

# *Benjamin J. Fregly*

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## **EDUCATION**

- 1982-1986     **Princeton University**, Mechanical and Aerospace Engineering Department, Princeton, NJ.  
                  B.S. (Magna Cum Laude) in Mechanical Engineering.
- 1986-1987     **Stanford University**, Mechanical Engineering Department (Design Division), Stanford, CA.  
                  M.S. in Mechanical Engineering.
- 1987-1993     **Stanford University**, Mechanical Engineering Department (Design Division), Stanford, CA.  
                  Ph.D. in Mechanical Engineering.  
                  Emphasis: Dynamics, design, and control of mechanical and biomechanical systems.
- 1993-1994     **University of Lyon**, Center for Mechanics, Lyon, France.  
                  Chateaubriand Post-doctoral Fellowship in Biomechanics.  
                  Emphasis: Three-dimensional kinematic analyses of human movement.

## **PROFESSIONAL EXPERIENCE**

- 1987-1993     **Research Assistant**, Mechanical Engineering Department (Design Division), Stanford University,  
Stanford, CA and Rehabilitation Research and Development Center, Veterans Administration  
Medical Center, Palo Alto, CA.
- 1993-1994     **Post-doctoral Fellow**, Center for Mechanics, University of Lyon, Lyon, France.
- 1994-1995     **Consultant**, Motion Analysis Corporation, Santa Rosa, CA.
- 1995-1999     **Research and Development/Software Engineer**, Rasna Corporation and Mechanica Division,  
Parametric Technology Corporation, San Jose, CA.
- 1999-2005     **Assistant Professor**, Department of Mechanical & Aerospace Engineering, Department of  
Biomedical Engineering (joint), and Department of Orthopaedics and Rehabilitation  
(courtesy), University of Florida, Gainesville, FL.
- 2005-2010     **Associate Professor**, Department of Mechanical & Aerospace Engineering, Department of  
Biomedical Engineering (joint), and Department of Orthopaedics and Rehabilitation  
(courtesy), University of Florida, Gainesville, FL.
- 2007-2009     **Adjunct Associate Professor**, Department of Mechanical Engineering, University of Melbourne,  
Melbourne, Australia.
- 2010-2015     **Professor**, Department of Mechanical & Aerospace Engineering, Department of Biomedical  
Engineering (affiliate), and Department of Orthopaedics and Rehabilitation (courtesy),  
University of Florida, Gainesville, FL.
- 2015-2017     **Knox T. Millsaps Professor (5-year term)**, Department of Mechanical & Aerospace  
Engineering, University of Florida, Gainesville, FL.
- 2016-2017     **University of Florida Research Foundation Professor (3-year term)**, Department of  
Mechanical & Aerospace Engineering, University of Florida, Gainesville, FL.
- 2017-present   **Professor and CPRIT Scholar in Cancer Research**, Department of Mechanical Engineering,  
Rice University, Houston, TX.

**HONORS**

1986	Tau Beta Pi National Engineering Honor Society.
1986-1987	Graduate Student Fellowship, Mechanical Engineering Department, Stanford University.
1993-1994	Chateaubriand Post-doctoral Fellowship, Dept. of Science and Technology, French Government.
2000-2001	Teacher of the Year Award, Dept. of Mechanical & Aerospace Engineering, University of Florida.
2003-2004	Faculty Who Made a Difference Award, University of Florida.
2003-2008	NSF CAREER Award.
2006	Tewkesbury Fellowship, Dept. of Mechanical & Manufacturing Engineering, University of Melbourne, Australia.
2007-2008	Teacher of the Year Award, College of Engineering, University of Florida.
2011-2012	Departmental Nominee for Lecturer of the Year Award (selected by undergraduate students), College of Engineering, University of Florida.
2011-2012	Anderson Scholar Faculty Honoree (selected by Anderson Scholars – undergraduate students with at least a 3.90 GPA – for being a “faculty member who has been particularly inspiring or influential”), University of Florida.
2015	Departmental Nominee, University of Florida International Educator of the Year Award, Department of Mechanical & Aerospace Engineering, University of Florida.
2015	Departmental Nominee, University of Florida Research Foundation Professorship, University of Florida.
2016	Recipient, University of Florida Research Foundation Professorship, University of Florida.
2017	Keynote Speaker for New Members Ceremony and Honorary Member, Golden Key International Honour Society, University of Florida.

**PUBLICATIONS**

\*Graduate student/post-doctoral fellow supervised by Dr. Fregly

§High school student supervised by Dr. Fregly

†Corresponding author

**Journal Articles**

Web of Science Citation Report - Times cited: 2864, Average citations per item: 38.7, h-index: 29

Google Scholar Citation Report – Times cited: 5653, h-index: 39, i10-index: 67

1. Meyer, A.J.\*, Patten, C., and Fregly, B.J.† (2017) Lower extremity EMG-driven modeling of walking with automated adjustment of musculoskeletal geometry. *PLoS One*.
2. De Groote, F.\*†, Kinney, A.L.\*, Rao, A.V., and Fregly, B.J. (2016) Evaluation of direct collocation optimal control problem formulations for solving the muscle redundancy problem. *Annals of Biomedical Engineering* **44**, 2922-2936.
3. Eskinazi, I.\* and Fregly, B.J.† (2016) An open-source toolbox for surrogate modeling of joint contact mechanics. *IEEE Transactions on Biomedical Engineering* **63**, 269-277 (**featured article on journal website**).
4. Jackson, J.N.\*, Hass, C.J., and Fregly, B.J.† (2016) Development of a subject-specific foot-ground contact model for gait. *Journal of Biomechanical Engineering* **138**, 091002 (12 pages).
5. Meyer, A.J.\*, Eskinazi, I.\*, Jackson, J.N.\*, Rao, A.V., Patten, C., and Fregly, B.J.† (2016) Muscle synergies facilitate computational prediction of subject-specific walking motions. *Frontiers in Bioengineering and Biotechnology* **4**, 77.
6. Serranoli, G.\*, Kinney, A.L.\*, Fregly, B.J., and Font-Llagunes, J.M.† (2016) Neuromusculoskeletal model calibration significantly affects accuracy of predicted knee contact forces for walking. *Journal of Biomechanical Engineering* **138**, 081001 (11 pages).
7. Eskinazi, I.\* and Fregly, B.J.† (2015) Surrogate modeling of deformable joint contact using artificial neural networks. *Medical Engineering & Physics* **37**, 885-891.
8. Fregly, B.J.†, Fregly, C.D.§, and Kim, B.T.§ (2015) Computational prediction of muscle moments during ARED squat exercise on the International Space Station. *Journal of Biomechanical Engineering* **137**, 121005 (8 pages).
9. Jackson, J.N.\*, Hass, C.J., and Fregly, B.J.† (2015) Residual elimination algorithm enhancements to improve foot motion tracking during forward dynamic simulations of gait. *Journal of Biomechanical Engineering* **137**, 111002 (8 pages).

