

STEVEN K. CHARLES

Associate Professor, Mechanical Engineering

Director, Neuroscience Center

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Research Interests

Biomechanics and neural control of movement

Movement disorders, especially tremor

Assistive, evaluative, and rehabilitative technology

Education

Post-doctoral Research Fellowship, Johns Hopkins University, 2008-2010

Advisors: Amy Bastian (Neuroscience) and Allison Okamura (Mechanical Engineering)

Investigated role of cerebellum in motor control

PhD in Mechanical and Medical Engineering, Harvard-MIT Division of Health Sciences and Technology (HST), 2008

Dissertation: "It's All in the Wrist: A Quantitative Characterization of Human Wrist Control"

Advisor: Prof. Neville Hogan

HST is a joint program between the Massachusetts Institute of Technology and Harvard Medical School that included doctoral coursework and qualifying exams in mechanical engineering at MIT, roughly half of the preclinical coursework at Harvard Medical School, clinical experiences at Harvard-affiliated teaching hospitals, and doctoral research at MIT.

MS in Mechanical Engineering, Massachusetts Institute of Technology, 2004

Thesis: "Design and Thermal Modeling of a Non-invasive Perfusion Probe"

Advisor: Dr. H. Frederick Bowman

BS in Mechanical Engineering, *magna cum laude*, Brigham Young University, 2001

Professional Experience

Director of Neuroscience Center, Aug. 2025-present

Brigham Young University, Provo, UT

Associate Professor, May 2016-present

Department of Mechanical Engineering and Neuroscience Center

Brigham Young University, Provo, UT

Visiting Researcher, 2018

Federal Institute of Technology (ETH) Zurich, Switzerland

Visiting Researcher, 2018
Imperial College London, UK

Assistant Professor, Nov. 2010-Apr. 2016
Neuroscience Center
Brigham Young University, Provo, UT

Assistant Professor, July 2010-Apr. 2016
Department of Mechanical Engineering
Brigham Young University, Provo, UT

Awards

Keith Duffin Teaching & Learning Faculty Fellowship, BYU, 2025-2028
Most Influential Faculty Award, Department of Mechanical Engineering, BYU, 2025
Karl G. Maeser Excellence in Teaching Award, BYU, 2023
Outstanding Teaching Award, Department of Mechanical Engineering, BYU, 2022
Most Influential Faculty Award, Department of Mechanical Engineering, BYU, 2022
Excellence in Teaching Award, Department of Mechanical Engineering, BYU, 2021
Outstanding Teaching Award, Department of Mechanical Engineering, BYU, 2016
Whitaker Foundation Graduate Fellowship (in Biomedical Engineering), 2001-2006
Presidential Fellowship, Massachusetts Institute of Technology, 2001-2002
National Science Foundation Graduate Fellowship, 2001 (declined)
Tau Beta Pi National Scholarship (Engineering Honors Society), 2000-2001
Phi Kappa Phi Undergraduate Writing Award, 2000
Edwin S. Hinckley Scholarship, 1999-2000
Full-Tuition Brigham Young University Scholarship, 1997-1999

Publications

*Note: BYU graduate and undergraduate students are indicated by * and **, respectively.*

Journal Articles

Links to my published journal articles can be found in [My Bibliography](#) at the National Library of Medicine.

1. *Harper B, **McNeill S, **Farmer M, Nichols JA, **Charles SK**. Method for creating subject-specific models of the wrist using measured muscle excitations and joint torques. In review.
2. *Ward SB, Farina D, Allen MS, and **Charles SK**. System identification of tremor propagation models using muscle excitation and joint displacement measurements at the wrist: a proof-of-concept study. In review.

3. *Johnson PK, *Kincaid CJ, **Lush NL, **Jackson SJ, Eggett DL, Feland JB, Bigler ED, and **Charles SK**. Administering movement assessments via markerless motion capture provides new normative values over clinical tests. In review.
4. *Syndergaard I, *Free DB, Farina D, and **Charles SK**. Feedback parameters for a closed-loop multiple-input multiple-output model of the upper limb. *PLOS Computational Biology*, 21(6): e1013183, 2025.
5. *Johnson PK, *Hedges-Muncy AM, Bigler ED, Richards L, and **Charles SK**. Comparing the Sensitivity and Specificity of Novel Motor Assessments for Traumatic Brain Injury. *PM&R*, 1-11, 2025.
6. **Baker S, **Beutler L, *Free DB, Farina D, and **Charles SK**. Potential of individual upper-limb muscles to contribute to postural tremor: simulations from neural drive to joint rotation. *Tremor and Other Hyperkinetic Movements*, 15(1): 7, 2025.
7. *Howes NH, Allen MS, Farina D, and **Charles SK**. A generalized coherence framework for quantifying input contributions in multi-input systems with correlated or uncorrelated inputs. *Biomedical Signal Processing and Control*, 104: 107522, 2025.
8. *Free DB, *Syndergaard I, *Pigg AC, Muceli S, Hallett M, Farina D, **Charles SK**. Hand and distal tremor is most coherent with the activity of elbow flexors and wrist extensors in persons with Essential Tremor. *Journal of Applied Physiology*, 136(2): 337-348, 2024.
9. *Bassett KE, Charles SK, and Bruening D. The signed helical angle: a technique for characterizing midfoot motion during gait. *Journal of Biomechanics*, 159: 111791, 2023.
10. **Metzner C, **Stringham A, **Hislop B, **Bonham J, **Chatterton L, **DeFigueiredo R, and **Charles SK**. Brief, synchronous, submotor-threshold electrical stimulation of antagonist muscles does not suppress Essential Tremor, independent of stimulation frequency. *Tremor and Other Hyperkinetic Movements*, 13:30, 2023.
11. *Kincaid C, *Johnson P, and **Charles SK**. Feasibility of using the Leap Motion Controller to administer conventional motor tests: a proof-of-concept study. *Biomedical Physics & Engineering Express*, 9(3), 2023.
12. *Free DB, *Syndergaard I, *Pigg AC, Muceli S, Thompson-Westra J, Mente K, Maurer CW, Haubenberger D, Hallett M, Farina D, **Charles SK**. Essential Tremor accentuates the pattern of tremor-band coherence between upper-limb muscles. *Journal of Neurophysiology*, 129(3): 524-540, 2023.
13. **Anderton W, **Tew S, **Ferguson S, **Hernandez J, **Charles SK**. Movement preferences of the wrist and forearm during activities of daily living. *Journal of Hand Therapy*, 36(3):580-592, 2023.
14. *Strandberg DJ, *Pigg AC, Thompson-Westra J, Mente K, Maurer CW, Haubenberger D, Hallett M, **Charles SK**. Distribution of tremorogenic activity among the major superficial muscles of the upper limb in subjects with Essential Tremor. *Clinical Neurophysiology*, 142: 20-32, 2022.

