Tiziano Passerini

Curriculum Vitae

PERSONAL DETAILS

Birth	July 18, 1980
Address	400 Dowman Dr., W401, Atlanta, GA 30322, USA
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E-mail	tiziano@mathcs.emory.edu

EDUCATION

PhD in Mathematical Engineering 2006-2009

Politecnico di Milano

I developed a novel technique to couple 3D and 1D models of blood flow, and I worked on the classification of a large dataset of cerebral aneurysms, based on geometric and hemodynamic factors. I studied reduced order modeling (1D networks) of the cardiovascular system.

The title of my thesis is "Computational hemodynamics of the cerebral circulation: multiscale modeling from the circle of Willis to cerebral aneurysms"; advisor Dr. A. Veneziani.

Master's degree in Biomedical Engineering 1999-2005

Politecnico di Milano

I learned design and management of biomedical devices, processing of biomedical data and signals. I studied mathematical and numerical models for blood flow problems.

The title of my Master's thesis is "Modelli multiscala per il sistema circolatorio: accoppiamento numerico di modelli tridimensionali e monodimensionali" (Multiscale modeling of the circulatory system: numerical coupling of three-dimensional and one-dimensional models); advisor Dr. A. Veneziani.

RESEARCH EXPERIENCE

American Heart Association postdoctoral fellow 2013-present

Emory University, Full-time

I am the principal investigator of the project "Blood flow patterns in the infrarenal aorta of amputees: relevance to AAA", awarded a two-year postdoctoral fellowship by the American Heart Association. I am studying hemodynamics risk factors for the development of AAAs in humans, considering in particular subjects with increased peripheral resistances. I am also working on high performance and cloud computing solutions for the simulation of blood flow in subject-specific vascular geometries.

Postdoctoral research associate 2009-2012

Emory University, Full-time

I worked on several projects in collaboration with the Department of Cardiology, Emory University and the joint Department of Biomedical Engineering at Emory and Georgia

Tech. In particular I focused on the role of wall shear stress as a potential marker for the initiation of vascular diseases. I designed and developed software tools for the study of blood flow in realistic vascular geometries, both rigid and deformable.
I was the lead developer and manager of the local community of developers of LifeV (`www.lifev.org`), an open source C++ software project for the numerical solution of partial differential equations with high performance computing technologies (joint collaboration with POLIMI, EPF Lausanne, INRIA Paris).
This position was partially supported by Dr. R. W. Taylor (School of Medicine, Division of Cardiology, Emory University) in the context of the NIH-funded program "Biology, Biomechanics and Atherosclerosis".

Research assistant 2008-2009
Emory University, Part-time

I spent one year at Emory as a visiting graduate student at the end of my PhD program. I worked on my PhD thesis and also on the development of LifeV. We released the first version of the library supporting parallel computing.

Research assistant 2009
Politecnico di Milano, Part-time

I was the manager of the local community of developers of LifeV at MOX (POLIMI).

Research assistant 2005-2008
Politecnico di Milano, Full-time

Siemens Medical Solutions Italy awarded me a fellowship to work on the research project Aneurisk, an Italian multi-center study on brain aneurysms, coordinated by Dr. A. Veneziani, using computational modeling techniques to characterize morphologic and hemodynamic features of cerebral arteries affected by aneurysms. This fellowship funded my graduate studies at Politecnico di Milano.

TEACHING EXPERIENCE

Instructor 2009-2012
Emory University

Multivariable Calculus (Spring 2012), Linear Algebra (Fall 2009, Spring 2011).

Teaching assistant 2006-2007
Politecnico di Milano

"Programmazione avanzata per il calcolo scientifico" (Advanced programming for scientific computing), instructor prof. L. Formaggia (Fall 2006, Fall 2007).
"Algebra Lineare e Calcolo Numerico" (Linear algebra and numerical analysis), instructor prof. L. Bonaventura (Spring 2006).

PUBLICATIONS

Refereed Journals

1. T. Passerini, A. Quaini, U. Villa, A. Veneziani, S. Canic. *Validation of an open source framework for the simulation of blood flow in rigid and deformable vessels*, Int J Numer Methods Biomed Eng, accepted, 2013.

2. B. D. Gogas, S. B. King III, L. H. Timmins, T. Passerini, M. Piccinelli, A. Veneziani, S. Kim, D. S. Molony, D. P. Giddens, H. Samady, *Biomechanical Assessment of Fully Bioresorbable Devices*, accepted, JACC: Cardiovascular Interventions - Images In Intervention, 2013.

