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Education

Postdoc	**Biomedical Engineering (Present)** Advisor: Dr. Naomi Chesler	University of Wisconsin-Madison Madison, Wi
Ph.D.	**Mechanical Engineering (Sept 2017)** Advisor: Dr. Seungik Baek	Michigan State University East Lansing, MI
MSc.	**Mechanical Engineering (Jan 2010)** Advisor: Dr. Stefano Leonardi	University of Puerto Rico at Mayaguez Mayaguez, Puerto Rico, PR
B.S.	**Mechanical Engineering (Oct 2007)**	Escuela Superior Politecnica del Litoral Guayaquil, Ecuador

Professional Experience

University of Wisconsin-Madison - Postdoctoral Fellow **Jan 2018 – Present**
Computational Cardiovascular Mechanics

Research Highlights:

- Right ventricle (RV) hypertrophy and failure due to pulmonary hypertension (PH): Analyzed energetic and functional aspects in the RV due to an increase in afterload. The study combined experimental hemodynamic data from hypertensive induced rats and mice (gathered from right heart catheterization) with a mechano-energetic computational framework. This low order multiscale computational model included passive (forces due to titin and collagen) and active forces (using a cross-bridge energetic contraction model) into a realistic bi-ventricular geometry.

- Isolated lung test experimental setup: Worked with a team for the preparation and execution of isolated lung tests. The main scope of the experimental technique was to estimate the static and dynamic impedance in hypertensive induced rats' lungs.

Michigan State University - PhD Candidate **May 2011 – October 2017**
Computational Vascular Hemodynamics

Research Highlights:

- Hemodynamics in Pulmonary Arterial Hypertension (PAH): created a computational framework that used patient-specific geometries (gathered from medical images and in-vivo measurements [e.g. volumetric flow rates and pressure waves]) to describe the fluid-structure interaction (FSI) between hemodynamics and vessel wall mechanics. This computational framework, initially tested in a PAH and a normal subject is currently being used to analyze hemodynamics in a large PAH data set.

- Quantitative analysis of relationships among hemodynamics, intraluminal thrombus (ILT), and abdominal aortic aneurysm (AAA) expansion: Using longitudinal CT studies from a large AAA patients' data set, computational fluid dynamics (CFD) and a Lagrangian particle method, the relationship among AAA expansion, ILT accumulation and hemodynamic forces were studied. This study determined the thrombus accumulation process inside AAAs, identified main hemodynamic factors that are related to the formation of thrombus, and revealed higher aneurysm expansion and lower wall shear stress values on patients with thick thrombi. Results from this study allowed us to formulate theories about the potential biochemical/biomechanical pathways leading to the formation of thrombus inside AAAs.

- Implementation of data driven accumulation of thrombus into a Fluid solid growth (FSG) formulation. As a collaboration with the University of Zagreb, this project implemented a formulation that uses geometrical and flow information derived from the large patient-specific analysis previously performed to estimate the accumulation of thrombus inside AAAs. This formulation will be added to the already existing Fluid solid growth (FSG) formulation that also includes the effect of thrombus on AAA growth. This method is intended to improve our growth prediction of previous FSG formulation.

Grant writing experience

American heart association postdoctoral fellowship Summer 2016

Title: "A novel patient-specific image-based computational framework of the cardio-pulmonary system to understand the interactions between distal vasculature hemodynamics and ventricular mechanics in pulmonary arterial hypertension".

Honors and Awards

2016 **Nominee for the Fitch H. Beach outstanding engineering award**.
2015 **13 US National Congress of Computational Mechanics travel award**.
2015 MSU College of Engineering Travel Award.
2015 MSU Graduate School Travel Award.
2015 MSU Graduate School Travel Award.
2013 MSU College of Engineering Travel Award.
2013 MSU Graduate School Travel Award.
2013 MSU Mechanical Engineering Travel Award.
2012 MSU College of Engineering Travel Award.
2012 MSU Graduate School Travel Award.
2012 MSU Mechanical Engineering Travel Award.
2009 **Grand Student Big Expo Travel Award** (Purdue University).