15. Puttaraksa G, Muceli S, Barsakcioglu DY, Holobar A, Clarke AK, **Charles SK**, Pons JL, and Farina D. Online Tracking of the Phase Difference Between Neural Drives to Antagonist Muscle Pairs in Essential Tremor Patients. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, 30: 709-718, 2022.
16. ****Bons Z, **Dickinson T, **Clark R, **Beardsley K, Charles SK**. Compensating for soft-tissue artifact using the orientation of distal limb segments during electromagnetic motion capture of the upper limb. *Journal of Biomechanical Engineering*, 144(7), 2022.
17. Ridge S, Bruening D, **Charles SK**, Stahl C, ****Smith D, **Reynolds R, **Adamo B, **Harper B, **Adair C, Manwaring P, and King D**. IceSense Proof of Concept: Calibrating an Instrumented Figure Skating Blade to Measure On-Ice Forces. *Sensors*, 20(24): 7082-7097, 2020.
18. ***Pigg AC, Thompson-Westra J, Mente K, Maurer CW, Haubenberger D, Hallett M, Charles SK**. Distribution of Essential Tremor among the degrees of freedom of the upper limb. *Clinical Neurophysiology*, 131(11): 2700-2712, 2020.
19. ****Clark R, **Dickinson T, **Loaiza J, *Geiger DW, and Charles SK**. Tracking whole-arm movements in-vivo using electromagnetic sensors. *Journal of Biomechanical Engineering*, 142(7), 2020.
20. Puttaraksa G, Muceli S, Gallego JA, Holobar A, **Charles SK**, Pons JL, and Farina D. Voluntary and tremorogenic inputs to motor neuron pools of agonist/antagonist muscles in essential tremor patients. *Journal of Neurophysiology*, 122(5): 2043-2053, 2019.
21. ***Corie TH and Charles SK**. Simulated Tremor Propagation in the Upper Limb: From Muscle Activity to Joint Displacement. *Journal of Biomechanical Engineering-Transactions of the ASME*, 141(8), 2019.
22. ***Allen BC and Charles SK**. Effect of gyroscope parameters on gyroscopic tremor suppression in a single degree of freedom. *Journal of Mechanics in Medicine and Biology*, 19(4), 2019.
23. ***Kincaid CJ, **Vaterlaus AC, **Stanford NR, and Charles SK**. Frequency response of the Leap Motion Controller and its suitability for measuring tremor. *Medical Engineering & Physics*, 63: 72-78, 2019.
24. ****Dorman GR, **Davis KC, *Peadar AW, Charles SK**. Control of redundant pointing movements involving the wrist and forearm. *Journal of Neurophysiology*, 120: 2138-2154, 2018.
25. ***Geiger DW, Eggett DL, Charles SK**. A method for characterizing Essential Tremor from the shoulder to the wrist. *Clinical Biomechanics*, 52: 117-123, 2018.
26. Park SW, Marino H, **Charles SK**, Sternad D, Hogan N. Moving slowly is hard for humans: Limitations of dynamic primitives. *Journal of Neurophysiology*, 118: 69-83, 2017.

27. *Salmond LH, **Davidson AD, **Charles SK**. Proximal-distal differences in movement smoothness reflect differences in biomechanics. *Journal of Neurophysiology*, 117: 1239-1257, 2017.
28. *Davidson AD and **Charles SK**. Fundamental principles of tremor propagation in the upper limb. *Annals of Biomedical Engineering*, 45: 1133-1147, 2017.
29. *Seegmiller DB, Eggett DL, **Charles SK**. Common wrist orthoses and their effects on the stiffness of wrist rotations. *Journal of Rehabilitation Research and Development*, 53(6): 1151-1166, 2016.
30. **Acuña SA, **Smith DM, **Robinson JM, **Hawks JC, Starbuck P, King DL, Ridge ST, **Charles SK**. Instrumented figure skating blade for measuring on-ice skating forces. *Measurement Science and Technology*, 25(12): 125901, 2014.
31. *Drake WB and **Charles SK**. Passive stiffness of coupled wrist and forearm rotations. *Annals of Biomedical Engineering*, 42(9): 1853-1866, 2014.
32. *Peadar AP and **Charles SK**. Dynamics of coupled wrist and forearm rotations. *Journal of Biomechanics*, 47(11): 2779-2785, 2014.
33. **Pando AL, Lee H, *Drake WB, Hogan N, **Charles SK**. Position-dependent characterization of passive wrist stiffness. *IEEE Transactions on Biomedical Engineering*, 61(8): 2235-2244, 2014.
34. Sternad D, Marino H, **Charles SK**, Duarte M, DiPietro L, Hogan N. Transitions between Rhythmic and Discrete Primitives in Unimanual Movements. *Frontiers in Computational Neuroscience*, 7, Article 90, 2013.
35. **Charles SK**, Okamura AM, Bastian AJ. Does a basic deficit in force control underlie cerebellar ataxia? *Journal of Neurophysiology*, 109:1107-1116, 2013.
36. Formica D, **Charles SK**, Zollo L, Guglielmelli E, Hogan N, Krebs HI. The passive stiffness of the wrist and forearm. *Journal of Neurophysiology*, 108:1158-1166, 2012.
37. **Charles SK**, Hogan N. Stiffness, not inertial coupling, determines path curvature in wrist motions. *Journal of Neurophysiology*, 107: 1230-1240, 2012.
38. **Charles SK**, Hogan N. Dynamics of wrist rotations. *Journal of Biomechanics*, Vol. 44, p. 614-621, 2011.
39. **Charles SK**, Hogan N. The curvature and variability of wrist and arm movements. *Experimental Brain Research*, Vol. 203, p. 63-73, 2010.
40. Krebs HI, Volpe BT, Williams D, Celestino J, **Charles SK**, Lynch D, Hogan N. Robot-aided neurorehabilitation: A robot for wrist rehabilitation. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, Vol. 15, Issue 3, p. 327-335, 2007.

Conference Articles and Abstracts

1. *Howes NH, Allen M, Farina D, and **Charles SK**. A generalized coherence framework for quantifying input contributions in multi-input biomechanical systems with correlated or uncorrelated inputs. American Society of Biomechanics, Pittsburgh, PA, 2025.

2. *Syndergaard I, Farina D, and **Charles SK**. Feedback parameters for a closed-loop multiple-input multiple-output model of the upper limb. American Society of Biomechanics, Pittsburgh, PA, 2025.
3. **Alley TB, *Wright DC, and **Charles SK**. Systematic analysis of tremor amplitudes in the upper limb: validating the small-angle approximation. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2025.
4. *Beutler LJ, **Baker S, *Syndergaard I, and **Charles SK**. Principal directions of simulated hand tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2025.
5. **Burt A, **Hamaker B, and **Charles SK**. Characterizing the variability in Essential Tremor across time. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2025.
6. *Howes NH, Allen M, Farina D, and **Charles SK**. A generalized coherence framework for quantifying input contributions in multi-input biomechanical systems with correlated or uncorrelated inputs. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2025.
7. **Francom NB, *Howes NH, *Wright DC, and **Charles SK**. Assessing tremor-band power in muscle activity of patients with tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2025.
8. *Howes NH, Allen M, Farina D, and **Charles SK**. A generalized coherence framework for quantifying input contributions in multi-input systems with correlated or uncorrelated inputs. International Modal Analysis Conference, Society for Experimental Mechanics. Orlando, FL, 2025.
9. *Howes NH, Allen M, Farina D, and **Charles SK**. Novel method to estimate the contributions of individual muscles to a person's tremor. Society for Neuroscience Annual Meeting. Chicago, IL, 2024.
10. *Howes NH, Allen MS, Farina D, and **Charles SK**. Developing novel coherence measures to estimate which muscles are most responsible for tremor. American Society of Biomechanics. Madison, WI, 2024.
11. **Baker S, **Farias C, **Beutler L, *Free D, Farina D, and **Charles SK**. Updated principles of tremor propagation throughout the upper limb based on a model with fifty muscles. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2024.
12. *Curtis CP, **Zinn S, and **Charles SK**. Sensitivity of upper-limb tremor propagation model to model parameters. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2024.
13. **Edralin M, **Meaders T, *Howes N, *Syndergaard I, and **Charles SK**. Characterizing the distribution of Essential Tremor in the six degrees of freedom of the hand. Regional

Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2024.

14. **Farmer M, **Nelson S, Nichols JA, and **Charles SK**. Modeling tremor propagation in OpenSim. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2024.
15. **Francom NB, *Howes NH, and **Charles SK**. Quantifying the portion of muscle activity related to tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2024.
16. *Howes NH, Allen MS, Farina D, and **Charles SK**. Developing novel coherence measures to estimate which muscles are most responsible for tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2024.
17. *Syndergaard I, *Free DB, Farina D, and **Charles SK**. The effect of afferent feedback on tremor propagation: a modeling study. Tremor Congress. New York City, NY, 2023.
18. *Free DB, *Syndergaard I, Farina D, and **Charles SK**. Elbow flexors and wrist extensors are most coherent with hand tremor in essential tremor patients. Tremor Congress. New York City, NY, 2023.
19. *Howes NH, Farina D, and **Charles SK**. Using system identification to determine which muscles are most responsible for a patient's hand tremor. Tremor Congress. New York City, NY, 2023.
20. **Metzner C, **Stringham A, **Hislop B, Bonham J, **Chatterton L, **DeFigueiredo R, and **Charles SK**. Brief, synchronous, submotor-threshold electrical stimulation of antagonist muscles does not suppress essential tremor, independent of stimulation frequency. Tremor Congress. New York City, NY, 2023.
21. **Francom NB, **Urrea J, *Howes NH, and **Charles SK**. Characterization of the tremor-band power of measured muscle activity in patients with essential tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.
22. *Free DB, *Syndergaard I, Farina D, and **Charles SK**. Elbow flexors and wrist extensors are most coherent with hand tremor in patients with essential tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.
23. **Reinsch AM, **Edwards AA, *Free DB, Farina D, and **Charles SK**. Characterization of error in a model of tremor propagation. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.
24. **Beutler LJ, **Baker S, *Syndergaard I, and **Charles SK**. Fifty-muscle computational model of tremor propagation. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.

