 49:2778-2784, 2016. doi: 10.1016/j.jbiomech.2016.06.021.
8. Capelli C, Corsini C, Biscarini D, Ruffini F, Migliavacca F, Kocher A, Laufer G, Taylor AM, Schievano S, Andreas M, Burriesci G, Rath C. **Pledget-Armed Sutures Affect the Haemodynamic Performance of Biologic Aortic Valve Substitutes: A Preliminary Experimental and Computational Study.** *Cardiovascular Engineering and Technology*. 8: 17-29, 2017. doi: 10.1007/s13239-016-0284-8.
9. Brindise MC, Chiastra C, Burzotta F, Migliavacca F, Pavlos PV. **Hemodynamics of Stent Implantation Procedures in Coronary Bifurcations: An In Vitro Study.** *Annals of Biomedical Engineering*. 45: 542-553, 2017. doi: 10.1007/s10439-016-1699-y.
10. Petrini L; Bertini A; Berti F; Pennati G; Migliavacca F. **The role of inelastic deformations in the mechanical response of endovascular shape memory alloys devices.** *Proc IMechE Part H, Journal of Engineering in Medicine*. 23: 391-404, 2017. doi: 10.1177/0954411917696336.
11. Touati J, Bologna M, Schwein A, Migliavacca F, Garbey M. **A robust construction algorithm of the centerline skeleton for complex aortic vascular structure using Computational Fluid Dynamics.** *Computers in Biology and Medicine*. 86: 6-17, 2017. doi: 10.1016/j.compbiomed.2017.04.017.
12. L Petrini, E Dordoni, D Allegretti, D Pott, M Kütting, F Migliavacca, G. Pennati. **Simplified multi-stage computational approach to assess the fatigue behavior of a NiTi transcatheter aortic valve during in vitro tests: a proof-of-concept study.** *Journal of Medical Devices*. 11 (2), 021009.
13. Chiastra C, Montin E, Bologna M, Migliori S, Aurigemma C, Burzotta F, Celi S, Dubini G, Migliavacca F, Mainardi L. **Reconstruction of stented coronary arteries from optical coherence tomography images: feasibility, validation, and repeatability of a segmentation method.** *PLoS ONE* 12(6): e0177495. <https://doi.org/10.1371/journal.pone.0177495>
14. Iannaccone F, Chiastra C, Karanasos A, Migliavacca F, Gijssen FJ, Segers P, Mortier P, Verheghe B, Dubini G, De Beule M, Regar E, Wentzel JJ. **Impact of plaque type and side branch geometry on side branch compromise after**

- provisional stent implantation. A simulation study.** *EuroIntervention*. 2017 13:e236-e245. doi: 10.4244/EIJ-D-16-00498.
15. Luraghi G, Wu W, De Gaetano F, Rodriguez Matas JF, Moggridge GD, Serrani M, Stasiak J, Costantino ML, Migliavacca F. **Evaluation of an aortic valve prosthesis: Fluid-Structure Interaction or structural simulation?** *Journal of Biomechanics*. 58: 45-51, 2017. doi: 10.1016/j.jbiomech.2017.04.004.
  16. Chiastra C, Gallo D, Tasso P; Iannaccone F; Migliavacca F; Wentzel JJ; Morbiducci U. **Healthy and diseased coronary bifurcation geometries influence near-wall and intravascular flow: a computational exploration of the hemodynamic risk.** *Journal of Biomechanics*. 58: 79-88, 2017 doi: 10.1016/j.jbiomech.2017.04.016.
  17. Corsini C, Cervi E, Migliavacca F, Schievano S, Hsia T-Y, Pennati G. **Mathematical modelling of the maternal cardiovascular system in the three stages of pregnancy.** *Medical Engineering & Physics*. 47: 55-63, 2017. 10.1016/j.medengphy.2017.06.025.
  18. Migliori S, Chiastra C, Bologna M, Montin E, Dubini G, Aurigemma C, Fedele R, Burzotta F, Mainardi L, Migliavacca F. **A framework for computational fluid dynamic analyses of patient-specific stented coronary arteries from optical coherence tomography images.** *Medical Engineering & Physics*. 47: 105-116, 2017. 10.1016/j.medengphy.2017.06.027.
  19. Cutri E, Meoli A, Dubini G, Migliavacca F, Hsia T-Y, Pennati G. **Patient-specific biomechanical model of hypoplastic left heart to predict post-operative cardio-circulatory behaviour.** *Medical Engineering & Physics*. 47: 85-92, 2017. 10.1016/j.medengphy.2017.06.024.
  20. Conover T, Hlavacek AM, Migliavacca F, Kung E, Dorfman A, Figliola RS, Hsia TY; Modeling of Congenital Hearts Alliance (MOCHA) Investigators. **An interactive simulation tool for patient-specific clinical decision support in single-ventricle physiology.** *Journal of Thoracic and Cardiovascular Surgery*. 155(2):712-721, 2018. 10.1016/j.jtcvs.2017.09.046.
