

# Calvin Kuo | Curriculum Vitae

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## Research Keywords

Sensorimotor Physiology	Bayesian Estimation	Wearable Sensors
Musculoskeletal Modeling and Simulation	Statistical Inference	Convex Optimization
Rigid Body Dynamics	Machine Learning	Robotic Control
Motion Capture	Reinforcement Learning	Nonlinear Control
Traumatic Brain Injury	Computer Vision	Sensor Fusion

## Positions and Education

- **Assistant Professor in School of Biomedical Engineering** **Current**  
University of British Columbia, BC, Canada
- **Killam Postdoctoral Scholar** **2020**  
University of British Columbia, BC, Canada  
Advisors: Jean-Sébastien Blouin, Dinesh Pai
- **Ph.D. in Mechanical Engineering** **2018**  
Stanford University, CA, USA  
Advisors: David Camarillo, Scott Delp
- **M.S. in Mechanical Engineering** **2015**  
Stanford University, CA, USA
- **B.S. in Mechanical Engineering and Computer Science** **2011**  
California Institute of Technology, CA, USA

## Peer-Reviewed Journal Publications

1. **Kuo C.**, Liang Z., Fan Y., Blouin J.-S., Pai D., 2019, Creating Impactful Characters: Correcting Human Impact Accelerations using High Rate IMUs in Dynamics Activities. *ACM Transactions on Graphics*. 38(4), 47.
2. **Kuo C.**, Sheffels J., Fanton M., Yu B., Hamalainen R., Camarillo D.B., 2019, Passive Cervical Spine Ligaments Provide Stability during Head Impacts. *Journal of the Royal Society Interface*, 16(154), 20190086.
3. Abboud J., **Kuo C.**, Descarreaux M., Blouin J.-S., 2019, Regional Activation in the Human Longissimus Thoracis pars Lumborum Muscle. *In Press at The Journal of Physiology*.
4. Chen A., Khosravi-Hashemi N., **Kuo C.**, Kramer J., Blouin J.-S., 2019, Development of a Conversion Model between Mechanical and Electrical Vestibular Stimuli. *Under Review at Journal of Neurophysiology*.
5. Ipsiroglu O., Bao S., Beyzaei N., Bao Y., Chen M., Hussaina H., Kloesch G., Kohn B., Kuzeljevic B., Maher K. S., McWilliams S., Spruyt K., Tse E., **Kuo C.**, Van der Loos H. F., 2019. Is Fidgety Phillip's Ground Truth Also Ours? How to Become a Learning System. *Under Review at Frontiers in Psychiatry*.
6. Tierney G., **Kuo C.**, Wu L., Camarillo D.B., 2019. Head-impact Severity from Helmet and Body Contact Events during Blocking in Collegiate-Level American Football Match-play and Practice. *Under Review at American Journal of Sports Medicine*.