25. *Syndergaard I, *Free DB, and **Charles SK**. Feedback parameters for a MIMO model of afferent feedback in the arm. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.
26. *Howes N, Allen MS, Farina D, and **Charles SK**. Using frequency response estimation to determine which muscles are most responsible for a patient's hand tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.
27. **Nelson S, **Harper B, Nichols J, and **Charles SK**. Estimating wrist muscle forces and torques during activities of daily living using subject-specific models. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.
28. **Cox J, **Clark R, **Stone E, **Dickinson T, **Beardsley K, and **Charles SK**. Comparison between landmark and postural methods for establishing sensor-to-body calibration for motion capture of whole-arm movements. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2023.
29. *Syndergaard I, *Free D, Farina D, and **Charles SK**. The effect of afferent feedback on tremor propagation: a modeling study. Society for Neuroscience Annual Meeting. San Diego, CA, 2022.
30. **Metzner C, **Stringham A, **Hislop B, **Bonham J, **Chatterton L, **DeFigueiredo R, and **Charles SK**. Brief, synchronous, sensory peripheral electrical stimulation does not suppress essential tremor effectively, independent of stimulation frequency. Society for Neuroscience Annual Meeting. San Diego, CA, 2022.
31. *Free D, *Syndergaard I, *Pigg A, Muceli S, Thompson-Westra J, Mente K, Maurer C, Haubenberger D, Hallet M, Farina D, **Charles SK**. Coherence between muscle activations and tremor in the upper limb of persons with Essential Tremor. Congress of the International Society of Electrophysiology and Kinesiology (ISEK). Quebec City, Canada, 2022.
32. **Meaders TK, **Smith R, *Syndergaard I, and **Charles SK**. Characterizing the distribution of Essential Tremor in six degrees of freedom of the hand. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2022.
33. **Reinsch AM, **Edwards AA, *Free DB, and **Charles SK**. Validation of a Model of Tremor Propagation. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2022.
34. **Metzner CJ, **Stringham A, **Hislop B, **Bonham J, **Chatterton L, **DeFigueiredo R, and **Charles SK**. Brief, synchronous, submotor-threshold stimulation of peripheral muscles does not suppress essential tremor effectively, independent of stimulation frequency. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2022.
35. *Free DB, *Syndergaard I, *Pigg AC, Muceli S, Thompson-Westra J, Mente K, Maurer CW, Haubenberger D, Hallett M, Farina D, and **Charles SK**. Coherence between muscle

- activations and tremor in the upper limb of persons with essential tremor. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2022.
36. *Syndergaard I, *Free DB, Farina D, and **Charles SK**. The effect of afferent feedback on tremor propagation: a modeling study. Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics. Estes Park, CO, 2022.
 37. *Syndergaard I, *Free DB, Farina D, **Charles SK**. The Effect of Afferent Feedback on Tremor Propagation: A Modeling Study. Society for Neuroscience Annual Meeting. Virtual conference, 2021.
 38. **Tew S, **Anderton W, **Ferguson S, **Hernandez J, **Charles SK**. Movement Preferences of the Wrist and Forearm Combined During Activities of Daily Living. Hand and Wrist Biomechanics International Symposium, International Society of Biomechanics Annual Meeting. Virtual Conference, 2021.
 39. *Ward S, Allen M, Farina D, **Charles SK**. Validation of postural tremor model using regression and optimization. Movement Disorders Congress. Virtual Conference, 2021.
 40. *Free DB, *Syndergaard I, *Pigg AC, Muceli S, Thompson-Westra J, Mente K, Maurer CW, Haubenberger D, Hallett M, Farina D, **Charles SK**. Intermuscular coherence within the upper limb in persons with essential tremor. Movement Disorders Congress. Virtual Conference, 2021.
 41. Puttaraksa G, Muceli S, Holobar A, Álvaro Gallego J, **Charles SK**, Pons JL, Farina D. Online tracking of phase difference between neural drive to antagonist muscle pairs of essential tremor patients using digital phase-locked loops. Annual Meeting of the International Society of Electrophysiology and Kinesiology (ISEK). Virtual conference, 2020.
 42. **Bons Z, **Dickinson T, **Clark R, **Beardsley K, **Charles SK**. Soft-tissue Artifact Compensation for Electromagnetic Motion Capture. American Society of Biomechanics Annual Meeting. Atlanta, GA, 2020.
 43. *Ward SB, **Huang JS, **Cutler S, *Curtis CP, **Charles SK**. Using System Identification to Determine how Tremor Propagates in the Upper Limb. American Society of Biomechanics Annual Meeting. Atlanta, GA, 2020.
 44. **Baker SA, *Free DB, **Charles SK**. Which Muscles are Most Responsible for Tremor? Principles from Computer Simulations. American Society of Biomechanics Annual Meeting. Atlanta, GA, 2020.
 45. *Syndergaard I, *Free DB, **Charles SK**. A Novel Closed-Loop MIMO Model for Studying the Effect of Spinal Afferents on Tremor. American Society of Biomechanics Annual Meeting. Atlanta, GA, 2020.
 46. *Free DB, *Syndergaard I, *Pigg AC, Muceli S, Thompson-Westra K, Mente K, Maurer CW, Haubenberger D, Hallett M, Farina D, **Charles SK**. Intermuscular Coherence within the Upper Limb in Persons with Essential Tremor. American Society of Biomechanics Annual Meeting. Atlanta, GA, 2020.

47. **Charles SK**, *Standring D, *Pigg A, Thompson-Westra J, Mente K, Maurer C, Haubenberger D, Hallett M. Distribution of tremorogenic activity and tremor in the upper limbs of persons with essential tremor. Society for Neuroscience Annual Meeting. Chicago, IL, 2019.
48. *Corie TH and **Charles SK**. Simulating tremor propagation in the upper limb. XVII International Symposium on Computer Simulation in Biomechanics, Alberta, Canada, 2019.
49. *Johnson PK, *Kincaid CJ, *Muncy NM, **Charles SK**. A quantitative motor assessment for TBI: Toward linking results to underlying neural injury. Society for Neuroscience Annual Meeting. Washington, DC, 2017.
50. **Charles SK**, *Geiger DW, *Davidson AD, *Pigg AC, *Curtis CP, and *Allen BC. Toward quantitative characterization of essential tremor for future tremor suppression. International Conference on Rehabilitation Robotics. London, UK, 2017.
51. *Pigg A, *Standring D, **Charles SK**. Characterization of essential tremor in the major degrees of freedom of the upper limb. Biomedical Engineering Western Regional Conference. Provo, UT, 2017.
52. *Corie T, **Charles SK**. Simulation of tremor propagation in the upper limb. Biomedical Engineering Western Regional Conference. Provo, UT, 2017.
53. *Curtis CP, **Charles SK**. Using optimization to determine tremor propagation. Biomedical Engineering Western Regional Conference. Provo, UT, 2017.
54. **Dickinson GT, **Charles SK**. Soft-tissue Artifact Compensation for Electromagnetic Motion Capture. Biomedical Engineering Western Regional Conference. Provo, UT, 2017.
55. **Charles SK**, *Davidson AD. How tremor propagates throughout the upper limb. Society for Neuroscience Annual Meeting. San Diego, CA, 2016.
56. *Johnson PK, *Kincaid CJ, Grimshaw SD, Bigler ED, **Charles SK**. A quantitative motor assessment with normative data for traumatic brain injury. Society for Neuroscience Annual Meeting. San Diego, CA, 2016.
57. **Charles SK**, **Davidson AD, *Salmond LH. Do proximal-distal differences in movement reflect differences in biomechanics or neural control? Biomechanics and Neural Control of Movement (BANCOM) Conference. Sterling, OH, 2016.
58. Stahl C, King D, Tuttle N, **Charles SK**, **Adair C, **Harper B, Ridge S. Cross validation of a figure skating blade instrumented to measure figure skating impact forces. *Medicine and Science in Sports and Exercise*, 48: 5 Suppl 1, 2016.
59. Stahl C, **Adair C, **Harper B, Tuttle N, **Charles SK**, Ridge S, King D. Validation of an instrumented figure skating blade to measure force across multiple subjects and days. Mid-Atlantic Regional Meeting of the American College of Sports Medicine. Harrisburg, PA, 2015.

