

# Stanford

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## Christopher Cheng

Adjunct Professor, Surgery - Vascular Surgery

 Curriculum Vitae available Online

### Bio

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#### BIO

I split my time between the medical device industry, aerospace government contracting, and academic research. For my day job, I run Global Science & Technology (gst.com), focusing on medical device consulting and satellite remote sensing for NASA and NOAA. At Stanford, my research is focused on the interaction between vascular implants and the dynamic anatomy. I advise companies on device design, biomechanics, mechanical testing, preclinical and cadaver testing, regulatory strategy, and entrepreneurship.

#### ACADEMIC APPOINTMENTS

- Adjunct Professor, Surgery - Vascular Surgery
- Member, Cardiovascular Institute

#### PROFESSIONAL EDUCATION

- PhD, Stanford University , Biomechanical Engineering (2002)
- MS, Stanford University , Biomechanical Engineering (2000)
- BSE, Duke University , Biomedical Engineering (1998)
- BSE, Duke University , Electrical Engineering (1998)

#### LINKS

- VIBE Lab website: <http://vibelab.stanford.edu>

### Research & Scholarship

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#### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our research laboratory focuses on understanding the mechanics of the cardiovascular system, especially with respect to interactions between medical devices and the dynamic cardiovascular environment. We use medical imaging, 3D geometric modeling, and custom deformation quantification techniques to investigate disease processes and medical device performance. We are interested in the dynamics of the heart, aorta, and peripheral vasculature, and are always seeking ways to apply our research to current and emerging therapies. While our research pursuits seek to add to the fundamental understanding of cardiovascular biomechanics, all of our projects are directly related to improving medical device design, evaluation, regulation, and their use in clinical practice.

### Teaching

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#### STANFORD ADVISEES

Med Scholar Project Advisor

Fikunwa Kolawole

## GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Cardiothoracic Surgery (Fellowship Program)
- Vascular Interventional Radiology (Fellowship Program)
- Vascular Surgery (Fellowship Program)

## Publications

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### PUBLICATIONS

- **Stent deformations in the common iliac and iliofemoral veins as a result of hip flexion and extension** *JOURNAL OF VASCULAR SURGERY-VENOUS AND LYMPHATIC DISORDERS*  
Cheng, C. P., Suh, G., Jalaie, H., Barbati, M. E.  
2023; 11 (5): 1014-1022
- **Pulsatile Deformations of a Conformable Descending Thoracic Aortic Endograft in Aneurysm, Dissection, and Blunt Traumatic Aortic Injury Patients.** *Journal of endovascular therapy : an official journal of the International Society of Endovascular Specialists*  
Cheng, C. P., Suh, G. Y., Moainie, S. L., Stern, J. R., Szeto, W. Y.  
2023: 15266028231187741
- **Cardiac Pulsatile Helical Deformation of the Thoracic Aorta Before and After Thoracic Endovascular Aortic Repair of Type B Dissections.** *Journal of endovascular therapy : an official journal of the International Society of Endovascular Specialists*  
Bondesson, J., Suh, G., Dake, M. D., Lee, J. T., Cheng, C. P.  
2023: 15266028231179592
- **Renovisceral Artery Alterations due to Branched Endovascular Aortic Repair and Respiratory-induced Deformations.** *Journal of vascular surgery*  
Cheng, C. P., Bondesson, J., Bendavid, J., Haulon, S.  
2023
- **Stent Deformations in the Common Iliac and Iliofemoral Veins as a Result of Hip Flexion and Extension.** *Journal of vascular surgery. Venous and lymphatic disorders*  
Cheng, C. P., Suh, G. Y., Jalaie, H., Barbati, M. E.  
2023
- **Ascending Aortic Endograft and Thoracic Aortic Deformation After Ascending Thoracic Endovascular Aortic Repair.** *Journal of endovascular therapy : an official journal of the International Society of Endovascular Specialists*  
Suh, G. K., Bondesson, J., Zhu, Y. D., Nilson, M. C., Roselli, E. E., Cheng, C. P.  
2023: 15266028231168351
- **Longitudinal Mapping of True Lumen Morphology for Accurate Endograft Oversizing in Patients with Type B Aortic Dissections**  
Bondesson, J., Raja, S., Suh, G., Dake, M. D., Lee, J. T., Cheng, C. P.  
MOSBY-ELSEVIER.2023: 64S-65S
- **Boundary Conditions and Long-Term Implantation Effects with Cardiovascular Nitinol Implants** *SHAPE MEMORY AND SUPERELASTICITY*  
Suh, G., Frakes, D., Kamali, R., Cheng, C. P.  
2022
- **Impact of renal chimney intra-aortic stent length on branch and end-stent angle in chimney endovascular aneurysm repair and endovascular aneurysm sealing configurations.** *Vascular*  
Ullery, B. W., Suh, G., Thompson, P., Lee, J. T., Holden, A., Dalman, R. L., Cheng, C. P.  
1800: 17085381211059978
- **Influence of Thoracic Endovascular Aortic Repair on True Lumen Helical Morphology for Stanford Type B Dissections.** *Journal of vascular surgery*  
Bondesson, J., Suh, G., Marks, N., Dake, M. D., Lee, J. T., Cheng, C. P.  
2021
- **Thoracic aortic parallel stent-graft behaviour when subjected to radial loading.** *Journal of the mechanical behavior of biomedical materials*  
Kwieceński, J., Cheng, C. P., Uberoi, R., Hadi, M., Hempel, P., Degel, C., You, Z.