7. Fanton M., **Kuo C.**, Sganga J., Hernandez F., Camarillo D.B., 2018, Dependency of Head Impact Rotation on Head-Neck Positioning and Soft Tissue Forces. *IEEE Transactions on Biomedical Engineering*.
8. **Kuo C.**, Fanton M., Wu L., Camarillo D.B., 2018. Spinal Constraint Modulates Head Instantaneous Center of Rotation and Dictates Head Angular Motion. *Journal of Biomechanics*, 76, 220-228.
9. **Kuo C.**, Wu L.C., Loza J., Senif D., Anderson S.C., and Camarillo, D.B., 2018. Comparison of Video-Based and Sensor-Based Head Impact Exposure. *Plos One*, 13(6), e0199238.
10. **Kuo C.**, Sganga J., Fanton M., Camarillo D.B., 2018. Head Impact Kinematics Estimation with Network of Inertial Measurement Units. *Journal of Biomechanical Engineering*, 140(9), 091006.
11. **Kuo C.**, Wu L.C., Zhao W., Fanton M., Ji S., and Camarillo D.B., 2018. Propagation of Errors from Skull Kinematic Measurements to Finite Element Tissue Responses. *Biomechanics and Modeling in Mechanobiology*, 17(1), 235-247.
12. Miller L.E., **Kuo C.**, Wu L.C., Urban L.E., Camarillo D.B., Stitzel J.D., 2018. Validation of a Custom Instrumented Retainer Form Factor for Measuring Linear and Angular Head Impact Kinematics. *Journal of Biomechanical Engineering*, 140(5), 054501.
13. Wu L.C., **Kuo C.**, Loza J., Kurt M., Laksari K., Yanez L.Z., Senif D., Anderson S.C., Miller L.E., Urban J.E., Stitzel J.D., Camarillo D.B., 2018. Accurate Detection of Football Head Impacts Using Biomechanical Features and Support Vector Machine Classification. *Scientific Reports*, 8(1), 855.
14. **Kuo C.\***, Wu L.C.\*, Ye P.P.\*, Laksari K., Camarillo D.B., Kuhl E., 2017. Pilot Findings of Brain Displacement and Deformations during Roller Coaster Rides. *Journal of Neurotrauma*, 34(22), 3198-3205. \*co-first authors.
15. Zhao W., **Kuo C.**, Wu L., Camarillo D.B., Ji S., 2017. Performance Evaluation of a Pre-Computed Brain Response Atlas in Dummy Head Impacts. *Annals of Biomedical Engineering*, 45(10), 2437-2450.
16. **Kuo C.**, Wu L.C., Hammor B.T., Luck J.F., Cutcliffe H.C., Lynall R.C., Kait J.R., Campbell K.R., Mihalik J.P., Bass C.R. and Camarillo D.B., 2016. Effect of the mandible on mouthguard measurements of head kinematics. *Journal of biomechanics*, 49(9), 1845-1853.
17. Jain A., **Kuo C.**, Sinkarenko I., 2016. Feedforward dynamics for the control of articulated multi-limb robots. *Multibody System Dynamics*, 37(1), 49-68.
18. Jain A., **Kuo C.**, Jayakumar P., Cameron J., 2016. Constraint Embedding for Vehicle Suspension Dynamics. *Archive of Mechanical Engineering*, 63(2), 193-213.
19. Kurt M., Laksari K., **Kuo C.**, Grant G.A., Camarillo D.B., 2016. Modeling and Optimization of Airbag Helmets for Preventing Head Injuries in Bicycling. *Annals of Biomedical Engineering*, 45(4), 1148-1160.
20. Wu L.C., Laksari K., **Kuo C.**, Luck J.F., Kleiven S., Bass C.R., Camarillo D.B., 2016. Bandwidth and sample rate requirements for wearable head impact sensors. *Journal of biomechanics*. 49(13), 2918-2924.
21. Wu L.C., Nangia V., Bui K., Hammor B., Kurt M., Hernandez F., **Kuo C.**, Camarillo D.B., 2016. In vivo evaluation of wearable head impact sensors. *Annals of biomedical engineering*, 44(4), 1234-1245. **Editor's Choice 2017**
22. Laksari K., Wu L.C., Kurt M., **Kuo C.**, Camarillo D.C., 2015. Resonance of human brain under head acceleration. *Journal of The Royal Society Interface*, 12(108), 20150331.
23. Hudson N., Ma J., Hebert P., Jain A., Bajracharya M., Allen T., Sharan R., Horowitz M., **Kuo C.**, Howard T., Matthies L., 2014. Model-based autonomous system for performing dexterous, human-level manipulation tasks. *Autonomous Robots*, 36(1-2), 31-49.

## Patents

1. **Kuo C.**, Wu L.C., Laksari K., Camarillo D.B., 2017. "Oral Appliance for Measuring Head Motions by Isolating Sensors from Jaw Perturbance." U.S. Patent Application 15/373,454

## Selected Conference Talks and Invited Talks

1. Ispolagru O., Quante M., Wensley D., McCabe S., Kloesch G., **Kuo C.**, van der Loos M., 2019, September. Capturing Standardized Outcome Measures for Registry Based Single N RCTs (nRCT=1). *World Sleep 2019*. **Invited Panelist**.
2. **Kuo C.**, Liang Z., Fan Y., Blouin J.-S., Pai D., 2019, July. Creating Impactful Characters: Correcting Human Impact Accelerations using High Rate IMUs in Dynamics Activities. *SIGGRAPH 2019*.
3. **Kuo C.**, 2019, May. Uncertainty in Motion Perception. *Optimal Neuroethology of Movement and Motor Control*. **Invited Talk**.
4. **Kuo C.**, Fanton M., Wu L., Camarillo D.B., 2017, October. Head Center of Rotation: How the Neck Constrains Head Motion Following External Loads in Vivo. *Proceedings of the 2017 BMES Annual Meeting*.
5. **Kuo C.** 2017, September. An Instrumented Mouthguard for Concussion Monitoring. *eWear Student Society Annual Symposium*. **Invited Talk**.
6. **Kuo C.**, Sganga J., Fanton M., Camarillo D., 2017, June. Improving Head Impact Kinematics Measurement Accuracy Using Sensor Fusion of Multiple Sensors. *Proceedings of the 2017 Summer Biomechanics, Bioengineering, and Biotransport Conference*.
7. **Kuo C.**, Fanton M., Wu L., Luck J., Cutcliffe H., Lynall R., Campbell K., Mihalik J., Bass C., Camarillo D.B., 2016, October. Strain-based Validation of an Instrumented Mouthguard. *Proceedings of the BMES 2016 Annual Meeting*.
8. **Kuo C.**, Wu L.C., Camarillo D.B., 2016, July. Novel Instrumented Mouthguard Designs to Accurately Measure Head Kinematics for Traumatic Brain Injury. *Proceedings of the 2016 Summer Biomechanics, Bioengineering, and Biotransport Conference*.
9. **Kuo C.**, Wu L.C., Luck J.F., Cutcliffe H., Lynall R., Kait J., Campbell K., Mihalik J., Bass C., Camarillo D.B., 2015, October. Ex Vivo Evaluation of an Instrumented Mouthguard. *Proceedings of the BMES 2015 Annual Meeting*.