60. *Pigg AC, *Geiger DW, **Charles SK**. Characterization of essential tremor throughout the upper limb. Society for Neuroscience Annual Meeting. Chicago, IL, 2015.
61. **Charles SK**, Grimshaw SD, *Seegmiller DB, **Pando AL, Hogan N, Lee H. Anthropometry of passive wrist stiffness. Society for Neuroscience Annual Meeting. Chicago, IL, 2015.
62. Hogan N, Marino H, **Charles SK**, Sternad D. Moving slowly is hard for humans. Society for Neuroscience Annual Meeting. Chicago, IL, 2015.
63. **Charles SK**, *Salmond LH, **Davidson AD. Proximal-distal differences in movement smoothness reflect differences in biomechanics, not neural control. Annual Meeting of the American Society of Biomechanics. Columbus, OH, 2015.
64. **Charles SK**, *Johnson P, *Kincaid C. Quick, low-cost, sensitive motor assessment using markerless motion capture. Annual Meeting of the American Society of Biomechanics. Columbus, OH, 2015.
65. **Charles SK**. Toward greater collaboration between clinicians and researchers of upper-limb movement disorders. Annual Meeting of the American Society of Biomechanics. Columbus, OH, 2015.
66. **Davidson AD, **Jenkins RP, **Siddoway NJ, **Smith DM, **Stephenson TK, **Toole RL, Redding JD, **Charles SK**. Development of a Low-Cost Upper Extremity Rehabilitation Robot Suitable For Home Use. World Congress of Biomechanics. Boston, MA, 2014.
67. *Geiger DW, **Charles SK**. Characterization of Essential Tremor in Seven Degrees of Freedom of the Upper Limb. World Congress of Biomechanics. Boston, MA, 2014.
68. **Smith DM, **Acuna SA, **Hawks JC, **Packard JG, **Robinson JM, King DL, Ridge ST, **Charles SK**. System for Measuring Figure Skate Forces on Ice. World Congress of Biomechanics. Boston, MA, 2014.
69. *Johnson P, **McCain M, **Charles SK**. Quick, low-cost, and highly sensitive motor assessment using markerless motion capture. Society for Neuroscience Annual Meeting Proceedings. Washington DC, 2014.
70. *Salmond LH, **Charles SK**. Fitting a minimum-jerk trajectory to real data. Society for Neuroscience Annual Meeting Proceedings. San Diego, CA, 2013.
71. **Pando AL, **Hernandez JN, **Charles SK**. Wrist forces and torques during activities of daily living. Society for Neuroscience Annual Meeting Proceedings. San Diego, CA, 2013.
72. *Salmond LH, **Davidson AD, **Charles SK**. Why are wrist rotations less smooth than reaching movements? Annual Meeting of the American Society of Biomechanics. Omaha, NE, 2013.
73. *Peadar AP, **Dorman GR, **Charles SK**. Controlling redundancy in wrist and forearm rotations. Annual Meeting of the American Society of Biomechanics. Omaha, NE, 2013.
74. *Salmond LH, **Charles SK**. Why are wrist rotations considerably less smooth than reaching movements? Society for Neuroscience Annual Meeting Proceedings. New Orleans, LA, 2012.

75. **Hernandez JN, **Charles SK**. Wrist forces and torques during activities of daily living. Society for Neuroscience Annual Meeting Proceedings. New Orleans, LA, 2012.
76. *Geiger DW, **Charles SK**. Characterization of essential tremor throughout the upper limb. Society for Neuroscience Annual Meeting Proceedings. New Orleans, LA, 2012.
77. **Dorman GR, **Charles SK**. Redundancy in wrist and forearm movements. Society for Neuroscience Annual Meeting Proceedings. New Orleans, LA, 2012.
78. **Anderton W, **Charles SK**. Kinematic coupling of wrist and forearm movements. Annual Meeting of the American Society of Biomechanics. Gainesville, FL, 2012.
79. *Drake W, **Charles SK**. Characterization of coupled wrist and forearm stiffness. Annual Meeting of the American Society of Biomechanics. Gainesville, FL, 2012.
80. *Salmond LH, **Charles SK**. Wrist rotations are considerably less smooth than reaching movements. Annual Meeting of the American Society of Biomechanics. Gainesville, FL, 2012.
81. Marino H, Duarte M, **Charles SK**, DiPietro L, Hogan N, Sternad D. Transitions between rhythmic and discrete performance in unimanual movements. Society for the Neural Control of Movement Annual Meeting Proceedings. Venice, Italy, 2012.
82. **Anderton W, *Drake W, **Hernandez J, **Dorman G, *Peadar A, **Pate J, **Charles SK**. Linking wrist biomechanics to wrist movement behavior. Annual Regional National Occupational Research Agenda Young/New Investigators Symposium. Salt Lake City, UT, 2012.
83. **Pate JR, **Charles SK**. Optimizing redundant wrist and forearm rotations. Society for the Neural Control of Movement Annual Meeting Proceedings. San Juan, Puerto Rico, 2011.
84. Duarte M, **Charles SK**, DiPietro L, Sternad D, Hogan N. Transitions between Rhythmic and Discrete Performance in Unimanual Movements. Society for Neuroscience Annual Meeting Proceedings. San Diego, CA, 2010.
85. **Charles, SK**. Using K'NEX to understand and teach concepts in movement biomechanics. Proceedings of the ASME 2010 Summer Bioengineering Conference, Naples, FL, 2010.
86. **Charles SK**, Okamura AM, Bastian AJ. Does a basic deficit in force control underlie cerebellar ataxia? Society for the Neural Control of Movement Annual Meeting Proceedings. Naples, FL, 2010.
87. Grow DI, Bhanpuri NH, **Charles SK**, Bastian AJ, Okamura AM. A Proposed Method for Correcting Coordination Deficits: Models and Simulations. IEEE International Conference on Robotics and Automation. Anchorage, AK, 2010.
88. **Charles SK**, Hogan N. It's All in the Wrist: A Quantitative Characterization of Human Wrist Control. Society for the Neural Control of Movement Annual Meeting Proceedings. Kona, HI, 2009.

89. **Charles SK**, Hogan N. Wrist Rotations Differ from Reaching: Stiffness Matters, Interaction Torques Do Not. Society for Neuroscience Annual Meeting Proceedings. San Diego, CA, 2007.
90. Dipietro L, Levy-Tzedek S, Kaufman MR, **Charles SK**, Krebs HI, Hogan N. Kinematic Analysis of Wrist Motor Learning. Society for Neuroscience Annual Meeting Proceedings. San Diego, CA, 2007.
91. **Charles SK**, Levy-Tzedek S, Dipietro L, Krebs HI, Hogan N. Why Do Wrist Rotations Appear Curved? Society for Neuroscience Annual Meeting Proceedings. Atlanta, GA, 2006.
92. **Charles SK**, Hogan N. Mechanics of Wrist Rotations. Annual Forum of the Harvard-MIT Division of Health Sciences and Technology. Boston, MA, 2006.
93. **Charles SK**, Kai L, Hogan N. Kinematic Analysis of Wrist Rotation in Unimpaired Humans. Progress in Motor Control V Conference. State College, PA, 2005.
94. **Charles SK**, Krebs HI, Volpe BT, Lynch D, Hogan N. Wrist Rehabilitation Following Stroke: Initial Clinical Results. Proceedings of the IEEE 9th International Conference on Rehabilitation Robotics, p. 13-16. Chicago, IL, 2005.