10. Mizu-uchi, H., Colwell, C.W., Flores-Hernandez, C., Fregly, B.J., Matsuda, S., and D'Lima, D.D.<sup>†</sup> (2015) Patient-specific computer model of dynamic squatting after total knee arthroplasty. *Journal of Arthroplasty* **30**, 870-874.
11. Pizzolato, C., Lloyd, D.G.<sup>†</sup>, Sartori, M., Ceseracciu, E., Besier, T.F., Fregly, B.J., and Reggiani, M.<sup>†</sup> (2015) CEINMS: A toolbox to investigate the influence of different neural solutions on the prediction of muscle excitation and joint moments during dynamic motor tasks. *Journal of Biomechanics* **48**, 3929-3936 (**Winner of the 2015 Australian and New Zealand Society of Biomechanics Publication of the Year Award**).
12. Walter, J.P.\* , Korkmaz, N., Fregly, B.J., and Pandey, M.G.<sup>†</sup> (2015) Contribution of tibiofemoral joint contact to net loads at the knee in gait. *Journal of Orthopaedic Research* **33**, 1054-1060.
13. Roemmich, R.T.<sup>†</sup>, Fregly, B.J., and Hass, C.J. (2014) Neuromuscular complexity during gait is not responsive to medication in persons with Parkinson's disease. *Annals of Biomedical Engineering* **42**, 1901-1912.
14. Walter J.P.\* , Kinney, A.L.\* , Banks, S.A., D'Lima, D.D., Besier, T.F., Lloyd, D.G., and Fregly, B.J.<sup>†</sup> (2014) Muscle synergies may improve optimization prediction of knee contact forces during walking. *Journal of Biomechanical Engineering* **136**, 021031 (9 pages).
15. D'Lima, D.D.<sup>†</sup>, Fregly, B.J., and Colwell, C.W. (2013) Implantable sensor technology: measuring bone and joint biomechanics of daily life in vivo. *Arthritis Research and Therapy* **15**, 203 (8 pages).
16. Gerus, P., Sartori, M., Besier, T.F., Fregly, B.J., Delp, S.L., Banks, S.A., Pandey, M.G., D'Lima, D.D., Lloyd, D.G.<sup>†</sup> (2013) Subject-specific knee joint geometry improves predictions of medial tibiofemoral contact forces. *Journal of Biomechanics* **46**, 2778-2786.
17. Kinney, A.L.\* , Besier, T.F., D'Lima, D.D., and Fregly, B.J.<sup>†</sup> (2013) Update on grand challenge competition to predict in vivo knee loads. *Journal of Biomechanical Engineering* **135**, 021005 (4 pages).
18. Kinney, A.L.\* , Besier, T.F., Silder, A., Delp, S.L., D'Lima, D.D., and Fregly, B.J.<sup>†</sup> (2013) Changes in in vivo knee contact forces through gait modification. *Journal of Orthopaedic Research* **31**, 434-440.
19. Meyer, A.J.\* , D'Lima, D.D., Besier, T.F., Lloyd, D.G., Banks, S.A., Colwell, C.W. Jr., and Fregly, B.J.<sup>†</sup> (2013) Are external knee load and EMG measures accurate indicators of internal knee contact forces during gait? *Journal of Orthopaedic Research* **31**, 921-929.
20. Pegg, E.C., Walter, J.\* , Mellon, S.J., Pandit, H.G., Murray, D.W., D'Lima, D.D., Fregly, B.J., and Gill, H.S.<sup>†</sup> (2013) Evaluation of factors affecting tibial bone strain after unicompartmental knee replacement. *Journal of Orthopaedic Research* **31**, 821-828.
21. Rodriguez, K., Roemmich R., Cam, B.\* , Fregly, B., and Hass, C.<sup>†</sup> (2013) Persons with Parkinson's disease exhibit decreased neuromuscular complexity during gait. *Clinical Neurophysiology* **124**, 1390-1397.
22. Boninger, M.L.<sup>†</sup>, Cowan, R.E., and Fregly, B.J. (2012) Structures promoting research, training, and technology transfer in mobility. *Journal of NeuroEngineering and Rehabilitation* **9**, 19 (5 pages).
23. Cowan, R.E.<sup>†</sup>, Fregly, B.J., Boninger, M.L., Chan, L., Rodgers, M.M., and Reinkensmeyer, D.J. (2012) Recent trends in assistive technology for mobility. *Journal of NeuroEngineering and Rehabilitation* **9**, 20 (8 pages).
24. D'Lima, D.D.<sup>†</sup>, Fregly, B.J., Patil, S., Steklov, N., and Colwell, C.W. (2012) Knee joint forces: prediction, measurement, and significance. *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine* **226**, 95-102.
25. Fregly, B.J.<sup>†</sup> (2012) Gait modification to treat knee osteoarthritis. *HSS Journal* **8**, 45-48.
26. Fregly, B.J.<sup>†</sup>, Besier, T.F., Lloyd, D.G., Delp, S.L., Banks, S.A., Pandey, M.G., and D'Lima, D.D. (2012) Grand challenge competition to predict in vivo knee loads. *Journal of Orthopaedic Research* **30**, 503-513 (**research perspective article featured on journal cover; listed in Web of Science as a Highly Cited Paper "in the top 1% of its academic field based on a highly cited threshold for the field and publication year"**).
27. Fregly, B.J.<sup>†</sup>, Boninger, M.L., and Reinkensmeyer, D.J. (2012) Personalized neuromusculoskeletal modeling to improve treatment of mobility impairments. *Journal of NeuroEngineering and Rehabilitation* **9**, 18 (11 pages).
28. Reinkensmeyer, D.J.<sup>†</sup>, Bonato, P., Boninger, M.L., Chan, L., Cowan, R.E., Fregly, B.J., and Rodgers, M.M. (2012) Major trends in mobility technology research and development: overview of the results of the NSF-WTEC European study. *Journal of NeuroEngineering and Rehabilitation* **9**, 22 (4 pages).
29. Vincent, K.R.<sup>†</sup>, Conrad, B.P., Fregly, B.J., and Vincent, H.K. (2012) The pathophysiology of osteoarthritis: a mechanical perspective on the knee joint. *Physical Medicine & Rehabilitation* **4**, S3-S9.
30. Li, L.\* , Patil, S., Steklov, N., Bae, W., Temple-Wong, M., D'Lima, D.D., Sah, R.L., and Fregly, B.J.<sup>†</sup> (2011) Computational wear simulation of patellofemoral articular cartilage during in vitro testing. *Journal of Biomechanics* **44**, 1507-1513.
31. Fregly, B.J.<sup>†</sup>, Marquez-Barrientos, C.\* , Banks, S.A., and DesJardins, J.D. (2010) Increased conformity offers diminishing returns for total knee replacement wear. *Journal of Biomechanical Engineering* **132**, 021007.