3. L. Mirabella, C. M. Haggerty, T. Passerini, M. Piccinelli, A. J. Powell, P. J. Del Nido, A. Veneziani, A. P. Yoganathan, *Treatment planning for a TCPC test case: a numerical investigation under rigid and moving wall assumptions*, Int J Numer Methods Biomed Eng, DOI: 10.1002/cnm.2517, 2012.

4. J. Alastruey, T. Passerini, L. Formaggia, J. Peiró, *Physical determinants of the arterial pulse waveform: theoretical analysis and calculation using the 1-D formulation*, J Eng Math, vol. 77, no. 1, pagg. 19-37, 2012.

5. T. Passerini, L. M. Sangalli, S. Vantini, M. Piccinelli, S. Bacigaluppi, L. Antiga, E. Boccardi, P. Secchi and A. Veneziani, *An Integrated Statistical Investigation of Internal Carotid Arteries of Patients affected by Cerebral Aneurysms*, CVET, vol. 3, no. 1, pagg. 26-40, 2012.

6. A. F. Corno, C. Vergara, C. Subramanian, R. A. Johnson, T. Passerini, A. Veneziani, L. Formaggia, N. Alphonso, A. Quarteroni, J. C. Jarvis, *Assisted Fontan procedure: animal and in vitro models and computational fluid dynamics study*, ICVTS, vol. 10, no. 5, pagg. 679-684, 2010.

7. T. Passerini, M. de Luca, L. Formaggia, A. Quarteroni and A. Veneziani, *A 3D/1D geometrical multiscale model of cerebral vasculature*, J Eng Math, vol. 64, no. 4, pagg. 319-330, 2009.

Refereed Conferences

1. J. Slawinski, U. Villa, T. Passerini, A. Veneziani, V. Sunderam, *Issues in Communication Heterogeneity for Message-Passing Concurrent Computing*, 27th IEEE International Parallel and Distributed Processing Symposium Workshops & PhD Forum, accepted for publication, 2013.

2. J. Slawinski, T. Passerini, U. Villa, A. Veneziani, V. Sunderam, *Experiences with Target-Platform Heterogeneity in Clouds, Grids, and On-Premises Resources*, 26th IEEE International Parallel and Distributed Processing Symposium Workshops & PhD Forum, pagg. 41-52, 2012.

3. L. Formaggia, A. Moura, F. Nobile, T. Passerini, *The interplay of different models in the simulation of the cardiovascular system*, Proceedings of the Third Asian-Pacific Congress on Computational Mechanics in conjunction with Eleventh International Conference on Enhancement and Promotion of Computational Methods in Engineering and Science (APCOM07-EPMESCXI), 2007 [12 pagg., CD_ROM].

Book Chapters

1. B. Ettinger, T. Passerini, S. Perotto, L. M. Sangalli, *Spatial smoothing for data distributed over non-planar domains.* to appear in Complex Models and Computational Methods in Statistics, M. Grigoletto, F. Lisi, S. Petrone (eds.). Milano, Italy: Springer, 2013.

2. M. D'Elia, L. Mirabella, T. Passerini, M. Perego, M. Piccinelli, C. Vergara and A. Veneziani, *Applications of Variational Data Assimilation in Computational Hemodynamics*. In Modeling of Physiological Flows, D. Ambrosi, A. Quarteroni, G. Rozza (eds.), ch. 12. Milano, Italy: Springer, 2011.

Research Presentations

1. Biomechanics Meeting, Emory University and Georgia Institute of Technology, Atlanta, January 30, 2013.
   Talk: *Validation of an open source framework for the simulation of blood flow in rigid and deformable vessels.*

2. Biomedical Engineering Society (BMES) Annual Meeting, Atlanta, October 24-27, 2012.
   Talk: *Blood Flow Patterns in infrarenal Aorta due to increased Peripheral Resistances: Relevance to AAA.*

3. Biomechanics Meeting, Emory University and Georgia Institute of Technology, Atlanta, March 8, 2012.
   Talk: *Blood flow patterns in infra-renal aorta: the effect of increased peripheral resistances.*

4. 11th US National Congress on Computational Mechanics (USNCCM 2011), Minneapolis, MN, July 25-28, 2011.
   Talk: *4D Image-Based approach for CFD in compliant blood vessels.*

5. 7th International Congress on Industrial and Applied Mathematics (ICIAM 2011), Vancouver, BC, Canada, July 18-22, 2011.
   Minisymposium (co-organizer): Computational Approaches to the Risk Assessment for Cerebral Aneurysms.
   Talk: *Morphological Parameterization of the Parent Vessel Geometry and Effects on the Hemodynamics.*