Other Conference Presentations

1. **Phair D, **Nelson S, **Charles SK**, Allen M. Tendon tensiometry: Application to flexor carpi radialis. Summit-ORS Ambassadors Regional Symposium. Sundance, UT, 2023.
2. *Geiger DW, **Charles SK**. Characterization of essential tremor. Annual BYU Gerontology Conference. Provo, UT, 2012.
3. **Charles SK**, Hogan N. Kinematic Analysis of Wrist Rotation in Unimpaired Humans. Annual Forum of the Harvard-MIT Division of Health Sciences and Technology. Boston, MA, 2005.
4. **Charles SK**, Hogan N. Robot-aided Wrist Rehabilitation after Stroke. Whitaker Foundation Conference. La Jolla, CA, 2004.
5. **Charles SK**, Bowman HF. Design and Thermal Modeling of a Non-invasive Perfusion Probe. Annual Forum of the Harvard-MIT Division of Health Sciences and Technology. Boston, MA, 2004.
6. **Charles SK**, Bowman HF. Developing a Simple and Non-Invasive Preliminary Test for Coronary Artery Disease. Annual Forum of the Harvard-MIT Division of Health Sciences and Technology. Boston, MA, 2003.

Invited Presentations

“Moving toward optimized, intelligent orthoses,” Biomechanics and Bioengineering Grand Rounds, BYU, 2022

“Predicting tremor: Toward validated, subject-specific models of tremor,” Biomechanics Grand Rounds, BYU, 2022

“Predicting tremor: Toward validated, subject-specific models of tremor,” Neuromechanics Seminar, University of Florida, Virtual Seminar, 2020

“Determining the Mechanical Origin and Propagation of Tremor for Effective Peripheral Tremor Suppression,” Swiss Federal Institute of Technology (ETH), Zurich, Switzerland, 2018

“Determining the Mechanical Origin and Propagation of Tremor for Future Tremor Suppression,” Biomimetic Membranes and Textiles (René Rossi), Materials Science and Technology (EMPA), St. Gallen, Switzerland, 2018

“Determining the Mechanical Origin and Propagation of Tremor for Future Tremor Suppression,” Next: Neurophysiology and Neuroengineering of Human-Technology Interaction (Giovanni Di Pino and Domenico Formica), Università Campus Bio-medico di Roma, Rome, Italy, 2018

“Current Efforts in Tremor Suppression at BYU,” Neural Rehabilitation Group (José Pons), Cajal Institute, Spanish National Research Council (CSIC), Madrid, Spain, 2018

“Wrist Rotations vs. Shoulder-Elbow Reaching”, Neuromechanical Control and Learning (graduate course taught by Etienne Burdet), Imperial College London, London, UK, 2018

“Current Efforts in Tremor Suppression at BYU,” Farina Research Group (Dario Farina), Imperial College London, London, UK, 2018

“Tremor Suppression,” Human Robotics Lab (Etienne Burdet), Imperial College London, London, UK, 2018

“Preliminary efforts to link TBI-induced motor deficits to the underlying abnormalities seen with neuroimaging,” Movement Control & Neuroplasticity (Stephan Swinnen), KU Leuven, Leuven, Belgium, 2018

“Mechanical Impedance of the Upper Limb: Measurements and Applications,” Biomechanics and Human-Machine Control (Frans van der Helm), Delft University of Technology, Delft, Netherlands, 2018

“Quantitative Motor Assessment of Traumatic Brain Injury,” The Brain-Body Dynamics Lab (Francisco Valero-Cuevas), University of Southern California, Los Angeles, CA, 2016

“Are Wrist Rotations Curved or Straight?” Systems Neuroscience Institute (Peter Strick), University of Pittsburgh, Pittsburgh, PA, 2007

“Monitoring Perfusion by Thermodiffusion,” Conduction and Change of Phase Heat Transfer (2.56), MIT, 2005

“Non-invasive Thermodiffusion Perfusion Measurements in Humans,” Hyperthermia: Biology, Technology, and Cancer Therapy, MIT, 2003

Patents

Stanford N, **Charles SK**. Marker-less monitoring of movement disorders. USA Patent US 11013451 B2, 2021.

Research Grants

Grant:	NIH R15 (\$440k)	09/21-01/25
Title:	Predicting tremor: Developing a validated, subject-specific model of tremor	
Aims:	To develop validated, subject-specific models of tremor to 1) predict tremor, 2) understand how the neuromusculoskeletal system affects tremor, and 3) determine which muscles and joints are most responsible for tremor at the hand.	
Role:	Principal Investigator, with co-investigators D Farina (Imperial College London) and Paolo Moretti (University of Utah)	
Grant:	BYU College of Engineering (\$12.5k)	07/23-12/24
Title:	Identification of tremor subtypes by combining quantitative motor phenotyping and genetic markers	
Aims:	To select protocols, sensors, and analysis methods, and to gather the preliminary data and perform the preliminary analyses necessary to develop an NIH proposal to characterize tremor over multiple days in a very large sample of subjects.	
Role:	Principal Investigator	
Grant:	NSF (\$330k)	07/18-06/21
Title:	Tremor Decomposition: A Method for Determining Which Muscles Are Most Responsible for a Patient's Tremor	
Aims:	To apply mathematical methods from sEMG decomposition to decompose tremor into the muscles causing the tremor, for the purpose of determining optimal locations (muscles, degrees of freedom) to intervene.	
Role:	Principal Investigator (with co-investigator D Farina, Imperial College London)	
Grant:	NIH R15 (\$423k)	04/15-03/19
Title:	Quantitative Characterization of Essential Tremor for Future Tremor Suppression	
Aims:	To identify the mechanical source, propagation, and distribution of tremor in the upper extremity of patients with Essential Tremor, for the purpose of future development of wearable tremor-suppressing devices.	
Role:	Principal Investigator (with co-investigators SA Ning and JD Blotter (both BYU) and consultant M Hallett, NIH Clinical Center)	
Grant:	Pilot Grant, Rocky Mountain Center for Occ. and Env. Health (\$7k)	07/12-06/13
Title:	Wrist stiffness torques and musculoskeletal disorders in industrial workers	
Aims:	To leverage data from a large prospective cohort study of Distal Upper Extremity Musculoskeletal Disorders (DUE MSDs) to evaluate the relationship between DUE and wrist stiffness.	
Role:	Principal Investigator (with AS Merryweather, Co-I)	

Internal (BYU)

High-impact Doctoral Research Assist. for student Brendan Allen (\$90k)	01/16-12/18
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College Research Initiation Grant to study Traumatic Brain Injury (\$10k)	07/15-07/16
MRI Research Facility Grant to investigate Traumatic Brain Injury (\$10k)	03/15-03/16
Mentoring Environment Grant to link wrist behavior to biomech. (\$20k)	01/12-01/13
Mentoring Environment Grant to quantify healthy wrist behavior (\$20k)	01/11-01/12
Gerontology Program Grant to characterize Essential Tremor (\$10k)	01/11-12/11

Professional activities

Conference and Workshop Service

Chair and co-organizer, Symposium titled “Walk This Way, Reach That Way: Exchanges between Upper- and Lower-Limb Biomechanics”, Annual Conference of the American Society of Biomechanics, 2025

Member, Review panel for the Goel Award for Translational Research in Biomechanics, American Society of Biomechanics, 2025

Session Moderator, 2nd International Tremor Congress, 2023

Co-organizer, 2023 Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics, 2022-2023

Abstract reviewer, North American Congress on Biomechanics, 2022

Paper reviewer, ACM/IEEE International Conference on Human-Robot Interaction, 2022

Abstract reviewer, Annual Conference of the American Society of Biomechanics, 2021

Abstract reviewer, Annual Conference of the American Society of Biomechanics, 2020

Paper reviewer, IEEE/RSJ International Conference on Intelligent Robots and Systems, 2019

Judge, Biomedical Engineering Western Regional Conference, 2017

Member of Program Committee, Annual Conference of the American Society of Biomechanics, 2016

Chair and organizer, Symposium on Grand Challenges in Upper-limb Biomechanics, Annual Conference of the American Society of Biomechanics, 2015

Abstract reviewer, Annual Conference of the American Society of Biomechanics, 2015