2021; 118: 104407

- **Multiaxial pulsatile dynamics of the thoracic aorta and impact of thoracic endovascular repair.** *European journal of radiology open*  
Suh, G., Bondesson, J., Zhu, Y. D., Lee, J. T., Dake, M. D., Cheng, C. P.  
2021; 8: 100333
- **Respiratory-induced changes in renovisceral branch vessel morphology after fenestrated thoracoabdominal aneurysm repair with the BeGraft balloon-expandable covered stent.** *Journal of vascular surgery*  
Tran, K., Suh, G. Y., Mougin, J., Haulon, S., Cheng, C.  
2021
- **The Triple-Wire Technique for Delivery of Endovascular Components in Difficult Anatomy.** *Annals of vascular surgery*  
Stern, J. R., Cheng, C. P., Colvard, B. D., Paranjape, H., Lee, J. T.  
2020
- **The biomechanical impact of hip movement on iliofemoral venous anatomy and stenting for deep venous thrombosis.** *Journal of vascular surgery. Venous and lymphatic disorders*  
Cheng, C. P., Dua, A., Suh, G., Shah, R. P., Black, S. A.  
2020
- **Thoracic aortic geometry correlates with endograft bird-beaking severity.** *Journal of vascular surgery*  
Frohlich, M. M., Suh, G., Bondesson, J., Leineweber, M., Lee, J. T., Dake, M. D., Cheng, C. P.  
2020
- **Quantification of True Lumen Helical Morphology and Chirality in Type B Aortic Dissections.** *American journal of physiology. Heart and circulatory physiology*  
Bondesson, J. n., Suh, G. Y., Lundh, T. n., Dake, M. D., Lee, J. T., Cheng, C. P.  
2020
- **Effects of Heat Treatment on the Magnetic Properties of Nitinol Devices** *SHAPE MEMORY AND SUPERELASTICITY*  
Combs, J., Levin, E., Cheng, C., Daly, S., Yeralan, S., Duerig, T.  
2019; 5 (4): 429–35
- **Automated Quantification of Diseased Thoracic Aortic Longitudinal Centerline and Surface Curvatures.** *Journal of biomechanical engineering*  
Bondesson, J. H., Suh, G., Lundh, T., Lee, J. T., Dake, M. D., Cheng, C.  
2019
- **Iliofemoral Vein Compression Is Caused by the Pubic Bone, Not the Inguinal Ligament**  
Cheng, C., Suh, G., Shah, R., Black, S., Chinubhai, A.  
ELSEVIER SCIENCE INC.2019: B558
- **Cardiac Pulsatility- and Respiratory-Induced Deformations of the Renal Arteries and Snorkel Stents After Snorkel Endovascular Aneurysm Sealing.** *Journal of endovascular therapy : an official journal of the International Society of Endovascular Specialists*  
Cheng, C. P., Suh, G., Kim, J. J., Holden, A.  
2019: 1526602819856363
- **Length Redundancy and Twist Improve the Biomechanical Properties of Polytetrafluoroethylene Bypass Grafts.** *Annals of vascular surgery*  
Lee, R. n., Stoddart, M. n., Dyson, I. n., Cassimjee, I. n., Handa, A. n., Cheng, C. P.  
2019
- **Cardiopulmonary-induced deformations of the thoracic aorta following thoracic endovascular aortic repair.** *Vascular*  
Suh, G., Ullery, B. W., Lee, J. T., Dake, M. D., Fleischmann, D., Cheng, C.  
2018: 1708538118811204
- **Stabilization of the Abdominal Aorta During the Cardiac Cycle with the Sac-Anchoring Nellix Device.** *Annals of vascular surgery*  
Itoga, N. K., Suh, G., Cheng, C. P.  
2018
- **Geometric Deformations of the Thoracic Aorta and Supra-Aortic Arch Branch Vessels Following Thoracic Endovascular Aortic Repair** *VASCULAR AND ENDOVASCULAR SURGERY*  
Ullery, B. W., Suh, G., Hirotsu, K., Zhu, D., Lee, J. T., Dake, M. D., Fleischmann, D., Cheng, C. P.