32. Lin, Y.C.\*, Haftka, R.T., Queipo, N.V., and Fregly, B.J.† (2010) Surrogate articular contact models for computationally efficient multibody dynamic simulations. *Medical Engineering & Physics* **32**, 584-594.
33. Lin, Y.C.\*, Walter, J.P.\*, Banks, S.A., Pandey, M.G., and Fregly, B.J.† (2010) Simultaneous prediction of muscle and contact forces in the knee during gait. *Journal of Biomechanics* **43**, 945-952.
34. Walter, J.P.\*, D'Lima, D.D., Colwell, C.W., and Fregly, B.J.† (2010) Decreased knee adduction moment does not guarantee decreased medial contact force during gait. *Journal of Orthopaedic Research* **28**, 1348-1354.
35. Fregly, B.J.† (2009) Design of optimal treatments for neuromusculoskeletal disorders using patient-specific multibody dynamic models. *International Journal of Computational Vision and Biomechanics* **2**, 145-154.
36. Fregly, B.J.†, D'Lima, D.D., and Colwell, C.W. (2009) Effective gait patterns for offloading the medial compartment of the knee. *Journal of Orthopaedic Research* **27**, 1016-1021.
37. Hamai, S., Moro-oka, T., Miura, H., Shimoto, T., Higaki, H., Fregly, B.J., Iwamoto, Y., and Banks, S.† (2009) Knee kinematics in medial osteoarthritis during in vivo weight-bearing activities. *Journal of Orthopaedic Research* **27**, 1555-1561.
38. Kim, H.J., Fernandez, J.W., Akbarshahi, M., Walter, J.P.\*, Fregly, B.J., and Pandey, M.G.† (2009) Evaluation of predicted knee-joint muscle forces during gait using an instrumented knee implant. *Journal of Orthopaedic Research* **27**, 1326-1331.
39. Koh, B.-I.\*, Reinbolt, J.A.\*, George, A.D., Haftka, R.T., and Fregly, B.J.† (2009) Limitations of parallel global optimization for large-scale human movement problems. *Medical Engineering & Physics* **31**, 515-521.
40. Lin, Y.C.\*, Queipo, N.V., Haftka, R.T., and Fregly, B.J.† (2009) Two-dimensional surrogate contact modeling for computationally efficient dynamic simulations of total knee replacements. *Journal of Biomechanical Engineering* **131**, 041010.
41. D'Lima, D.D.†, Steklov, N., Fregly, B.J., Banks, S.A., and Colwell, C.W. (2008) In vivo contact stresses during activities of daily living after knee arthroplasty. *Journal of Orthopaedic Research* **26**, 1549-1555.
42. Fregly, B.J.† (2008) Computational assessment of combinations of gait modifications for knee osteoarthritis rehabilitation. *IEEE Transactions on Biomedical Engineering* **55**, 2104-2106.
43. Fregly, B.J.†, Banks, S.A., D'Lima, D.D., and Colwell, C.W. (2008) Sensitivity of knee replacement contact calculations to kinematic measurement errors. *Journal of Orthopaedic Research* **26**, 1173-1179.
44. Fregly, B.J.†, Reinbolt, J.A.\*, and Chmielewski, T.L. (2008) Evaluation of a patient-specific cost function to predict the influence of foot path on the knee adduction torque during gait. *Computer Methods in Biomechanics and Biomedical Engineering* **11**, 63-71.
45. Moro-oka, T., Hamai, S., Miura, H., Shimoto, T., Higaki, H., Fregly, B.J., Iwamoto, Y., and Banks, S.† (2008) Dynamic activity dependence of in vivo normal knee kinematics. *Journal of Orthopaedic Research* **26**, 428-434.
46. Reinbolt, J.A.\*, Haftka, R.T., Chmielewski, T.L., and Fregly, B.J.† (2008) A computational framework to predict post-treatment outcome for gait-related disorders. *Medical Engineering & Physics* **30**, 434-443.
47. Schache, A.G.†, Fregly, B.J., Crossley, K.M., Hinman, R.S., and Pandey, M.G. (2008) The effect of gait modification on the external knee adductor moment is reference frame dependent. *Clinical Biomechanics* **23**, 601-608.
48. Verma, N.N., Kolb, E., Cole, B.J., Berkson, E., Garretson, R., Farr, J., and Fregly, B. (2008) The effects of medial meniscal transplantation techniques on intra-articular contact pressures. *The Journal of Knee Surgery* **21**, 20-26.
49. Zhao, D.\*, Sadoka, H., Sawyer, W.G., Banks, S.A., and Fregly, B.J.† (2008) Predicting knee replacement damage in a simulator machine using a computational model with a consistent wear factor. *Journal of Biomechanical Engineering* **130**, 011004.
50. Fregly, B.J.†, Reinbolt, J.A.\*, Rooney, K.L.\*, Mitchell, K.H., and Chmielewski, T.L. (2007) Design of patient-specific gait modifications for knee osteoarthritis rehabilitation. *IEEE Transactions on Biomedical Engineering* **54**, 1687-1695.
51. Moro-oka, T., Hamai, S., Miura, H., Higaki, H., Fregly, B.J., Iwamoto, Y., Banks, S.A.† (2007) Can magnetic resonance imaging-derived bone models be used for accurate motion measurement with single-plane three-dimensional shape registration? *Journal of Orthopaedic Research* **25**, 867-872.
52. Schutte, J.F.\*, Haftka, R.T., and Fregly, B.J.† (2007) Improved global convergence probability using multiple independent swarms. *International Journal for Numerical Methods in Engineering* **71**, 678-702.
53. Reinbolt, J.A.\*, Haftka, R.T., Chmielewski, T.L., and Fregly, B.J.† (2007) Are patient-specific joint and inertial parameters necessary for accurate inverse dynamics analyses of gait? *IEEE Transactions on Biomedical Engineering* **54**, 782-793.
54. Zhao, D.\*, Banks, S.A., D'Lima, D.D., Colwell, C.W., and Fregly, B.J.† (2007) In vivo medial and lateral tibial loads during dynamic and high flexion activities. *Journal of Orthopaedic Research* **25**, 593-602. **(Article featured on the cover of this issue).**

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55. Zhao, D.\*, Banks, S.A., Mitchell, K.H., D'Lima, D.D., Colwell, C.W., and Fregly, B.J.† (2007) Correlation between the knee adduction torque and medial contact force for a variety of gait patterns. *Journal of Orthopaedic Research* **25**, 789-797 (listed in Web of Science as a Highly Cited Paper “in the top 1% of its academic field based on a highly cited threshold for the field and publication year”).
  56. Zhao, D.\*, Sawyer, W.G., and Fregly, B.J.† (2006) Computational wear prediction of UHMWPE in knee replacements. *Journal of ASTM International* **3**, 45-50.
  57. Koh, B.-I.\*, George, A.D., Haftka, R.T., and Fregly, B.J.† (2006) Parallel asynchronous particle swarm optimization. *International Journal for Numerical Methods in Engineering* **67**, 578-595.
  58. Lin, Y.-C.\*, Farr, J., Carter, K., and Fregly, B.J.† (2006) Response surface optimization for joint contact model evaluation. *Journal of Applied Biomechanics* **22**, 120-130.
  59. Banks, S.A.†, Fregly, B.J., Boniforti, F., Reinschmidt, C., and Romagnoli, S. (2005) Comparing in vivo kinematics of unicondylar and bi-unicondylar knee replacements. *Knee Surgery, Sports Traumatology, Arthroscopy* **13**, 551-556.
  60. Fregly, B.J.†, Rahman, H.\*, and Banks, S.A. (2005) Theoretical accuracy of model-based shape matching for measuring natural knee kinematics with single-plane fluoroscopy. *Journal of Biomechanical Engineering* **127**, 692-699.
  61. Fregly, B.J.†, Sawyer, W.G., Harman, M.K., and Banks, S.A. (2005) Computational wear prediction of a total knee replacement from in vivo kinematics. *Journal of Biomechanics* **38**, 305-314.
  62. Hamilton, M.A., Sucec, M.C., Fregly, B.J., Banks, S.A., and Sawyer, W.G.† (2005) Quantifying multidirectional sliding motions in total knee replacements. *Journal of Tribology* **127**, 280-286.
  63. Harman, M.K.†, Banks, S.A., Fregly, B.J., Sawyer, W.G., and Hodge, W.A. (2005) Biomechanical mechanisms for damage: Retrieval analysis and computational wear predictions in total knee replacements. *Journal of Mechanics in Medicine and Biology* **5**, 469-475.
  64. Reinbolt, J.A.\*, Schutte, J.F.\*, Fregly, B.J.†, Haftka, R.T., George, A.D., and Mitchell, K.H. (2005) Determination of patient-specific multi-joint kinematic models through two-level optimization. *Journal of Biomechanics* **38**, 621-626.
  65. Schutte, J.F.\*, Koh, B.-I.\*, Reinbolt, J.A.\*, Haftka, R.T., George, A.D., and Fregly, B.J.† (2005) Evaluation of a particle swarm algorithm for biomechanical optimization. *Journal of Biomechanical Engineering* **127**, 465-474.
  66. Bei, Y.\* and Fregly, B.J.† (2004) Multibody dynamic simulation of knee contact mechanics. *Medical Engineering & Physics* **26**, 777-789.
  67. Schutte, J.F.\*, Reinbolt, J.A.\*, Fregly, B.J.†, Haftka, R.T., and George, A.D. (2004) Parallel global optimization with the particle swarm algorithm. *International Journal for Numerical Methods in Engineering* **61**, 2296-2315.
  68. Bei, Y.\*, Fregly, B.J.†, Sawyer, W.G., Banks, S.A., and Kim, N.H. (2004) The relationship between contact pressure, insert thickness, and mild wear in total knee replacements. *Computer Modeling in Engineering & Sciences* **6**, 145-152.
  69. Koh, B.I.\*, Reinbolt, J.A.\*, Fregly, B.J.†, and George, A.D. (2004) Evaluation of parallel decomposition methods for biomechanical optimizations. *Computer Methods in Biomechanics and Biomedical Engineering* **7**, 215-225.
  70. Fregly, B.J.†, Bei, Y.\*, and Sylvester, M.E.\* (2003) Experimental evaluation of an elastic foundation model to predict contact pressures in knee replacements. *Journal of Biomechanics* **36**, 1659-1668.
  71. Fregly, B.J.† and Sawyer, W.G. (2003) Estimation of discretization errors in contact pressure measurements. *Journal of Biomechanics* **36**, 609-613.
  72. Sawyer, W.G.†, Hamilton, M.A., Fregly, B.J., and Banks, S.A. (2003) Temperature modeling in a total knee joint replacement using patient-specific kinematics. *Tribology Letters* **15**, 343-351.
  73. Hansen E.A.†, Jorgensen L.V., Jensen K., Fregly B.J., Sjogaard G. (2002) Crank inertial load affects freely chosen pedal rate during cycling. *Journal of Biomechanics* **35**, 277-285.
  74. Fregly, B.J.†, Zajac, F.E., and Dairaghi, C. A. (2000) Bicycle drive system dynamics: theory and experimental validation. *Journal of Biomechanical Engineering* **122**, 446-452.
  75. Chèze, L.†, Fregly, B.J., and Dimnet, J. (1998) Determination of joint functional axes from noisy marker data using the finite helical axis. *Human Movement Science* **17**, 1-15.
  76. Fregly, B.J. and Zajac, F.E.† (1996) A state-space analysis of mechanical energy generation, absorption, and transfer during pedaling. *Journal of Biomechanics* **29**, 81-90.
  77. Fregly, B.J., Zajac, F.E.†, and Dairaghi, C.A. (1996) Crank inertial load has little effect on steady-state pedaling coordination. *Journal of Biomechanics* **29**, 1559-1567.
  78. Chèze, L., Fregly, B.J., and Dimnet, J.† (1995) A solidification procedure to facilitate kinematic analyses based on video system data. *Journal of Biomechanics* **28**, 879-884.