Abstract reviewer, International Conference on Rehabilitation Robotics, 2015 and 2017

Co-chair, Upper Extremity Biomechanics Session, Annual Conference of the American Society of Biomechanics, 2012

Abstract reviewer, Annual Conference of the American Society of Biomechanics, 2012

Contributor, Biomechanics Priorities Conference (to determine future research priorities in the field of biomechanics), 2010

Scribe, NSF-sponsored Workshop on Neuromechanical Engineering, 2009

Reviewing Service

Journal articles

Reviewer for:

ASME Journal of Biomechanical Engineering
ASME Journal of Mechanisms and Robotics
Control Engineering Practice
Current Opinion in Biomedical Engineering
Exercise and Sport Sciences Review
Frontiers
Heliyon
Human Factors and Ergonomics in Manufacturing and Service Industries
Human Movement Science
IEEE Journal of Biomedical and Health Informatics
IEEE Transactions on Biomedical Engineering
IEEE Transactions on Haptics
IEEE Transactions on Neural Systems and Rehabilitation Engineering
International Journal of Robotics Research
Journal of Applied Biomechanics
Journal of Biomechanics
Journal of Electromyography and Kinesiology
Journal of Hand Therapy
Journal of Motor Behavior
Journal of NeuroEngineering and Rehabilitation
Journal of Neurophysiology
Journal of Neuroscience
Journal of Neuroscience Methods
Journal of Sensors
Medical Engineering and Medical Physics
Scientific Reports
Tremor and Other Hyperkinetic Movements

Grant Proposals

Ad hoc reviewer, CBET DARE, National Science Foundation, 2024

Ad hoc reviewer, Musculoskeletal Rehabilitation Sciences (MRS) Study Section, National Institutes of Health, 2023

Ad hoc reviewer, Velux Foundations, Denmark, 2020

Ad hoc reviewer, Musculoskeletal, Oral, Skin, Rheumatology and Rehab Sciences AREA (R15) Review, National Institutes of Health, 2018

Ad hoc reviewer, Musculoskeletal Rehabilitation Sciences (MRS) Study Section, National Institutes of Health, 2013

Ad hoc reviewer, National Science Foundation, 2011

External Dissertations

Dissertation reviewer for Università Campus Biomedico di Roma, Italy

Professional Affiliations

American Society of Biomechanics

Society for Neuroscience

Hand and Wrist Biomechanics International

Professional Development

Participated in “Multipliers: How the Best Leaders Ignite Everyone's Intelligence” Workshop, BYU, Fall 2022

Audited Detection and Estimation Theory (EC En 672), BYU, Winter 2020

Audited Mathematics of Signals and Systems (EC En 671), BYU, Fall 2019

Executed Professional Development Leave in identification of tremorogenic activity with Dario Farina at Imperial College London (3 months) and in wearable tremor suppression with Roger Gassert at ETH Zurich (3 months), 2018

Audited Stochastic Processes (EC En 670), BYU, Fall 2017

University Service

University Assignments

Director, BYU Neuroscience Center, August 2025-present

College Assignments

College Computing Task Force, September-December 2020

Teaching and Learning Committee, January-August 2019

Department Assignments

Chair, Course Committee for MeEn 275 (Computational Methods in Engineering), July 2023-August 2025

Member, Undergraduate Committee, August 2020-present

Chair, Lab-o-ween Committee (Lab-o-ween is an annual Halloween-themed open house showcasing Mechanical Engineering research labs at BYU), October 2015-present

Member, Dept. PhD Qualifying Exam Subcommittee for Dynamics, System Dynamics and Controls, or Math, March 2011-present

Co-chair, Undergraduate Committee, January-August 2023

Chair, Statistics for Mechanical Engineers Curriculum Committee, August 2020-June 2023

Chair, Course Committee for MeEn 273 (Scientific Computing and CAE), August 2016-June 2023

Faculty Liaison, American Society of Mechanical Engineers, August 2014-August 2020

Member, Curriculum Sub-committee for Mechatronics/System Dynamics/Computing, August 2013-August 2015

Member, Department Faculty Search Committee, February 2012-August 2014

Member, Department External Relations Committee, August 2011-August 2012

Neuroscience Center Assignments

Member, Graduate Committee, May 2019-August 2025

Member, Publicity Committee, 2017-April 2019

Reviewing Service

Reviewer, Chiasm (Undergraduate Research Journal), BYU Neuroscience, 2022

Reviewer, Olsen Mentorship in Biomedical Engineering, 2012, 2014-2017

Reviewer, BYU Emerging Ideas in Biomedical Research Conference, 2012

Reviewer, ORCA Grant Proposals, 2010, 2011, 2012

Other

Panelist, University-wide Proposal Development Bootcamp Workshop, 2015-2017

Judge, BYU Emerging Ideas in Biomedical Research Conference, 2014

Clinical Experience

Medical Clerkship, 2007 (4 weeks)

Mount Auburn Hospital, Cambridge, MA

Under the supervision of resident and attending physicians, administered care for five patients.

Clinical Training, 2007 (6 weeks)

Mount Auburn Hospital, Cambridge, MA; Massachusetts General Hospital and Children's Hospital, Boston, MA

Performed physical exams and medical histories; observed neurologists and surgeons.

Teaching Experience

Courses Taught

BYU Foundations (UNIV 101), University-level course, BYU, Fall 2024-present (1 semester)

Static Systems in Mechanical Engineering (MeEn 101), Mechanical Engineering, Spring 2019-present (4 semesters/terms)

Introduction to Scientific Computing and Computer-aided Engineering (MeEn 273), Mechanical Engineering, Winter 2014-Winter 2022 (3 semesters)

Computational Methods in Engineering (MeEn 275), Mechanical Engineering, Fall 2023-present (5 semesters/terms)

Design of Mechatronic Systems (MeEn 330), Mechanical Engineering, BYU, Winter 2019-present (3 semesters)

Dynamic System Modeling and Analysis (MeEn 335), Mechanical Engineering, BYU, Fall 2010-present (16 semesters/terms)

Coach for Capstone Course (MeEn 475/476), Mechanical Engineering, BYU, Fall 2011-present (14 semesters)

Neuromechanics of Movement (MeEn 552), New graduate-level course in Mechanical Engineering and Neuroscience Center, BYU, Fall 2011-present (14 semesters)

Digital Signal Processing (MeEn 595R), Graduate-level seminar course (1-5 students), Mechanical Engineering, BYU, Summer 2017-present (7 semesters/terms)

Neuroscience Graduate Research Presentation (Neuro 694R; Co-instructor), Graduate-level seminar course, Neuroscience Center, BYU, Winter 2020-present (11 semesters)

Advanced Neuromechanics (MeEn 795R), PhD level course in neuromechanics, Mechanical Engineering, BYU, Spring 2014

Invited Lectures to Students

“Predicting tremor: Toward validated, subject-specific models of tremor,” Neuroscience Club “Food for Thought” Activity, BYU, 2010-2022 (2 lectures)

“Some of the Math involved in Motor Control,” Math for Engineering (MATH 302/303), BYU, 2011-present (25 lectures)

Research presentation and Q&A (Sweet Talk), New Student Seminar for mechanical engineering majors (MeEn 101), 2011-present (13 lectures)

“The Biomechanics and Neural Control of Wrist and Arm Movements,” Introduction to Biomechanics (MeEn 555), BYU, 2010-2020 (4 lectures)

“Pathways to Biomedical Engineering,” Freshman Seminar (UNIV 101), BYU, 2012

“Controlling Upper Limb Movements and Preparing for Graduate School,” BYU Biomedical Eng. Club, 2011

“The Biomechanics and Neural Control of Wrist and Arm Movements,” Department of Physiology and Developmental Biology, Brigham Young University, Provo, UT, 2011

“Control of Movement,” Behavioral Neuroscience (NEURO 380), 2010

Teaching Assistant and Instructor Experiences

Teaching Assistant, Mechanics of Materials, BYU, 2001

Teaching Assistant, Elementary Instrumentation, BYU, 2000 (2 semesters)

Teaching Assistant, Dynamics, BYU, 1999 (2 semesters)