2018; 52 (3): 173–80

- **A Lagrangian cylindrical coordinate system for characterizing dynamic surface geometry of tubular anatomic structures.** *Medical & biological engineering & computing*  
Lundh, T., Suh, G., DiGiacomo, P., Cheng, C.  
2018
- **Optimization of three-dimensional modeling for geometric precision and efficiency for healthy and diseased aortas** *COMPUTER METHODS IN BIOMECHANICS AND BIOMEDICAL ENGINEERING*  
Cheng, C. P., Zhu, Y. D., Suh, G.  
2018; 21 (1): 65–74
- **Changes in Geometry and Cardiac Deformation of the Thoracic Aorta after Thoracic Endovascular Aortic Repair.** *Annals of vascular surgery*  
Hirotsu, K., Suh, G., Lee, J. T., Dake, M. D., Fleischmann, D., Cheng, C. P.  
2017
- **Quantification of motion of the thoracic aorta after ascending aortic repair of type-A dissection** *INTERNATIONAL JOURNAL OF COMPUTER ASSISTED RADIOLOGY AND SURGERY*  
Suh, G., Fleischmann, D., Beygui, R. E., Cheng, C. P.  
2017; 12 (5): 811-819
- **If You Build It, They Will Come: How to Establish an Academic Innovation Enterprise** *TECHNIQUES IN VASCULAR AND INTERVENTIONAL RADIOLOGY*  
Srimathveeravalli, G., Balesh, E., Cheng, C. P., Chen, D.  
2017; 20 (2): 121–26
- **Dynamic Geometric Analysis of the Renal Arteries and Aorta following Complex Endovascular Aneurysm Repair.** *Annals of vascular surgery*  
Ullery, B. W., Suh, G., Kim, J. J., Lee, J. T., Dalman, R. L., Cheng, C. P.  
2017
- **Quantification of motion of the thoracic aorta after ascending aortic repair of type-A dissection.** *International journal of computer assisted radiology and surgery*  
Suh, G., Fleischmann, D., Beygui, R. E., Cheng, C. P.  
2016: -?
- **Three-Dimensional Modeling Analysis of Visceral Arteries and Kidneys during Respiration.** *Annals of vascular surgery*  
Suh, G., Choi, G., Herfkens, R. J., Dalman, R. L., Cheng, C. P.  
2016; 34: 250-260
- **Comparative geometric analysis of renal artery anatomy before and after fenestrated or snorkel/chimney endovascular aneurysm repair** *JOURNAL OF VASCULAR SURGERY*  
Ullery, B. W., Suh, G., Lee, J. T., Liu, B., Stineman, R., Daman, R. L., Cheng, C. P.  
2016; 63 (4): 922-929
- **Comparative geometric analysis of renal artery anatomy before and after fenestrated or snorkel/chimney endovascular aneurysm repair.** *Journal of vascular surgery*  
Ullery, B. W., Suh, G., Lee, J. T., Liu, B., Stineman, R., Dalman, R. L., Cheng, C. P.  
2016; 63 (4): 922-929
- **Quantification of In Vivo Kinematics of Superficial Femoral Artery due to Hip and Knee Flexion Using Magnetic Resonance Imaging** *JOURNAL OF MEDICAL AND BIOLOGICAL ENGINEERING*  
Choi, G., Cheng, C. P.  
2016; 36 (1): 80-86
- **Abdominal Aortic Hemodynamics in Intermittent Claudication Patients at Rest and during Dynamic Pedaling Exercise** *ANNALS OF VASCULAR SURGERY*  
Cheng, C. P., Taylor, C. A., Dalman, R. L.  
2015; 29 (8): 1516-1523
- **Geometry and respiratory-induced deformation of abdominal branch vessels and stents after complex endovascular aneurysm repair** *JOURNAL OF VASCULAR SURGERY*  
Ullery, B. W., Suh, G., Lee, J. T., Liu, B., Stineman, R., Dalman, R. L., Cheng, C. P.