*Journal Manuscripts (in review)*

1. Banks, C.L.\*, Fregly, B.J., and Patten, C.† (2017) Muscle synergy analysis differentiates responders and non-responders post-stroke. *Frontiers in Computational Neuroscience* (in first review).
2. Bianco, N.A.\*, Patten, C., and Fregly, B.J.† (2017) Can measured synergy excitations accurately construct unmeasured muscle excitations? *Journal of Biomechanical Engineering* (in second review).

*Conference Papers*

1. Agarwal, P., McDonald, C.G., Dennis, T.A., Fregly, B.J., and O'Malley, M.K. (2017) Towards a comprehensive model of robot-arm interactions: a tool for computational neurorehabilitation. *Proceedings of the XVI International Symposium on Computer Simulation in Biomechanics*, July 20-22, Gold Coast, Australia.
2. Febrer-Nafria, M., Mouzo, F., Lugris, U., Fregly, B.J., and Font-Llagunes, J.M. (2017) Optimal control prediction of a dynamically consistent walking motion for a spinal cord-injured subject assisted by orthoses. *Proceedings of the 8th ECCOMAS Thematic conference on Multibody Dynamics*, June 19-22, Prague, Czech Republic.
3. Fregly, B.J. (2017) Increased joint stiffness during walking: a potential consequence of fewer muscle synergies. *Proceedings of the XVI International Symposium on Computer Simulation in Biomechanics*, July 20-22, Gold Coast, Australia.
4. Fregly, B.J. (2017) **Keynote lecture:** Neuromusculoskeletal modeling and rehabilitation robotics: Two great tastes that taste great together. *The International Symposium on Wearable Robotics*, November 6-8, Houston, TX.
5. Mouzo, F., Dopico, D., Lugris, U., Fregly, B.J., and Cuadrado, J. (2017) Use of analytical derivatives in an optimal control algorithm for the residual elimination problem of gait. *Proceedings of the 8th ECCOMAS Thematic conference on Multibody Dynamics*, June 19-22, Prague, Czech Republic.
6. Fregly, B.J. (2016) **Keynote lecture:** Computational neurorehabilitation of walking impairments. *Proceedings of Canadian Society of Biomechanics*, July 19-22, Hamilton, Ontario, Canada.
7. Bianco, N.A., Patten, C., and Fregly, B.J. (2015) Can measured muscle synergies reconstruct unmeasured muscle excitations? **Winner of the B.S. student paper competition.** *Proceedings of the Summer Biomechanics, Bioengineering and Biotransport Conference*, June 17-20, Snowbird, Utah.
8. Churchwell, E., Roper, J., Terza, M., Roemmich, R., Fregly, B.J., and Hass, C.J. (2015) Differences in synergistic control of muscles during treadmill walking in anterior cruciate ligament reconstructed legs. *Proceedings of the 39th Annual Meeting of the American Society of Biomechanics*, August 5-8, Columbus, OH.
9. De Groot, F., Kinney, A.L., Anil V. Rao, and Fregly, B.J. (2015) Evaluation of different optimal control problem formulations for solving the muscle redundancy problem. *Proceedings of the XV International Symposium on Computer Simulation in Biomechanics*, July 9-11, Edinburgh, Scotland.
10. Eskinazi, I. and Fregly, B.J. (2015) An open-source toolbox for surrogate modeling of joint contact mechanics. *Proceedings of the Summer Biomechanics, Bioengineering and Biotransport Conference*, June 17-20, Snowbird, Utah.
11. Eskinazi, I. and Fregly, B.J. (2015) An open-source toolbox for surrogate modeling of joint contact mechanics. *Proceedings of the XV International Symposium on Computer Simulation in Biomechanics*, July 9-11, Edinburgh, Scotland.
12. Fregly, B.J. (2015) **Keynote lecture:** Design of optimal treatments for walking impairments using neuromusculoskeletal models. *Proceedings of Northwest Biomechanics Symposium*, May 1-2, Seattle, WA.
13. Fregly, B.J. (2015) **Keynote lecture:** Design of optimal treatments for walking impairments using multibody dynamic models. *Proceedings of the European Community on Computational Methods in Applied Sciences (ECCOMAS) Thematic Conference on Multibody Dynamics*, June 29-July 2, Barcelona, Spain.
14. Fregly, B.J. and Rao, A.V. (2015) Optimal Control Workshop. *Proceedings of the XV International Symposium on Computer Simulation in Biomechanics*, July 9-11, Edinburgh, Scotland.
15. Kinney, A.L. and Fregly, B.J. (2015) Development of a muscle model parameter calibration method via passive muscle force minimization. *Proceedings of the XXV Congress of the International Society of Biomechanics*, July 12-15, Glasgow, Scotland.
16. Meyer, A.J., Patten, C., and Fregly, B.J. (2015) Subject-specific calibration of geometric neuromusculoskeletal models. *Proceedings of the XV International Symposium on Computer Simulation in Biomechanics*, July 9-11, Edinburgh, Scotland.