  21. Tobar AM, Ferrero JM, Migliavacca F, Rodríguez Matas JF. **Vulnerability in regionally ischemic human heart. Effect of the extracellular potassium concentration.** *Journal of Computational Science*. 24: 160-168, 2018. 10.1016/j.jocs.2017.11.009.
  22. Chiastra C, Migliori S, Burzotta F, Dubini G, Migliavacca F. **Patient-specific modeling of stented coronary arteries reconstructed from optical coherence tomography: towards a widespread clinical use of fluid dynamics analyses.** *Journal of Cardiovascular Translational Research*. 11:156–172, 2018. doi.org/10.1007/s12265-017-9777-6
  23. Chiastra C, Grundeken MJ, Collet C, Wu W, Wykrzykowska JJ, Pennati G, Dubini G, Migliavacca F. **Biomechanical impact of wrong positioning of a dedicated stent for coronary bifurcations: A virtual bench testing study.** *Cardiovascular Engineering and Technology*. 9:415-426, 2018. doi: 10.1007/s13239-018-0359-9.
  24. Corsini C, Migliavacca F, Hsia TY, Pennati G; Modeling of Congenital Hearts Alliance (MOCHA) Investigators. **The influence of systemic-to-pulmonary arterial shunts and peripheral vasculatures in univentricular circulations: Focus on coronary perfusion and aortic arch hemodynamics through computational multi-domain modeling.** *Journal of Biomechanics*. 79: 97-104, 2018 doi: 10.1016/j.jbiomech.2018.07.042.
  25. Migliori S, Rampat R, Bologna M, Montin E, Burzotta F, Hildick-Smith D, Dubini G, Mainardi L, Migliavacca F, Cockburn J, Chiastra C. **A patient-specific study investigating the relation between coronary hemodynamics and neo-intimal thickening after bifurcation stenting with a polymeric bioresorbable scaffold.** *Applied Sciences* (Switzerland). 8(9),1510, 2018. doi: 10.3390/app8091510.
  26. Allegretti D, Berti F, Migliavacca F, Pennati G, Petrini L. **Fatigue Assessment of Nickel–Titanium Peripheral Stents: Comparison of Multi-Axial Fatigue Models.** *Shape Memory and Superelasticity* 4: 186-196, 2018. doi:10.1007/s40830-018-0150-7.
  27. Luraghi G, Wu W, De Castilla H, Rodriguez Matas JF, Dubini G, Dubuis P, Grimmé M, Migliavacca F. **Numerical Approach to Study the Behavior of an Artificial Ventricle: Fluid-Structure Interaction Followed By Fluid Dynamics With Moving Boundaries.** *Artificial Organs*. 42(10):E315-E324, 2018. doi: 10.1111/aor.13316.
  28. Grundeken MJ, Chiastra C, Wu W, Wykrzykowska JJ, De Winter RJ, Dubini G, Migliavacca F. **Differences in rotational positioning and subsequent distal main branch re-wiring of the Tryton stent: an optical coherence tomography and computational study.** *Catheterization & Cardiovascular Interventions*. 92: 897–906, 2018. doi: 10.1002/ccd.27567.
  29. Wang PJ, Gorji MB; Nezami FR, Berti F, Petrini L, Wierzbicki T, Migliavacca F, Edelman ER. **Effect of working environment and procedural strategies on mechanical performance of bioresorbable vascular scaffolds.** *Acta Biomaterialia*. 82: 34-43, 2018. doi: 10.1016/j.actbio.2018.10.020
  30. Morris PD, Iqbal J, Chiastra C, Wu W, Migliavacca F, Gunn J. **Simultaneous kissing stents to treat unprotected left main stem coronary artery bifurcation disease; stent expansion, vessel injury, hemodynamics, tissue healing, restenosis and repeat revascularization.** *Catheterization & Cardiovascular Interventions*. doi: 10.1002/ccd.27640. 92: E381–E392, 2018.

31. Steinman DA, Migliavacca F. **Special Issue on Verification, Validation, and Uncertainty Quantification of Cardiovascular Models: Towards Effective VVUQ for Translating Cardiovascular Modelling to Clinical Utility.** *Cardiovascular Engineering and Technology*. 10.1007/s13239-018-00393-z. 9(4), 539-543, 2018.
32. Luraghi G, Migliavacca F, Rodriguez Matas JF. **Study on the Accuracy of Structural and FSI Heart Valves Simulations.** *Cardiovascular Engineering and Technology*. 10.1007/s13239-018-00373-3. 9(4), 723-738, 2018.
33. Chen C, Tan J, Wu W, Petrini L, Zhang L, Shi Y, Cattarinuzzi E, Pei J, Huang H, Ding W-J, Yuan G, Migliavacca F. **Modeling and experimental studies of coating delamination of biodegradable magnesium alloy cardiovascular stents.** *ACS Biomaterials Science & Engineering*. 10.1021/acsbiomaterials.8b00700. 4(11), 3864-3873, 2018.