2015; 61 (4): 875-884

- **Aortic Arch Vessel Geometries and Deformations in Patients with Thoracic Aortic Aneurysms and Dissections** *JOURNAL OF VASCULAR AND INTERVENTIONAL RADIOLOGY*  
Suh, G., Beygui, R. E., Fleischmann, D., Cheng, C. P.  
2014; 25 (12): 1903-1911
- **Methods for Characterizing Human Coronary Artery Deformation From Cardiac-Gated Computed Tomography Data** *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*  
Choi, G., Xiong, G., Cheng, C. P., Taylor, C. A.  
2014; 61 (10): 2582-2592
- **Respiratory-Induced 3D Deformations of the Renal Arteries Quantified With Geometric Modeling During Inspiration and Expiration Breath-Holds of Magnetic Resonance Angiography** *JOURNAL OF MAGNETIC RESONANCE IMAGING*  
Suh, G., Choi, G., Draney, M. T., Herfkens, R. J., Dalman, R. L., Cheng, C. P.  
2013; 38 (6): 1325-1332
- **Respiration-induced Deformations of the Superior Mesenteric and Renal Arteries in Patients with Abdominal Aortic Aneurysms.** *Journal of vascular and interventional radiology*  
Suh, G., Choi, G., Herfkens, R. J., Dalman, R. L., Cheng, C. P.  
2013; 24 (7): 1035-1042
- **Hemodynamic Changes Quantified in Abdominal Aortic Aneurysms with Increasing Exercise Intensity Using MR Exercise Imaging and Image-Based Computational Fluid Dynamics** *ANNALS OF BIOMEDICAL ENGINEERING*  
Suh, G., Les, A. S., Tenforde, A. S., Shadden, S. C., Spilker, R. L., Yeung, J. J., Cheng, C. P., Herfkens, R. J., Dalman, R. L., Taylor, C. A.  
2011; 39 (8): 2186-2202
- **Quantification of Particle Residence Time in Abdominal Aortic Aneurysms Using Magnetic Resonance Imaging and Computational Fluid Dynamics** *ANNALS OF BIOMEDICAL ENGINEERING*  
Suh, G., Les, A. S., Tenforde, A. S., Shadden, S. C., Spilker, R. L., Yeung, J. J., Cheng, C. P., Herfkens, R. J., Dalman, R. L., Taylor, C. A.  
2011; 39 (2): 864-883
- **The NovoStent® SAMBA® stent: A novel alternating helix self-expanding nitinol stent design** *Interventional Cardiology*  
Zeller T., Braunlich S., Waldo M., Cheng C.P., Macharzina R., Scheinert D., Rastan A.  
2011; 3 (2): 247-261
- **The Effect of Aging on Deformations of the Superficial Femoral Artery Resulting from Hip and Knee Flexion: Potential Clinical Implications** *JOURNAL OF VASCULAR AND INTERVENTIONAL RADIOLOGY*  
Cheng, C. P., Choi, G., Herfkens, R. J., Taylor, C. A.  
2010; 21 (2): 195-202
- **Quantifying In Vivo Hemodynamic Response to Exercise in Patients With Intermittent Claudication and Abdominal Aortic Aneurysms Using Cine Phase-Contrast MRI** *JOURNAL OF MAGNETIC RESONANCE IMAGING*  
Tenforde, A. S., Cheng, C. P., Suh, G., Herfkens, R. J., Dalman, R. L., Taylor, C. A.  
2010; 31 (2): 425-429
- **In Vivo Deformation of the Human Abdominal Aorta and Common Iliac Arteries With Hip and Knee Flexion: Implications for the Design of Stent-Grafts** *JOURNAL OF ENDOVASCULAR THERAPY*  
Choi, G., Shin, L. K., Taylor, C. A., Cheng, C. P.  
2009; 16 (5): 531-538
- **Methods for Quantifying Three-Dimensional Deformation of Arteries due to Pulsatile and Nonpulsatile Forces: Implications for the Design of Stents and Stent Grafts** *ANNALS OF BIOMEDICAL ENGINEERING*  
Choi, G., Cheng, C. P., Wilson, N. M., Taylor, C. A.  
2009; 37 (1): 14-33
- **QUANTIFICATION OF THE DEFORMATION OF THE HUMAN ILIAC ARTERIES WITH HIP AND KNEE FLEXION: IMPLICATIONS FOR STENT-GRAFT DESIGN** *ASME Summer Bioengineering Conference*  
Choi, G., Shin, L. K., Taylor, C. A., Cheng, C. P.  
AMER SOC MECHANICAL ENGINEERS.2009: 239-240