17. Meyer, A.J., Patten, C. and Fregly, B.J. (2015) Subject-specific calibration of geometric neuromusculoskeletal models. **Finalist in the Ph.D. student paper competition.** *Proceedings of the Summer Biomechanics, Bioengineering and Biotransport Conference*, June 17-20, Snowbird, Utah.
18. Sauder, N.R., Coburn, J.C., Harman, M.K., Vincent, H.K., D'Lima, D.D., and Fregly, B.J. (2015) Do external load measures predict knee contact force changes due to weight loss? *Proceedings of the Summer Biomechanics, Bioengineering and Biotransport Conference*, June 17-20, Snowbird, Utah.
19. Serrancolí, G., Kinney, A.L., Fregly, B.J., and Font-Llagunes, J.M. (2015) Can a well-calibrated neuromusculoskeletal model predict knee contact forces accurately over multiple walking cycles? *Proceedings of the XV International Symposium on Computer Simulation in Biomechanics*, July 9-11, Edinburgh, Scotland.
20. Serrancolí, G., Kinney, A.L., Fregly, B.J., and Font-Llagunes, J.M. (2015) How do in vivo knee contact force data affect calibration of muscle-tendon model parameter values? *Proceedings of the VI International Conference on Computational Bioengineering*, September 14-16, Barcelona, Spain.
21. Serrancolí, G., Kinney, A.L., Fregly, B.J., and Font-Llagunes, J.M. (2015) Prediction of knee contact forces based on synergy-based two-level optimization. **Finalist in the Ph.D. student paper competition.** *Proceedings of the European Community on Computational Methods in Applied Sciences (ECCOMAS) Thematic Conference on Multibody Dynamics*, June 29-July 2, Barcelona, Spain.
22. Serrancolí, G., Kinney, A.L., Fregly, B.J., Font-Llagunes, J.M. (2015) The influence of neuromusculoskeletal model calibration method on predicted knee contact forces during walking. *Proceedings of the European Community on Computational Methods in Applied Sciences (ECCOMAS) Thematic Conference on Multibody Dynamics*, June 29-July 2, Barcelona, Spain.
23. Serrancolí, G., Kinney, A.L., Fregly, B.J., and Font-Llagunes, J.M. (2015) Synergy-based two-level optimization for predicting knee contact forces during walking. *Proceedings of the XXV Congress of the International Society of Biomechanics*, July 12-15, Glasgow, Scotland.
24. Serrancolí, G., Kinney, A.L., Fregly, B.J., and Font-Llagunes, J.M. (2015) What can knee contact force data teach us about calibration of muscle-tendon model parameter values? *Proceedings of the Summer Biomechanics, Bioengineering and Biotransport Conference*, June 17-20, Snowbird Resort, Utah.
25. Tse, J., Bohne, W., Tran, L., D'Lima, D.D., Patil, S., Fregly, B.J., Backus, S.I., Krazsewski, A.P., Garrison, G., Kontaxis, A., Lenhoff, M., and Hillstrom, H.J. (2015) Effect of knee bracing and wedged insoles upon knee joint contact forces. *Proceedings of the 39th Annual Meeting of the American Society of Biomechanics*, August 5-8, Columbus, OH.
26. Tse, J., Tran, L., D'Lima, D.D., Patil, S., Fregly, B.J., Backus, S.I., Krazsewski, A.P., Garrison, G., Kontaxis, A., Lenhoff, M., and Hillstrom, H.J. (2015) Biomechanical dosage effect of knee braces on internal joint moment as measured by the e-tibia. *Proceedings of the XXV Congress of the International Society of Biomechanics*, July 12-15, Glasgow, Scotland.
27. Tse, J., Tran, L., D'Lima, D.D., Patil, S., Fregly, B.J., Backus, S.I., Krazsewski, A.P., Garrison, G., Kontaxis, A., Lenhoff, M., and Hillstrom, H.J. (2015) Valgus/varus knee bracing: effects of biomechanical dosage on joint forces. *Proceedings of the Gait and Clinical Movement Analysis Society*, March 18-21, Portland, OR.
28. Bianco, N.A.\*, Kinney, A.L.\*, and Fregly, B.J. (2014) Predicting unmeasured muscle excitations from measured muscle synergies. *Proceedings of the 7<sup>th</sup> World Congress of Biomechanics*, July 6-11, Boston, MA.
29. Eskinazi, I.\*, Rao, A.V., and Fregly, B.J. (2014) Minimizing OpenSim state derivative computational cost for optimal control applications. *Proceedings of the 7<sup>th</sup> World Congress of Biomechanics*, July 6-11, Boston, MA.
30. Fregly, B.J., Kinney, A.L.\*, Besier, T.F., and D'Lima, D.D. (2014) How has the Knee Grand Challenge improved musculoskeletal modeling research? *Proceedings of the 7<sup>th</sup> World Congress of Biomechanics*, July 6-11, Boston, MA.
31. Fregly, C.D.<sup>§</sup>, Kim, B.T.<sup>§</sup>, De Witt, J.K., and Fregly, B.J. (2014) Model-based recommendations for reducing back loads during squat exercise on the International Space Station. *Proceedings of the 7<sup>th</sup> World Congress of Biomechanics*, July 6-11, Boston, MA. (This high school science fair project, which received 3<sup>rd</sup> place at the 2014 Florida State Science Fair in the Physics and Astronomy category, was accepted as a poster presentation and was presented at the conference by the first author).
32. Kinney, A.L.\*, Rao, A.V., and Fregly, B.J. (2014) Feasibility tuning to improve optimization prediction of knee contact forces. *Proceedings of the 7<sup>th</sup> World Congress of Biomechanics*, July 6-11, Boston, MA.
33. Meyer, A.J.\*, Jackson, J.J.\*, Patterson, M.A., Rao, A.V., and Fregly, B.J. (2014) Generating three-dimensional dynamically consistent simulations of walking using optimal control. *Proceedings of the 7<sup>th</sup> World Congress of Biomechanics*, July 6-11, Boston, MA.

34. Pai, M.\*, Patten, C., and Fregly, B.J. (2014) Synergy analysis of pre-treatment EMG differentiates responders and non-responders to stroke rehabilitation. *Proceedings of the 7<sup>th</sup> World Congress of Biomechanics*, July 6-11, Boston, MA.
35. Tran, L., Tse, J., Chao, K., Minacori, R., Kirane, Y., Steklov, N., Patil, S., Fregly, B.J., D’Lima, D.D., Garrison, G., Bido, J., Lenhoff, M., Backus, S., Kraszewski, A., Kontaxis, A., and Hillstrom, H. (2014) Effect of valgus knee bracing on medial and lateral compartment loading during stair descent. *Proceedings of the Gait and Clinical Movement Analysis Society*, June 24-28, Newark, DE.
36. Tran, L., Tse, J., Chao, K., Minacor, R., Kirane, Y., Steklov, N., Patil, S., Fregly, B.J., D’Lima, D.D., Lenhoff, M., Backus, S., Kraszewski, A., Kontaxis, A., and Hillstrom, H. (2014) Effect of knee bracing on knee joint contact mechanics during stair descent. *Proceedings of the 60<sup>th</sup> Annual Meeting Orthopaedic Research Society*, March 15-18, New Orleans, LA.
37. Eskinazi, I.\* and Fregly, B.J. (2013) Surrogate knee contact modeling using artificial neural networks. *Proceedings of the ASME Summer Bioengineering Conference*, June 26-29, Sunriver, OR.
38. Fregly, B.J., Walter, J.P\*, Kinney, A.L.\*, Banks, S.A., D’Lima, D.D., Besier, T.F., and Lloyd, D.G. (2013) Muscle synergies improve estimation of knee contact forces during walking. *Proceedings of the 11<sup>th</sup> International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, April 3-7, Salt Lake City, UT.
39. Fregly, B.J., Walter, J.P\*, Kinney, A.L.\*, Banks, S.A., D’Lima, D.D., Besier, T.F., and Lloyd, D.G. (2013) Muscle synergy constraints improve prediction of knee contact forces during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 26-29, Sunriver, OR.
40. Fregly, B.J., Walter, J.P\*, Kinney, A.L.\*, Banks, S.A., D’Lima, D.D., Besier, T.F., and Lloyd, D.G. (2013) Synergy controls improve prediction of knee contact forces and muscle excitations during gait. *Proceedings of the XIV International Symposium on Computer Simulation in Biomechanics*, August 1-3, Natal, Brazil.
41. Fregly, C.D.<sup>§</sup>, Kim, B.T.<sup>§</sup>, De Witt, J.K., and Fregly, B.J. (2013) Dynamic simulation of muscle loading during ARED squat exercise on the International Space Station. *Proceedings of the ASME Summer Bioengineering Conference*, June 26-29, Sunriver, OR. (This high school science fair project received a Recognition Award at the 2013 Florida State Science Fair in the Medicine and Health category).
42. Higa, M., Fregly, B.J., Tanino, H., Ito, H. Abo, M., Kakunai, S., and Banks, S.A. (2013) Predicting patient-specific muscle parameters of the hip with osteoarthritis. *Proceedings of the 59<sup>th</sup> Annual Meeting Orthopaedic Research Society*, January 26-29, San Antonio, TX.
43. Jackson, J.N.\* , Hass, C.J., and Fregly, B.J. (2013) Development of a subject-specific foot-ground contact model to predict all six ground reaction components. *Proceedings of the ASME Summer Bioengineering Conference*, June 26-29, Sunriver, OR.
44. Kinney, A.L.\* , Vincent, H.K., Harman, M.K., Coburn, J., D’Lima, D.D., and Fregly, B.J. (2013) Effects of body weight modification on internal knee contact forces during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 26-29, Sunriver, OR.
45. Meyer, A.J.\* , Patten, C., and Fregly, B.J. (2013) A surrogate model for lower extremity EMG-to-moment estimation during walking. *Proceedings of the XIV International Symposium on Computer Simulation in Biomechanics*, August 1-3, Natal, Brazil.
46. Meyer, A.J.\* , Patten, C., and Fregly, B.J. (2013) A surrogate model for lower extremity EMG-to-moment estimation during walking. *Proceedings of the XXIV Congress of the International Society of Biomechanics*, August 4-9, Natal, Brazil.
47. Meyer, A.J.\* , Patten, C., and Fregly, B.J. (2013) Physiologically consistent EMG-to-moment estimation at the hip, knee, and ankle during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 26-29, Sunriver, OR.
48. Minacori, R., Kirane, Y., D’Lima, D.D., Fregly, B.J., Lenhoff, M., Backus, S., Kraszewski, A., Garrison, G., Bido, J., Kontaxis, A., and Hillstrom, H, (2013) In-vivo Biomechanical Effects of Conservative Realignment Bracing: A Case Study. *Proceedings of IMechE Knee Surgery and Rehabilitation in 2013: How is Engineering Driving Improved Treatment?*, November 11-12, London, England.
49. Serrancolí, G., Walter, J.P., Kinney, A.L., Barjau, A., Fregly, B.J., and Font-Llagunes, J.M (2013) Formulation to predict lower limb muscle forces during gait. III Reunión del Capítulo Español de la Sociedad Europea de Biomecánica, October 23-24, Barcelona, Spain.
50. Serrancolí, G.\* , Walter, J.P.\* , Kinney, A.L.\* , Fregly, B.J., and Font-Llagunes, J.M. (2013) Optimization problem formulation for predicting knee muscle and contact forces during gait. *Proceedings of the XIV International Symposium on Computer Simulation in Biomechanics*, August 1-3, Natal, Brazil.