Computational Languages and Softwares

Softwares : UGS Nx 5., Fluent 6.3, Gambit 2.4, ICEM, Tecplot, Paraview, Mimics, Microsoft Office, Autocad 2006 , comsol, CRIMSON, Simvascular

Computer languages : Matlab, C++, FORTRAN, Openmp

Manuscript and Book Contributions

1. Do H, Ijaz A, Gharahi H, **Zambrano B,** Chio J, Lee W, Baek S. Prediction of Abdominal Aortic Aneurysm growth using Dynamical Gaussian Process Implicit Surface. Transactions on Biomedical Engineering. IEEE Trans Biomed Eng; 2018 Jul 2. doi: 10.1109/TBME.2018.2852306.
2. **Zambrano B,** McLean N, Zhao X, Tan J, Zhong L, Figueroa CA, Baek S Image-Based computational assessment of vascular wall mechanics and hemodynamics in pulmonary arterial hypertension patients. Journal of Biomechanics; DOI 10.1016/j.jbiomech.2017.12.022. Epub 2017 Dec 27.
3. Gharahi H, **Zambrano B,** Zhu D., DeMarco J K, Baek S Computational fluid dynamic simulation of human carotid artery bifurcation based on anatomy and volumetric blood flow rate measured with magnetic resonance imaging. Int J Adv Eng Sci Appl Math. DOI 10.1007/s12572-016-0161-6. February 2016.
4. **Zambrano B**, Gharahi H, Lim C, Choi J, Jaberi F, Lee W, Baek S. Association of intraluminal thrombus, hemodynamic forces, and abdominal aortic aneurysm expansion using longitudinal CT images. Annals of Biomedical Engineering; DOI: 10.1007/s10439-015-1461-x, October 2015.
5. Gharahi H, **Zambrano B**, Lim C, Choi J, Lee W, Baek S. On growth measurements of abdominal aortic aneurysms using maximally inscribed sphere. Med Eng Phys. doi: 10.1016. May 21 2015
6. Farsad M, **Zambrano B**, Baek S. Data-guided growth and remodeling model of abdominal aortic aneurysm accounting for the Bio-chemical effects of intraluminal thrombus. Computational Biomechanics for Medicine. DOI 10.1007/978-3-319-15503-6_2. July 12, 201

Forthcoming publications

7. **Zambrano B**, Gharahi H, Lim C, Lee W, Baek S; Correlations of hemodynamic parameters with regional thrombus accumulation and their mechanisms in abdominal aortic aneurysms. *In preparation.*

Conference presentations

1. **Zambrano B,** Jaberi F, Baek S. Longitudinal CFD Infers mechanisms of thrombus formation and abdominal aortic aneurysm expansion. Biomedical engineering society annual meeting, Minneapolis MN, 2016
2. **Zambrano B**, Mclean N, Zhong L, Le Tan J, Figueroa CA, Lee LC, Baek S. Patient-specific computational modeling of hemodynamics in pulmonary arterial hypertension, Biomedical engineering society annual meeting, Minneapolis MN, 2016
3. **Zambrano B**, Jaberi F, Baek S. Association of intraluminal thrombus and hemodynamic factors for abdominal aortic aneurysm expansion. US National Congress of Computational Mechanics (2015).
4. **Zambrano B**, Jaberi F, Baek S. Role of Intraluminal thrombus in abdominal aortic aneurysm expansion. 17th U.S. National Congress on theoretical & applied mechanics, East Lansing, MI. 2014
5. **Zambrano B,** Choi J, Baek S. Effect of intraluminal thrombus in abdominal aortic aneurysm expansion: a longitudinal patient study. Biomedical engineering society annual meeting, Seattle WA, 2013
6. **Zambrano B**, Jaberi F, Lee W, Baek. S Wall shear stress and intraluminal thrombus changes in abdominal aortic aneurysms: atudy with longitudinal patients. ASME Summer Bioengineering conference. Sunriver, OR 2013
7. **Zambrano B,** Dupay A, Jaberi F, Baek S. Effect of wall shear stress on abdominal aortic aneurysm expansion: Study with longitudinal patient images. ASME Summer bioengineering conference Fajardo, Pr. 2012

Service and Outreach Activities

- Graduate student representative for the Mechanical Engineering graduate student committee.
- Mentor for Research experience for teacher program (RET) funded by the National Science Foundation.

- Coordinator for Grandparent week visit at Research Laboratories

Teaching and Mentoring Experience

- Mentored graduate and undergraduate students for PAH and AAA projects.
- Teacher assistant for **Fluid dynamics** laboratory (3 semesters)
- Teacher assistant for **Introduction of engineering modeling** class (3 semesters)
- Mentored High school students and teachers as part of summer programs (2 semesters)
- Guest lecturer for the **Cardiovascular Mechanics class** (Fall 2014)
- Led workshops to introduce undergraduate students to CAD parametric modeling (NX)