6. SIAM Conference on Computational Science and Engineering (CSE11), Reno, Nevada, February 28-March 4, 2011.
   Minisymposium (co-organizer): Computational Approaches to the Risk Assessment for Cerebral Aneurysms.
   Talk: *Hemodynamics and morphology in the parent vessels could predict the aneurysm phenomenology.*

7. MPF2010 IV International Symposium on Modelling of Physiological Flows, Chia Laguna, Italy, June 2-5, 2010.
   Talk: *Geometry, hemodynamics, aneurysm location in cerebral vasculature.*

8. The 18th IMACS World Congress: Computational and Applied Mathematics & Applications in Science and Engineering, Athens, USA, August 3-7, 2009.
   Talk: *A geometrical multiscale model of cerebral vasculature.*

9. The Cardiac Physiome: Multi-scale and Multi-physics Mathematical Modelling Applied to the Heart, Cambridge, UK, July 20-24, 2009.
   Talk: *A 3D/1D geometrical multiscale model of vascular networks.*

10. Multiscale and Adaptivity: Modeling, Numerics and Applications, Cetraro (CS), Italy, July 6-11, 2009.
    Talk: *A 3D/1D geometrical multiscale model of cerebral vasculature.*

11. 1st International Conference on Computational & Mathematical Biomedical Engineering, Swansea, UK, June 29-July 1, 2009.
    Talk: *Wall shear stress in the Internal Carotid Artery and its relation to aneurysm location.*

12. Biomechanics Meeting, Emory University and Georgia Institute of Technology, Atlanta, May 27, 2009.
    Talk: *Computational hemodynamics of the cerebral circulation: cerebral aneurysms.*

13. CEMAT (Center for Mathematics and its Applications) Seminar, Invited presentation, Instituto Superior Técnico, Lisbon, March 24, 2009.

14. Convegno Annuale 2009 del Gruppo Nazionale di Calcolo Scientifico, Montecatini Terme, February 3-5, 2009.
    Talk: *A 3D/1D geometrical multiscale model of cerebral vasculature.*

15. Biomechanics Meeting, Emory University and Georgia Institute of Technology, Atlanta, November 18, 2008.
    Talk: *LifeV: a C++ finite element methods (parallel) library.*

16. General CMB Seminar, Invited presentation, University of Houston, Houston, October 2, 2008.

17. SIMAI 9th Congress, Roma, Italy, September 15-19, 2008.
    Talk: *CFD analysis of haemodynamics factors in Internal Carotid Arteries Aneurysms.*

18. SIAM Annual Meeting (AN08), San Diego, CA, July 7-11, 2008.
    Talk: *Classification of cerebral aneurysms: the role of geometry and haemodynamics of internal carotid artery.*

19. Department of Aeronautics Seminar, Invited presentation, Imperial College, London, May 8, 2008.

20. 6th International Congress on Industrial and Applied Mathematics (ICIAM07), Zurich, Switzerland, July 16-20, 2007.
    Talk: *Geometrical and haemodynamical risk factors for internal carotid artery aneurysm development.*

21. SIMAI Congress "Prospettive di sviluppo della matematica applicata in Italia", Parma, Italy, May 18-19, 2007.
    Talk: *Realistic boundary conditions for 3D haemodynamics models of cerebral arteries aneurysms.*

22. Séminaire de calcul scientifique du Cermics, Invited presentation, École des Ponts ParisTech (ENPC), Paris, November 9, 2006.

23. 3rd International Symposium on Modeling of Physiological Flows (MPF2006), Bergamo, Italy, September 25-27, 2006.
    Talk: *Mathematical models for cerebral circulation*.

Abstracts in conference proceedings

1. A. V. Smolensky, S. Clement, T. Passerini, M. Piccinelli, A. Veneziani, J. N. Oshinski, W. R. Taylor, *Potential hemodynamic mechanisms for gender differences in AAA formation*, to appear in Proceedings of the ASME 2012 Summer Bioengineering Conference (SBC2012), June 20-23, Fajardo, Puerto Rico, USA.

2. T. Passerini, M. Piccinelli, A. Veneziani, L. M. Sangalli, P. Secchi and S. Vantini, *Computational and Statistical Analysis of ICA Morphology and Hemodynamics*, Proceedings of CMBE2011, 2nd International Conference on Mathematical and Computational Biomedical Engineering, P. Nithiarasu and R. Lohner (Eds.), 2011.