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51. Hass, C.J., Rodriguez, K., Roemmich R., Stegemoller, E., Cam, B.\*, and Fregly, B. (2012) Persons with Parkinson's disease exhibit decreased neuromuscular complexity during gait. *Proceedings of the Society for Neuroscience*, October, October 13-17, New Orleans, LA.
  52. Lloyd, D.G., Sartori, M., Gerus, P., Saxby, D., Fregly, B.J., Besier, T.F., Delp, S.L., Banks, S.A., Pandy, M.G., and D'Lima, D.D. (2012) Computational neuromusculoskeletal modelling to examine tissue loading in humans. Plenary lecture, *Proceedings of the 6<sup>th</sup> European Congress on Computational Methods in Applied Sciences and Engineering*, September 10-14, Vienna, Austria.
  53. Gerus, P., Lloyd, D.G., Sartori, M., Fregly, B.J., Besier, T.F., Delp, S.L., Banks, S.A., Pandy, M.G., and D'Lima, D.D. (2012) Using subject-specific bones and implant geometry improves the accuracy in estimating the joint contact forces at the knee medial and lateral condyles. *Proceedings of the 6<sup>th</sup> European Congress on Computational Methods in Applied Sciences and Engineering*, September 10-14, Vienna, Austria.
  54. Hall, A.L.\*, Besier, T.F., Silder, A., Delp, S.L., D'Lima, D.D., and Fregly, B.J. (2012) Changes in in vivo knee contact force through gait modification. *Proceedings of the 36<sup>th</sup> Annual Meeting of the American Society of Biomechanics*, August 15-18, Gainesville, FL.
  55. Jackson, J.N.\*, Hass, C.J., and Fregly, B.J. (2012) Development of a subject-specific vertical ground contact force model. *Proceedings of the 36<sup>th</sup> Annual Meeting of the American Society of Biomechanics*, August 15-18, Gainesville, FL.
  56. Jackson, J.N.\*, Hass, C.J., and Fregly, B.J. (2012) Residual elimination algorithm improvements for forward dynamic simulation of gait. *Proceedings of the 36<sup>th</sup> Annual Meeting of the American Society of Biomechanics*, August 15-18, Gainesville, FL.
  57. Li, Lingmin\*, Patil, S., Steklov, N., Bae, W., D'Lima, D.D., Sah, R.L., and Fregly, B.J. (2012) Predicting in vitro articular cartilage wear in the patellofemoral joint using finite element modeling. *Proceedings of the 36<sup>th</sup> Annual Meeting of the American Society of Biomechanics*, August 15-18, Gainesville, FL.
  58. Meyer, A.J.\*, D'Lima, D.D., Banks, S.A., Lloyd, D.G., Besier, T.F., Colwell, C.W., and Fregly, B.J. (2012) Are external knee load and EMG measures strong indicators of internal knee contact forces during gait? *Proceedings of the 36<sup>th</sup> Annual Meeting of the American Society of Biomechanics*, August 15-18, Gainesville, FL.
  59. Meyer, A.J.\*, Patten, C., and Fregly, B.J. (2012) A novel statistical method for EMG-to-moment estimation during gait. *Proceedings of the 36<sup>th</sup> Annual Meeting of the American Society of Biomechanics*, August 15-18, Gainesville, FL.
  60. Fregly, C.D.§, Kim, B.T.§, Li, Z.§, De Witt, J.K., and Fregly, B.J. (2012) Estimated muscle loads during squat exercise in microgravity conditions. *Proceedings of the ASME Summer Bioengineering Conference*, June 20-23, Fajardo, Puerto Rico. (This middle school science fair project, which took 2<sup>nd</sup> place at the 2012 Florida State Science Fair in the Medicine and Health category, was accepted as a podium presentation and was presented at the conference by the first two authors).
  61. Hall, A.L.\*, Besier, T.F., Silder, A., Delp, S.L., D'Lima, D.D., and Fregly, B.J. (2012) Changes in medial knee contact force through gait modification. *Proceedings of the ASME Summer Bioengineering Conference*, June 20-23, Fajardo, Puerto Rico.
  62. Hall, A.L.\*, Walter, J.P.\*, Besier, T.F., Silder, A., Delp, S.L., D'Lima, D.D., and Fregly, B.J. (2012) Experimental evaluation of computationally predicted changed in knee loads resulting from medial thrust gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 20-23, Fajardo, Puerto Rico.
  63. Jackson, J.N.\*, Hass, C.J., and Fregly, B.J. (2012) Residual elimination algorithm enhancements to improve foot motion tracking during forward dynamic simulation of gait. **Finalist in the Ph.D. student paper competition.** *Proceedings of the ASME Summer Bioengineering Conference*, June 20-23, Fajardo, Puerto Rico.
  64. Li, L.\*, Patil, S., Steklov, N., Bae, W., D'Lima, D.D., Sah, R.L., and Fregly, B.J. (2012) Finite element modeling of in vitro articular cartilage wear in the patellofemoral joint. *Proceedings of the ASME Summer Bioengineering Conference*, June 20-23, Fajardo, Puerto Rico.
  65. Meyer, A.J.\*, D'Lima, D.D., Banks, S.A., Lloyd, D.G., Besier, T.F., Colwell, C.W., and Fregly, B.J. (2012) Correlation between in vivo knee contact forces and external measures during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 20-23, Fajardo, Puerto Rico.
  66. Meyer, A.J.\*, Patten, C., and Fregly, B.J. (2012) Evaluation of a novel statistical method for EMG-to-moment estimation during gait. **Third place in the Ph.D. student paper competition.** *Proceedings of the ASME Summer Bioengineering Conference*, June 20-23, Fajardo, Puerto Rico.
  67. Fregly, B.J. and Patten, C. (2012) Technical-clinical symposium: Model-based stroke rehabilitation case study. *Proceedings of the Gait and Clinical Movement Society Annual Meeting*, May 9-12, Grand Rapids, MI.