- **IN VIVO QUANTIFICATION OF HUMAN CORONARY ARTERY DEFORMATION FROM CARDIAC-GATED COMPUTED TOMOGRAPHY DATA** *ASME Summer Bioengineering Conference*  
Choi, G., Dusch, M. N., Xiong, G., Xiao, N., Cheng, C. P., Taylor, C. A.  
AMER SOC MECHANICAL ENGINEERS.2009: 983-984
- **Biomechanical Response of Stented Carotid Arteries to Swallowing and Neck Motion** *JOURNAL OF ENDOVASCULAR THERAPY*  
Robertson, S. W., Cheng, C. P., Razavi, M. K.  
2008; 15 (6): 663-671
- **Right renal artery in vivo stent fracture** *JOURNAL OF VASCULAR AND INTERVENTIONAL RADIOLOGY*  
Robertson, S. W., Jessup, D. B., Boero, I. J., Cheng, C. P.  
2008; 19 (3): 439-442
- **A Review of Peripheral Vascular Deformations Due to Respiration and Musculoskeletal Influences** *Journal of ASTM International (Symposium on Fatigue and Fracture of Medical Metallic Materials and Devices)*  
Cheng, C.P.  
2008; 5 (10): JAI102074
- **Methods for quantifying vessel deformation due to pulsatile and non-pulsatile forces** *ASME Summer Bioengineering Conference*  
Choi, G., Cheng, C. P., Wilson, N. M., Taylor, C. A.  
AMER SOC MECHANICAL ENGINEERS.2007: 543-544
- **Hemodynamics in human abdominal aortic aneurysms during rest and simulated exercise** *ASME Summer Bioengineering Conference*  
Les, A. S., Cheng, C. P., Blomme, M. T., Figueroa, C. A., LaDisa, J. F., Park, J. M., Herfkens, R. J., Dalman, R. L., Taylor, C. A.  
AMER SOC MECHANICAL ENGINEERS.2007: 169-170
- **Relative lung perfusion distribution in normal lung scans: observations and clinical implications.** *Congenital heart disease*  
Cheng, C. P., Taur, A. S., Lee, G. S., Goris, M. L., Feinstein, J. A.  
2006; 1 (5): 210-216
- **Abdominal aortic hemodynamics in young healthy adults at rest and during lower limb exercise: quantification using image-based computer modeling** *AMERICAN JOURNAL OF PHYSIOLOGY-HEART AND CIRCULATORY PHYSIOLOGY*  
Tang, B. T., Cheng, C. P., Draney, M. T., Wilson, N. M., Tsao, P. S., Herfkens, R. J., Taylor, C. A.  
2006; 291 (2): H668-H676
- **In vivo MR angiographic quantification of axial and twisting deformations of the superficial femoral artery resulting from maximum hip and knee flexion** *JOURNAL OF VASCULAR AND INTERVENTIONAL RADIOLOGY*  