Instructor of French, Missionary Training Center, Provo, UT, 1996-1998

Mentoring Experience

Current Research Assistants

Doctoral Students

Ian Syndergaard, Candidate for PhD in Mechanical Engineering, "Developing and using a closed-loop multiple-input multiple-output model of the arm to identify which muscles contribute most to tremor," Sept. 2018-present

Nolan Howes, Candidate for PhD in Mechanical Engineering, "Tremor decomposition: A method for estimation the contributions of individual muscles to pathological tremor using novel coherence measures," June 2022-present

Chayse Wright, Candidate for PhD in Mechanical Engineering, Jan. 2025-present

Undergraduate Students

Carlos Inca Roca, Mechanical Engineering, Jan. 2025-present

Berkeley Hamaker, Neuroscience, Jan. 2025-present

Thomas Alley, Mechanical Engineering, Jan. 2005-present

Alisa Burt, Neuroscience, Jan. 2025-present

Nicholas Hardman, Mechanical Engineering, June 2025-present

Former Research Assistants

Doctoral Students

Daniel Free, PhD in Mechanical Engineering, "Investigating which muscles are most responsible for tremor through both experimental data and simulation," April 2024

Paula Johnson, PhD in Neuroscience, "A quantitative motor assessment linked to underlying damage in traumatic brain injury," Aug. 2019

Master's Students

Landon Beutler, Candidate for MS in Mechanical Engineering, "Tracing Tremor: From Upper-Limb Neuromusculoskeletal Dynamics to Movement Signatures in Essential Tremor," August 2025

Sydney Ward, MS in Mechanical Engineering, "System identification of postural tremor in wrist flexion-extension and radial-ulnar deviation," Dec. 2021

Paul Curtis, MS in Mechanical Engineering, "Sensitivity of tremor propagation to model parameters," Dec. 2021

Blake Harper, MS in Mechanical Engineering, "Method for creating subject-specific models of the wrist in both degrees of freedom using measured muscle excitations and joint torques," Dec. 2021

David Standring, MS in Mechanical Engineering, "Distribution of tremorogenic muscle activity throughout the upper limb in people with Essential Tremor," Aug. 2019

Thomas Corie, MS in Mechanical Engineering, "Simulated Tremor Propagation in the Upper Limb: From Muscle Activity to Joint Displacement," Apr. 2018

Brendon Allen, MS in Mechanical Engineering, "Effect of Gyroscope Parameters on Gyroscopic Tremor Suppression in a Single Degree of Freedom," Apr. 2018

Adam Pigg, MS in Mechanical Engineering, "Distribution of Essential Tremor among the degrees of freedom of the upper limb," Dec. 2017

Clay Kincaid, MS in Mechanical Engineering, "Quantitative Assessment of Motor Deficits in Patients with Traumatic Brain Injury," Dec. 2016

Andrew Davidson, MS in Mechanical Engineering, "Fundamental Principles of Tremor Propagation in the Upper Limb," Dec. 2016

Erika Baker, Former candidate for MS in Mechanical Engineering (withdrew from program), "Detecting tremor origin from measurements throughout the upper limb," Feb. 2016

Layne Salmond, MS in Mechanical Engineering, "Characterization of Movement Smoothness in Wrist Rotations," Dec. 2014

Daniel Geiger, MS in Mechanical Engineering, "Mechanics of essential tremor throughout the upper limb," Aug. 2014

Daniel Seegmiller, MS in Mechanical Engineering, "Effect of wrist orthoses on wrist joint dynamics," Dec. 2013

Allan Peaden, MS in Mechanical Engineering, "Dynamics of wrist and forearm rotations," Aug. 2013

Will Drake, MS in Mechanical Engineering, "Passive stiffness of coupled wrist and forearm rotations," Apr. 2013

Undergraduate Students with Honors Theses

Christian Metzner, BS in Neuroscience, "Analysis of electromyographic effects of peripheral sensory stimulation on Essential Tremor in tremor suppression study", Dec. 2022

Dorman GR, BS in Neuroscience, "Control of redundant wrist and forearm movements," Dec. 2013

Salmond LH, BS in Mechanical Engineering, "Characterization of speed and smoothness in wrist rotations, Mechanical Engineering," Dec. 2012

Undergraduate Students without Honors Theses

Steven Zinn, Neuroscience, January 2023-December 2024
Max Robison, Neuroscience, June-August 2024
Edralin McKaelin, Mechanical Engineering, January-August 2024
Melissa Farmer, Mechanical Engineering, January 2023-May 2024
Samantha Nelson, Mechanical Engineering, September 2022-June 2024
Stephen Jackson, Neuroscience, September 2022-April 2024
Ryan Hanson, Mechanical Engineering, January-April 2024
Caio Farias, Mechanical Engineering, January-April 2024
Landon Beutler, Mechanical Engineering, September 2022-June 2024
Noah Francom, Mechanical Engineering, May 2022-June 2024
Reed Zitting, Mechanical Engineering, May-August 2023
Jacob Cox, Mechanical Engineering, September 2022-April 2023
Timothy Baird, Mechanical Engineering, September 2022-April 2023
Julian Urrea, Mechanical Engineering, September 2022-April 2023
Adam Reinsch, Mechanical Engineering, September 2021-April 2023
Alex Edwards, Mechanical Engineering, September 2021-August 2023
Tasia Meaders, Mechanical Engineering, September 2017-April 2018, January 2020-April 2023
Jason Finch, Mechanical Engineering, September 2022-December 2022
Nolan Howes, Mechanical Engineering, January 2022-June 2022
Lindsay Akagi, Mechanical Engineering, September 2019-April 2022
Michela Lo Russo, Mechanical Engineering, January 2021-August 2021
Anna Knutson, Mechanical Engineering, January 2021-April 2021
Enoch Groberg, Mechanical Engineering, January 2021-April 2021
Zach Bons, Mechanical Engineering, September 2019-April 2021
Larrisa Chatterton, Neuroscience, September 2019-April 2021
Ryan Smith, Mechanical Engineering, January 2019-April 2021
Kyle Adams, Neuroscience, September 2019-December 2020
Spencer Baker, Mechanical Engineering, January 2019-August 2020
Parker King, Mechanical Engineering, January 2019-August 2020
Jing-Song (Jason) Huang, Mechanical Engineering, January 2019-April 2020
Brenna Hislop, Mechanical Engineering, January 2019-April 2020

Lorin Costley, Mechanical Engineering, September 2019-April 2020
Scott Tew, Mechanical Engineering, September 2019-April 2020
Eric Stone, Mechanical Engineering, January-August 2019
Nic Lush, Mechanical Engineering, June 2017-August 2019
Madeline Ward, Mechanical Engineering, January-June 2019
Adam Stringham, Mechanical Engineering, April 2017-April 2019
Sadie Cutler, Mechanical Engineering, April 2017- April 2019
Joseph Bonham, Mechanical Engineering, April 2017- April 2019
Josh Tsai, Mechanical Engineering, Sept. 2017-April 2018
Ryan Clark, Mechanical Engineering, May 2016-April 2018
Austin Vaterlaus, Mechanical Engineering, May 2016-April 2018
Timothy Shoop, Mechanical Engineering, April 2017-April 2018
Riley Reynolds, Mechanical Engineering, April 2017-April 2018
Daniel Free, Mechanical Engineering, April 2017-Aug. 2018
Michael Eyler, Mechanical Engineering, April 2017-Dec. 2017
Ryan DeFigueiredo, Neuroscience, Sept. 2015-August 2017
Chris Adair (co-advised), Mechanical Engineering, June 2015-April 2017
Taylor Dickinson, Mechanical Engineering, May 2016-April 2017
Thomas Corie, Mechanical Engineering, Jan 2016-April 2016
Paul Curtis, Mechanical Engineering, May 2015-June 2016
Blake Harper (co-advised), Mechanical Engineering, Jan. 2015-April 2016
Whitney Smith, Mechanical Engineering, Sept. 2015-April 2016
Bryce DeFigueiredo, Mechanical Engineering, Apr. 2013 – August 2015
Kevin Davis, Neuroscience, Apr. 2013 – June 2015
Kari Beardsley, Mechanical Engineering, Apr. 2015 – June 2105
Nathan Stanford, Neuroscience, Sept. 2012 – Apr. 2015
Nicholas Whipple (co-advised), Mechanical Engineering, Apr. 2014 – Apr. 2015
Daniel Bodily, Mechanical Engineering, Jan. 2015 – Apr. 2015
Jason Skouson, Mechanical Engineering, Jan. 2015 – Apr. 2015
Brandon Adamo (co-advised), Mechanical Engineering, Jan. 2014 – Dec. 2014
Michael McCain, Mechanical Engineering, Jan. 2013 – Apr. 2014