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68. Machado, M.\*, Flores, P., Walter, J.P.\*, and Fregly, B.J. (2012) Challenges in using OpenSim as a multibody design tool to model, simulate, and analyze prosthetic devices: a knee joint case-study. *Proceedings of the EUROMECH Colloquium 524: Multibody System Modelling, Control and Simulation for Engineering Design*, February 27-March 1, Enschede, the Netherlands.
  69. Fregly, B.J., Chmielewski, T.L., Walter, J.P.\*, Pun, H., Chan, N.K.\*, Moser, M.W., and Vincent, K.R. (2011) Evaluation of a model-based gait retraining method for knee osteoarthritis rehabilitation. *Proceedings of the Gait and Clinical Movement Society Annual Meeting*, April 26-29, Bethesda, MD.
  70. Meyer, A.J.\*, D'Lima, D.D., Banks, S.A., Coburn, J., Harman, M., Mikashima, Y., and Fregly, B.J. (2011) Evaluation of regression equations for medial and lateral contact force from instrumented knee implant data. *Proceedings of the ASME Summer Bioengineering Conference*, June 22-25, Farmington, PA.
  71. Walter, J.P.\*, D'Lima, D.D., and Fregly, B.J. (2011) Model-based prediction of medial contact force changes due to gait modification. *Proceedings of the 13th International Symposium on Computer Simulation in Biomechanics*, June 30-July 2, Leuven, Belgium.
  72. Walter, J.P.\*, D'Lima, D.D., Besier, T.P., and Fregly, B.J. (2011) Feasibility of highly constrained muscle force predictions for the knee during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 22-25, Farmington, PA.
  73. Walter, J.P.\*, D'Lima, D.D., and Fregly, B.J. (2011) Model-based prediction of medial contact force changes due to gait modification. *Proceedings of the 13th International Symposium on Computer Simulation in Biomechanics*, Leuven, Belgium.
  74. Fregly, B.J., Chmielewski, T.L., Walter, J.P.\*, Pun, H.\*, Chan, N.K., Moser, M.W., and Vincent, K.R. (2011) Evaluation of a model-based gait retraining method for knee osteoarthritis. *Proceedings of the Annual Meeting of the Gait and Clinical Movement Analysis Society*, April 26-29, Bethesda, MD.
  75. Meyer, A.J.\*, D'Lima, D.D., Banks, S.A., Coburn, J., Harman, M., Mikashima, Y., and Fregly, B.J. (2011) Evaluation of regression equations for medial and lateral contact force from instrumented knee implant data. *Proceedings of the ASME Summer Bioengineering Conference*, June 22-25, Farmington, PA.
  76. Walter, J.P.\*, D'Lima, D.D., and Fregly, B.J. (2011) Feasibility of highly constrained muscle force predictions for the knee during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 22-25, Farmington, PA.
  77. Jackson, J.N.\*, Hass, C.J., DeWitt, J.K., Walter, J.P.\*, and Fregly, B.J. (2010) Variation of whole-body angular and linear momentum during locomotion. *Proceedings of the ASME Summer Bioengineering Conference*, June 16-19, Naples, FL.
  78. Li, L.\*, Patil, S., Steklov, N., Bae, W., Temple-Wong, M., D'Lima, D.D., Sah, R.L., and Fregly, B.J. (2010) Computational simulation of articular cartilage wear in the patellofemoral joint during in vitro testing. *Proceedings of the ASME Summer Bioengineering Conference*, June 16-19, Naples, FL.
  79. Meyer, A.J.\*, D'Lima, D.D., Banks, S.A., Coburn, J., Harman, M., and Fregly, B.J. (2010) Estimation of pose and medial/lateral contact force using multi-axial load measurements from an instrumented knee implant. *Proceedings of the ASME Summer Bioengineering Conference*, June 16-19, Naples, FL.
  80. Walter, J.P.\*, D'Lima, D.D., and Fregly, B.J. (2010) Muscle forces may explain paradoxical knee loads during different gait patterns. *Proceedings of the ASME Summer Bioengineering Conference*, June 16-19, Naples, FL.
  81. Fregly, B.J., Lin, Y.C.\*, Walter, J.P.\*, Fernandez, J.W., Banks, S.A., and Pandy, M.G. (2009) Simultaneous prediction of muscle and contact forces in the knee during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 17-21, Lake Tahoe, CA.
  82. Fregly, B.J., Lin, Y.C.\*, Walter, J.P.\*, Pandy, M.G., Banks, S.A., and D'Lima, D.D. (2009) Muscle and contact contributions to inverse dynamic knee loads during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 17-21, Lake Tahoe, CA.
  83. Walter, J.P.\*, D'Lima, D.D., and Fregly, B.J. (2009) Decreased knee adduction moment does not guarantee decreased medial contact force during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 17-21, Lake Tahoe, CA.
  84. Walter, J.P.\*, Pun, H.\*, Chan, N., Chmielewski, T.L., and Fregly, B.J. (2009) Real-time model-based gait retraining for knee osteoarthritis rehabilitation. *Proceedings of the ASME Summer Bioengineering Conference*, June 17-21, Lake Tahoe, CA.
  85. Fregly, B.J., Lin, Y.C.\*, Walter, J.P.\*, Banks, S.A., Pandy, M.G., and D'Lima, D.D. (2009) Muscle and contact contributions to inverse dynamic knee loads during gait. *Knee Arthroplasty: From Early Intervention to Revision Conference*, April 27-May 2, London, England.
  86. Whatling, G.M., Ozturk, H., Pierron, F., Larcher, M., Young, P., Evans, J., Jones, D., Banks, S.A., Fregly, B.J., and Holt, C.A. (2009) A study of the errors associated with measuring knee kinematics using marker based

- motion capture and imaging. *Knee Arthroplasty: From Early Intervention to Revision Conference*, April 27-May 2, London, England.
87. Pineda, L., Fregly, B.J., Haftka, R.T., and Queipo, N.V. (2009) Assessing the validity of surrogate models with restricted input spaces. *Proceedings of the 8th World Congress on Structural and Multidisciplinary Optimization*, June 1-5, Lisbon, Portugal.
  88. Whatling, G.M., Ozturk, H., Pierron, F., Larcher, M., Young, P., Evans, J., Jones, D., Banks, S.A., Fregly, B.J., and Holt, C.A. (2008) Fusing marker-based motion capture with image registration to study the errors associated with quantifying knee kinematics. *Proceedings of the Tenth International Symposium on the 3-D Analysis of Human Movement*, October 28-31, Santpoort-Amsterdam, Netherlands.
  89. Jackson, J.N.\*, Walter, J.P.\*, DeWitt, J.K., and Fregly, B.J. (2008) Effects of external loading on optimization predictions of vertical ground reaction forces during 0g walking. *Proceedings of the 16th International Conference of Mechanics in Medicine and Biology*, July 23-25, Pittsburgh, PA.
  90. Fattey, M.G.\* and Fregly, B.J. (2008) Simultaneous determination of skeletal model parameter values, motions, and controls from noisy measurement data. *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-192605, June 25-29, Marco Island, FL.
  91. Fernandez, J.W., Kim, H.J., Akbarshahi, M., Walter, J.P.\*, Fregly, B.J., and Pandey, M.G. (2008) Evaluation of predicted knee joint muscle forces during gait using an instrumented knee implant. *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-191839, June 25-29, Marco Island, FL.
  92. Lin, Y.C.\*, Haftka, R.T., Queipo, N.V., and Fregly, B.J. (2008) Dynamic simulation of knee motion using three-dimensional surrogate contact modeling. *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-190966, June 25-29, Marco Island, FL.
  93. Walter, J.P.\*, Banks, S.A., D'Lima, D.D., and Fregly, B.J. (2008) Prediction of internal contact forces at the knee from external measurements. *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-193169, June 25-29, Marco Island, FL.
  94. Fregly, B.J., D'Lima, D.D., and Colwell, C.W. (2008) Effective gait modification strategies for offloading the medial compartment of the knee. *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-192701, June 25-29, Marco Island, FL.
  95. Fregly, B.J. (2008) Effect of foot path alterations on adduction moment reductions produced by knee medialization during gait. *Proceedings of the 13<sup>th</sup> Annual Meeting of the Gait and Clinical Movement Analysis Society*, April 2-5, Richmond, Virginia.
  96. Fregly, B.J., Banks, S.A., D'Lima, D.D., and Colwell, C.W. (2007) Sensitivity of knee replacement contact conditions to kinematic measurement errors. *Proceedings of the XXI Congress of the International Society of Biomechanics*, July 1-5, Taipei, Taiwan.
  97. Fregly, B.J., Crossley, K., Hinman, R., and Schache, A. (2007) Evaluation of a medial-thrust gait pattern to reduce the peak knee adduction torque. *Proceedings of the XXI Congress of the International Society of Biomechanics*, July 1-5, Taipei, Taiwan.
  98. Lin, Y.-C.\*, Haftka, R.T., Queipo, N.V., and Fregly, B.J. (2007) Sensitivity of knee simulator machine wear volume to variations in motion and load inputs and component placements. *Proceedings of the XXI Congress of the International Society of Biomechanics*, July 1-5, Taipei, Taiwan.
  99. Moro-oka, T., Hamai, S., Miura, H., Higaki, H., Shimoto, T., Fregly, B.J., Iwamoto, Y., and Banks, S.A. (2007) Dynamic activity dependence of normal knee kinematics in vivo. *Proceedings of the 53rd Annual Meeting of the Orthopaedic Research Society*, February 11-14, San Diego, CA.
  100. DiGiovanna, J., Sanchez, J.C., Fregly, B.J., and Principe, J.C. (2006) Arm motion reconstruction via feature clustering in joint angle space. *Proceedings of the International Joint Conference on Neural Networks*, July 16-21, pp. 4678 - 4683, Vancouver, Canada.
  101. Fregly, B.J. and Reinbolt, J.A.\* (2006) Simulation-based treatment planning for knee osteoarthritis. *Proceedings of the 30th Annual Meeting of the American Society of Biomechanics*, September 6-9, Blacksburg, VA (Invited panelist presentation for special symposium on Clinical Application of Modeling in Biomechanics).
  102. Zhao, D.\*, Banks, S.A., Mitchell, K., D'Lima, D., Colwell, C., and Fregly, B.J. (2006) The relationship between the knee adduction torque and medial contact force during gait. *Proceedings of the 5th World Congress of Biomechanics*, July 29-August 4, Munich, Germany.
  103. Lin, Y.-C.\*, Haftka, R.T., Queipo, N.V., and Fregly, B.J. (2006) A generalized surrogate contact model for dynamic simulations with anatomic joints. *Proceedings of the ASME Summer Bioengineering Conference*, June 21-25, Amelia Island, Florida.