3. T. Passerini, A. Veneziani, L. M. Sangalli, P. Secchi and S. Vantini, *Wall shear stress in the Internal Carotid Artery and its relation to aneurysm location*, Proceedings of CMBE2009, 1st International Conference on Mathematical and Computational Biomedical Engineering, P. Nithiarasu and R. Lohner (Eds.), pp. 163-166, 2009.

4. S. Bacigaluppi, T. Passerini, L. Sangalli, P. Secchi, S. Vantini, S. Vele and A. Veneziani, *Analysis of cerebral vascular morphologies for assessing rupture risk in cerebral aneurysms*, Abstracts of the 16th Congress, European Society of Biomechanics, Journal of Biomechanics, Vol. 41, pp. S9, 2008.

5. S. Bacigaluppi, L. Antiga, T. Passerini, M. Piccinelli, S. Vantini, L. Sangalli, A. Remuzzi, P. Secchi, M. Collice, E. Boccardi and A. Veneziani, *Geometric analysis of the Internal Carotid Artery (ICA) in relation to aneurysms (An)*,Proceedings of the 59th Annual Meeting of the German Society of Neurosurgery (DGNC) - 3rd Joint Meeting with the Italian Neurosurgical Society (SINch).GMS German Medical Science e-journal, German Medical Science GMS Publishing House, Dsseldorf, 2008.

6. T. Passerini, A. Veneziani, *A geometrical multiscale approach to the evaluation of hemodynamic risk factors for internal carotid artery aneurysm development*, PAMM, Volume 7, Issue 1, Pages 2120013 - 2120014, 2007.

Posters in conferences

1. P. Eshtehardi, M. T. Corban, J. Suo, M. Piccinelli, L. H. Timmins, T. Passerini, E. Rasoul-Arzrumly, M. McDaniel, G. Mekonnen, A. A. Quyyumi, A. Veneziani, D. P. Giddens, H. Samady, *Higher Coronary Wall Shear Stress Is Associated with Greater Impairment in Microvascular Function in Patients with NonObstructive Coronary Artery Disease*, 62nd Annual Scientific Session of the American College of Cardiology, San Francisco, CA, March 9-12, 2013.

2. M. T. Corban, M. Piccinelli, L. H. Timmins, T. Passerini, P. Eshtehardi, R. A. Nanjundappa, E. Rasoul-Arzrumly, M. McDaniel, J. Oshinski, A. A. Quyyumi, A. Veneziani, D. P. Giddens, H. Samady, *Lower Coronary Wall Shear Stress is Associated with Endothelial Dysfunction in Patients with Non-Obstructive Coronary Artery Disease*, Abstracts From the American Heart Association 2012 Scientific Sessions and Resuscitation Science Symposium, Circulation, vol. 126, no. 21 Supplement, A17758, 2012.

3. M. A. Consolini, T. Passerini, J. N. Oshinski, A. Veneziani, W. R. Taylor, *Angiotensin II and shear stress in the development and localization of abdominal aortic aneurysms*, The 7th International Symposium on Biomechanics in Vascular Biology & Cardiovascular Disease, Atlanta, GA, April 26-27, 2012.

4. M. A. Consolini, T. Passerini, M. Piccinelli, B. Fornwalt, N. J. Willett, R. C. Long, A. Veneziani, J. N. Oshinski, W. R. Taylor, *Shear stress and angiotensin II in the development and localization of abdominal aortic aneurysms*, ASME Summer Bioengineering Conference, Lake Tahoe, CA, June 17-21, 2009.

5. M. Consolini, B. Fornwalt, N. Willett, D. Karolyi, R. Long, T. Passerini, M. Piccinelli, A. Veneziani, J. Oshinski, D. Giddens, W. Taylor, *The role of shear stress in the development and localization of abdominal aortic aneurysms*, BMES Annual Fall Meeting, St. Louis, MO, October 2-4, 2008.

6. M. de Luca, T. Passerini, A. Veneziani, *Numerical modeling of the Circle of Willis*, IPAM Optimal Transport, Workshop IV: Optimal Transport in the Human Body: Lungs and Blood, Los Angeles, CA, May 19 - 23, 2008.

7. L. Mirabella, T. Passerini, S. Deparis, A. Veneziani, *Applications of a parallel finite element library to cardiovascular simulations*, SIAM Conference on Parallel Processing for Scientific Computing (PP08), Atlanta, USA, March 12-14 2008.