Jordan Peterson, Mechanical Engineering, Jan. 2013 – Apr. 2014
Danny Smith (co-advised), Mechanical Engineering, Jan. 2013 – Apr. 2014
Andrew Davidson, Mechanical Engineering, Jan. 2013 – Apr. 2014
Johnfredy Loaiza, Mechanical Engineering, Apr. 2013 – Apr. 2014
Spencer Ferguson, Mechanical Engineering, Sept. 2013 – Apr. 2014
Natalie Siddoway, Mechanical Engineering, Sept. 2013 – Apr. 2014
Michael Cloward, Mechanical Engineering, Sept. – Dec. 2013
Jacob Jackson, Mechanical Engineering, Apr. – Dec. 2013
Alex Hutchings, Mechanical Engineering, Apr. – June 2012
Jacob Robinson, Mechanical Engineering, Apr. 2012 – Apr. 2013
Autumn Pando, Mechanical Engineering, Jan. 2012 – Apr. 2013
Nathan Doyle, Neuroscience, Spring/Summer 2011 – 2012, Jan. 2013 – Apr. 2013
Garrett Dorman, Neuroscience, Jan. 2011 – Dec. 2013
Dilip Malla, Mechanical Engineering, Summer 2012
Jacob Hipps, Mechanical Engineering, Jan. 2011 – Apr. 2011
Layne Salmond, Mechanical Engineering, Sept. 2010 – Apr. 2012
Joshua Hernandez, Neuroscience, Sept. 2010 – June 2012
Jenny Pate, Mechanical Engineering, Sept. 2010 – Apr. 2011
Will Anderton, Mechanical Engineering, Sept. 2010 – Aug. 2012
Samuel Acuna, Mechanical Engineering, Sept. 2010 – Dec. 2012
Will Drake, Mechanical Engineering, Sept. 2010 – Apr. 2011
Charles Wang, Biomedical Engineering, Johns Hopkins University, 2009 – 2010
Karina Pikhart, Mechanical Engineering, MIT, 2006 – 2008
Philip Pare, Summer intern, MIT, Summer 2005
Lauren Kai, Mechanical Engineering, MIT, 2004 – 2005

Advising of Student Awards

Undergraduate research assistant Thomas Alley received the “Best Undergraduate Student Poster Presentation Award” at the Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics in Estes Park, CO, 2025

Doctoral research assistant Nolan Howes received the “Students’ Choice Podium Presentation Award” at the Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics in Estes Park, CO, 2023

Undergraduate research assistant Samantha Nelson received the “Students’ Choice Poster Presentation Award” at the Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics in Estes Park, CO, 2023

Undergraduate research assistant Jacob Cox received the “Best Undergraduate Poster Presentation Award” at the Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics in Estes Park, CO, 2023

Doctoral research assistant Ian Syndergaard received the Best Doctoral Podium Presentation Award at the Regional Meeting of the Rocky Mountain Chapter of the American Society of Biomechanics in Estes Park, CO, 2022

In collaboration with future doctoral research assistant Brendan Allen (anticipated to start Jan. 2016), obtained BYU’s High Impact Doctoral Research Assistantship (HIDRA), a three-year, \$90k assistantship designed to attract high-quality graduate students who received their undergraduate educations at institutions other than BYU, 2015

Advisor for undergraduate research assistant (Nathan Stanford), who founded Vykon company to develop DextraSense software for markerless monitoring of movement disorders (co-invented with SK Charles) and won the 2015 Miller New Venture Challenge (\$15k in start-up funds), as well as being selected as a finalist in the 2015 Utah Entrepreneur Challenge and one of the “5 coolest, most successful BYU inventions in 2015”¹

Advisor for undergraduate student (Andrew Davidson), who won the Best Product award from the BYU Social Venture Academy for a low-cost rehabilitation robot developed under my direction, 2014

Advisor for MS student (Daniel Geiger), who was selected as finalist for the MS Student Paper Competition at the World Congress of Biomechanics Conference, Boston, MA, 2014

Advisor for six undergraduate research assistants (Adam Stringham, Will Drake, Jenny Pate, Josh Hernandez, Garrett Dorman, and Autumn Pando), who received Student Mentoring Grants from the BYU Office of Research and Creative Activities, 2010 – 2012, 2017

Advising of Student Presentations (not listed under Publications above)

Edwards A, Reinsch A, Free DB, and Charles SK. Measurement of Error in a Model of Tremor Propagation. Utah Undergraduate Research Conference. Salt Lake City, UT, 2023.

Francom N, Howes N, Charles SK. Characterization of the Power Spectral Density of Essential Tremor. Utah Undergraduate Research Conference. Salt Lake City, UT, 2023.

Baker S, Charles SK. Principles of Tremor Propagation from Neurological Activity to Joint Displacement Discovered from Upper Limb Simulation. Utah Undergraduate Research Conference. Logan, UT, 2020.

Smith, Danny. Instrumentation of a Force Measurement System for On-Ice Figure Skating Jumps. Utah Undergraduate Research Conference. Provo, UT, 2014.

¹ See <http://news.byu.edu/archive15-may-techtransfer.aspx>

Pando A. Wrist Forces and Torques during Activities of Daily Living. Utah Undergraduate Research Conference. Logan, UT, 2013.

Robinson J. Measuring impact forces during figure skating jumps. Utah Undergraduate Research Conference. Logan, UT, 2013.

Awards

Keith Duffin Teaching & Learning Faculty Fellowship, BYU, 2025-2028

Most Influential Faculty Award, Department of Mechanical Engineering, BYU, 2025

Karl G. Maeser Excellence in Teaching Award, BYU, 2023

Outstanding Teaching Award, Department of Mechanical Engineering, BYU, 2022

Most Influential Faculty Award, Department of Mechanical Engineering, BYU, 2022

Excellence in Teaching Award, Department of Mechanical Engineering, BYU, 2021

Outstanding Teaching Award, Department of Mechanical Engineering, BYU, 2016

Whitaker Foundation Graduate Fellowship (in Biomedical Engineering), 2001-2006

Presidential Fellowship, Massachusetts Institute of Technology, 2001-2002

National Science Foundation Graduate Fellowship, 2001 (declined)

Tau Beta Pi National Scholarship (Engineering Honors Society), 2000-2001

Phi Kappa Phi Undergraduate Writing Award, 2000

Edwin S. Hinckley Scholarship, 1999-2000

Full-Tuition Brigham Young University Scholarship, 1997-1999

Community Outreach

Remote presentation on preparing to become a mechanical engineer, given virtually to High School Robotics Club, Skagway, AK, 2022

Presentation on Rehabilitation Robotics, Juvenile Detention Center, Provo, UT, 2015

Presentation on Neuromechanics Lab to under-privileged sixth graders in the Provo Youth Mentoring Program, 2015

Presentation on Rehabilitation Robotics, BYU Traumatic Brain Injury and Stroke Support Group, Provo, UT, 2014

BYU produced video and news release on research to measure forces in figure skaters, resulting in national and international coverage on the "Smartblade" in 18 venues on television, radio, and internet, including Top BYU videos of 2014 (31,000 views), 2014.²

² See <https://news.byu.edu/news/figure-8-skaters-feel-eight-times-their-body-weight-when-they-land-jump> or <https://www.youtube.com/watch?v=wx1dLQfnZ8>

Presentation on Markerless Motion Capture for Evaluating Essential Tremor, Educational Seminar sponsored by the International Essential Tremor Foundation, Provo, UT, 2013

Research on using the Leap Motion sensor to measure tremor in patients with Essential Tremor was featured in Tremor Talk, the publication of the International Essential Tremor Foundation, Issue 13, Dec. 2013