Cheng, C. P., Wilson, N. M., Hallett, R. L., Herfkens, R. J., Taylor, C. A.  
2006; 17 (6): 979-987
- **Proximal pulmonary artery blood flow characteristics in healthy subjects measured in an upright posture using MRI: The effects of exercise and age** *12th Annual Meeting of the International-Society-for-Magnetic-Resonance-in-Medicine*  
Cheng, C. P., Herfkens, R. J., Taylor, C. A., Feinstein, J. A.  
JOHN WILEY & SONS INC.2005: 752-58
- **Blood flow conditions in the proximal pulmonary arteries and vena cavae: healthy children during upright cycling exercise** *AMERICAN JOURNAL OF PHYSIOLOGY-HEART AND CIRCULATORY PHYSIOLOGY*  
Cheng, C. P., Herfkens, R. J., Lightner, A. L., Taylor, C. A., Feinstein, J. A.  
2004; 287 (2): H921-H926
- **Abdominal aortic hemodynamic conditions in healthy subjects aged 50-70 at rest and during lower limb exercise: in vivo quantification using MRI** *ATHEROSCLEROSIS*  
Cheng, C. P., Herfkens, R. J., Taylor, C. A.  
2003; 168 (2): 323-331
- **Inferior vena caval hemodynamics quantified in vivo at rest and during cycling exercise using magnetic resonance imaging** *AMERICAN JOURNAL OF PHYSIOLOGY-HEART AND CIRCULATORY PHYSIOLOGY*  
Cheng, C. P., Herfkens, R. J., Taylor, C. A.  
2003; 284 (4): H1161-H1167
- **Dynamic exercise imaging with an MR-Compatible stationary cycle within the general electric open magnet** *MAGNETIC RESONANCE IN MEDICINE*

Cheng, C. P., Schwandt, D. F., Topp, E. L., Anderson, J. H., Herfkens, R. J., Taylor, C. A.  
2003; 49 (3): 581-585

- **Comparison of abdominal aortic hemodynamics between men and women at rest and during lower limb exercise** *JOURNAL OF VASCULAR SURGERY*

Cheng, C. P., Herfkens, R. J., Taylor, C. A.  
2003; 37 (1): 118-123

- **Quantification of wall shear stress in large blood vessels using lagrangian interpolation functions with cine phase-contrast magnetic resonance imaging** *ANNALS OF BIOMEDICAL ENGINEERING*

Cheng, C. P., Parker, D., Taylor, C. A.  
2002; 30 (8): 1020-1032

- **In vivo quantification of blood flow and wall shear stress in the human abdominal aorta during lower limb exercise** *ANNALS OF BIOMEDICAL ENGINEERING*

Taylor, C. A., Cheng, C. P., Espinosa, L. A., Tang, B. T., Parker, D., Herfkens, R. J.  
2002; 30 (3): 402-408