8. T. Passerini, A. Veneziani, *Geometrical and haemodynamical risk factors for internal carotid artery aneurysm development*, Workshop on Advanced Methods For The Estimation of Human Brain Activity And Connectivity (NEUROMATH 2007), Roma, Italy, December 4-5 2007.

GRANTS AND AWARDS

- American Heart Association postdoctoral fellowship to work on the research project "Blood flow patterns in the infrarenal aorta of amputees: relevance to AAA" (2013-2014).
- Fellowship to attend the workshop "Careers in Academia" at the American Institute of Mathematics (AIM) in Palo Alto, California (June 11-13, 2012).
- Postdoc/Early Career Travel Award (550$) to attend the SIAM Conference on Computational Science and Engineering (CSE11) (February 28-March 4, 2011).
- Co-PI of the research project "Computational and Statistical Analysis of Cerebral Aneurysm Morphology", awarded a 15000$ research grant by The Brain Aneurysm Foundation (2010) (PI: A. Veneziani).
- Co-Investigator of the project "Large p Small n, Inferential Tools for the Statistical Analysis of the Brain Vascular System", awarded a 40000€ research grant by Politecnico di Milano (2009) (PI: Dr. S. Vantini).
- Finalist of the 2009 ECCOMAS PhD award, nominated by SIMAI.
- Italian coordinator of the 2008 British-Italian partnership program for young researchers "Numerical modelling of cerebral blood flow and auto-regulation" (8000€ grant). This project is in partnership with the Departments of Aeronautics and Bioengineering, Imperial College London.

ADVISING EXPERIENCE

- E. Cappello, *Computer simulations of Bicuspid Aortic Valve (BAV) disorder*, SIRE program (Co-advisor), Department of Mathematics and Computer Science, Emory University, 2011.
- R. Blum, *Numerical Simulations of Aortic Blood Flow with a Bicuspid Aortic Valve*, Honors Thesis (Co-advisor), Department of Mathematics and Computer Science, Emory University, 2010.
- D. Morini, *Modellazione integrata 1D-0D di reti di arterie* (in italian), Master's Thesis (Co-advisor), Ingegneria Aereospaziale, Politecnico di Milano, 2009.
- S. Vele, *Metodi numerici e statistici per l'analisi di aneurismi cerebrali* (in italian), Master's Thesis (Co-advisor), Ingegneria Matematica, Politecnico di Milano, 2007.

- E. Maculan, *Simulazioni fluidodinamiche in vasi deformabili con moto della parete ricostruito da immagini mediche* (in italian), Master's Thesis (Co-advisor), Ingegneria Matematica, Politecnico di Milano, 2007.
- M. Oosterwaal, *An adaptive model for the transport of blood solutes*, Report (Co-advisor), Technische Universiteit Eindhoven, 2007.
- G. Trombini, *Modello matematico e numerico di circolazione arteriosa sistemica: simulazione di casi fisiologici e patologici* (in italian), Bachelor's Thesis (Co-advisor), Ingegneria Matematica, Politecnico di Milano, 2006.
- M. Pischedda, *Condizioni al bordo realistiche per le equazioni di Navier-Stokes in emodinamica* (in italian), Bachelor's Thesis (Co-advisor), Ingegneria Matematica, Politecnico di Milano, 2006.
- E. Mazzoleni, *Calcolo numerico di parametri clinicamente significativi ottenuti da simulazioni emodinamiche in aneurismi cerebrali* (in italian), Bachelor's Thesis (Co-advisor), Ingegneria Matematica, Politecnico di Milano, 2006.
- M. de Luca, *Modellazione matematico-numerica del Circolo di Willis* (in italian), Masters Thesis (Co-advisor), Ingegneria Biomedica, Politecnico di Milano, 2005.

SKILLS

Languages	Italian (mother tongue)
	English (fluent)
	French (basic)
Software	GNU/LINUX, MAC OS X, MICROSOFT WINDOWS
	C++, LaTeX
	PYTHON (basic)
	VMTK, NETGEN, GMSH
	MATLAB, GNU OCTAVE, PARAVIEW

OTHER ACTIVITIES

- Developer and admin for the software project LifeV (`www.lifev.org`), a C++ library for finite element methods.
- Contributor to the Aneurisk dataset repository, an open database of images, geometries and results from morphological analysis and blood flow simulations of the cerebral circulatory system (`ecm2.mathcs.emory.edu/aneuriskweb`).
- Reviewer for the Journal of Engineering Mathematics, the Journal of Biomechanics, the International Journal for Numerical Methods in Fluids, Journal of Fluids and Structures, SIAM Journal on Scientific Computing, Medical Engineering and Physics.