## Open Source Contributions

- OpenSim Head and Neck Project: <https://simtk.org/projects/kuo-head-neck>
- Github Repositories for Project and Sensor Code: <https://github.com/>

## Awards and Fellowships

- Killam Postdoctoral Research Fellowship (2018)
- NSF Graduate Research Fellowship Program Honorable Mention (2015)
- JPL Group Achievement Award for phase 1A in DARPA Humanoid Challenge (2013)
- NASA Group Achievement Award for placing first in the DARPA ARM competition (2012)
- JPL Group Achievement Award for placing first in the DARPA ARM competition (2012)
- Summer Undergraduate Research Fellowship at JPL (2010)
- Summer Undergraduate Research Fellowship at Caltech (2009)

## Teaching and Mentoring

- **Origins of Balance Deficits and Falls Summer School,** **University of British Columbia** **July 2019**
- **RISE Mentor** **June, 2017 – August 2017**  
**Department of Science Outreach, Stanford University**

Student Project:

- Leonardo Espinoza: Observing Deformations in Gelatin Brain Surrogate During Impacts

• **SIMR Mentor** **July, 2016 – August 2017**

**Bioengineering Department, Stanford University**

Student Projects:

- Ashwin Bhumbra: Role of Maximum Axial Cervical Rotation in Torque Generation
- William Hu: 3D Clinical Scanning with a Smart Phone

• **REU Mentor** **July, 2016 – August 2017**

**Bioengineering Department, Stanford University**

Student Projects:

- Jodie Sheffels: Effect of Cervical Spine Ligament Sprain on Head and Neck Stability
- Bianca Yu: Role of Cervical Intervertebral Discs in Head Stabilization. **Finalist, BS-Level Paper Competition, World Congress of Biomechanics 2018**
- Michelle Tran: Machine Learning Techniques for Differentiating Impacts and Non-Impacts in American Football
- Tatyanna Dadobbo: 3D Reconstruction for Clinical Applications

• **SURI Mentor** **July, 2015 – August 2017**

**Mechanical Engineering Department, Stanford University**

Student Projects:

- Jordan Miller: Measuring Deformation in Instrumented Mouthguards
- Jesus Loza: Quality Testing Instrumented Mouthguards
- Rosa Hamalainen: Are Humans more Accurate than Sensors in Head Impact Severity Estimation? **Undergraduate Design Award, BMES 2017**
- Rosa Hamalainen: Designing a Biofidelic Neck Surrogate for Head Impact Testing. **Finalist, BS-Level Paper Competition, World Congress of Biomechanics 2018**
- Alejandra Garcia: Smartphone Based 3D Scanning for Clinical Applications
- Andy Kim: A Pendulum Impactor Design for Helmet and Instrumentation Testing

• **High School Science Fair Mentor** **September, 2015 – March 2016**

**Mechanical Engineering Department, Stanford University**

Student Projects:

- Bhavana Kunisetty: A Novel Concussion Diagnosis System using SCAT3 Baseline Correlations. **First Place, Biomedical and Biological Sciences, Alameda County Science Fair, 2016; Finalist, California Bay Area BioGENEius Challenge, 2016.**
- Helen Gordon: Investigating Saccadic Eye Movements during a Tablet-Based Neurological Test. **First Place San Mateo County STEM Fair, 2017. Finalist at Intel International Science and Engineering Fair, 2017.**

• **ME281: Biomechanics of Motion (Teaching Assistant)** **Winter Quarter 2015, 2017**

**Mechanical Engineering Department, Stanford University**

• **ME485: Modeling and Simulation of Human Motion** **Spring Quarter 2017**

**(Teaching Assistant)**

**Mechanical Engineering Department, Stanford University**

## **Volunteering and Outreach**

- Faculty Faceoff B.C. Science World, February 2019
- Teen Tuesdays B.C. Science World 2018, 2019
- Bay Area Science Festival November 2015, 2016, 2017
- North Bay Science Festival October 2016
- Stanford BioX Science Day Demo June 2016, 2017