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104. Marquez-Barrientos, C.\*, Banks, S.A., and Fregly, B.J. (2006) The influence of sagittal and coronal conformity on predicted wear volume in total knee replacement design. *Proceedings of the ASME Summer Bioengineering Conference*, June 21-25, Amelia Island, Florida.
  105. Reinbolt, J.A.\* and Fregly, B.J. (2006) Benefits of automatic differentiation for biomechanical optimizations. *Proceedings of the ASME Summer Bioengineering Conference*, June 21-25, Amelia Island, Florida.
  106. Zhao, D.\*, Banks, S.A., Mitchell, K., D'Lima, D., Colwell, C., and Fregly, B.J. (2006) The relationship between the knee adduction torque and medial contact force during gait. *Proceedings of the ASME Summer Bioengineering Conference*, June 21-25, Amelia Island, Florida.
  107. Zhao, D.\*, Sakoda, H., Sawyer, W.G., Banks, S.A., and Fregly, B.J. (2006) Can pin-on-plate tests be used to predict joint-level wear in knee replacements? In *Proceedings of the ASME Summer Bioengineering Conference*, June 21-25, Amelia Island, Florida.
  108. Fregly, B.J., Reinbolt, J.A.\*, Rooney, K.L.\*, Mitchell, K.H., and Chmielweski, T.L. (2006) Predicting patient-specific gait modifications for knee osteoarthritis rehabilitation. *Proceedings of the 7<sup>th</sup> International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, manuscript 174, Juan-les-Pins, France.
  109. Fregly, B.J., Reinbolt, J.A.\*, Koh, B.I.\*, and Chmielweski, T.L. (2006) Evaluation of a patient-specific cost function to predict the influence of foot path on the knee adduction torque during gait. *Proceedings of the 7<sup>th</sup> International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, manuscript 173, Juan-les-Pins, France.
  110. Lin, Y.C.\*, Haftka, R.T., Queipo, N.V., and Fregly, B.J. (2006) A generalized analytical joint contact model for dynamic musculoskeletal simulations. *Proceedings of the 7<sup>th</sup> International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, manuscript 172, Juan-les-Pins, France.
  111. Banks, S.A., Zhao, D.\*, Fregly B.J., D'Lima, D.D., and Colwell, C.W. (2006) Can fluoroscopically derived kinematics be used to infer coronal knee loads? In *Proceedings of the 52nd Annual Meeting of the Orthopaedic Research Society*, p. 556, Chicago, IL.
  112. Zhao, D.\*, Fregly, B.J., Mitchell, K., D'Lima, D.D., Colwell, C.W., and Banks, S.A. (2006) Sensitivity of joint contact model predictions to imperfectly synchronized motion data inputs. *Proceedings of the 52nd Annual Meeting of the Orthopaedic Research Society*, p. 590, Chicago, IL.
  113. Zhao, D.\*, Fregly, B.J., Banks, S.A., D'Lima, D.D., and Colwell, C.W. (2006) In vivo medial and lateral tibial loads during gait, stair, kneel, and lunge activities. *Proceedings of the 52nd Annual Meeting of the Orthopaedic Research Society*, p. 277, Chicago, IL.
  114. Banks, S.A., Fregly, B.J., Harman, M.K., Hamilton, M.A., and Sawyer, W.G. (2005) Objective lifetime design of orthopaedic joint replacements: Are we there yet? In *Proceedings of the World Tribology Congress III*, p 651-652, Washington, DC.
  115. Fregly, B.J., Rooney, K.L.\*, and Reinbolt, J.A.\* (2005) Predicted gait modifications to reduce the peak knee adduction torque. *Proceedings of the XXth Congress of the International Society of Biomechanics*, p. 283, Cleveland, OH.
  116. Koh, B.-I.\*, Fregly, B.J., George, A.D., and Haftka, R.T. (2005) Parallel asynchronous particle swarm for global biomechanical optimization. *Proceedings of the 10th International Symposium on Computer Simulation in Biomechanics*, pp. 86-87, Cleveland, OH.
  117. Lin, Y.-C.\*, Fregly, B.J., Haftka, R.T., and Queipo, N.V. (2005) Surrogate-based contact modeling for efficient dynamic simulation with deformable anatomic joints. *Proceedings of the 10th International Symposium on Computer Simulation in Biomechanics*, pp. 23-24, Cleveland, OH.
  118. Reinbolt, J.A.\* and Fregly, B.J. (2005) Creation of patient-specific dynamic models from three-dimensional movement data using optimization. *Proceedings of the 10th International Symposium on Computer Simulation in Biomechanics*, pp. 11-12, Cleveland, OH.
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  121. Zhao, D.\*, Sawyer, W.G., and Fregly, B.J. (2005) Computational wear prediction of UHMWPE in knee replacements. *Proceedings of the ASTM Conference on Medical and Surgical Materials and Devices*, **Winner of the PhD Student Paper Competition** sponsored by ASTM International Committee F04 on Medical and Surgical Materials and Devices, Dallas, TX.

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122. Fregly, B.J. and Reinbolt, J.A.\* (2004) Estimation of body segment parameters from three-dimensional gait data using optimization. *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 13-16, Tampa, FL.
  123. Koh, B.I.\*, Reinbolt, J.A.\*, Fregly, B.J., and George, A.D. (2004) Parallel decomposition methods for biomechanical optimization. *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 69-72, Tampa, FL.
  124. Kolb, E., Cole, B.J., Berkson, E., Garretson, R., Farr, J., and Fregly B. (2004) The effects of medial meniscal transplantation techniques on intra-articular contact pressures. *Proceedings of the 71st Annual Meeting of the American Academy of Orthopedic Surgeons*, San Francisco, CA, March 10-14.
  125. Lin, Y.-C.\* and Fregly, B.J. (2004) Experimental evaluation of a three-dimensional knee contact model using response surface optimization. *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 29-32, Tampa, FL.
  126. Rooney, K.\* and Fregly, B.J. (2004) An inverse dynamics optimization approach for predicting human movement. *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 85-88, Tampa, FL.
  127. Banks, S.A., Fregly, B.J., Reinschmidt, C., Boniforti, F., and Romagnoli, S. (2004) In vivo gait and stair kinematics in patients with uni- and bi-unicondylar knee arthroplasty. of unicondylar and bi-unicondylar knee replacements. *Transactions of the 50th Annual Meeting of the Orthopaedic Research Society*, p. 243, San Francisco, CA.
  128. Bei, Y.\*, Fregly, B.J., Sawyer, W.G., and Banks, S.A. (2004) Predicted sensitivity of knee implant wear to insert thickness and body mass. *Transactions of the 50th Annual Meeting of the Orthopaedic Research Society*, p. 1465, San Francisco, CA.
  129. Fregly, B.J., Rahman, H.\*, and Banks, S.A. (2004) An automated image matching procedure for measuring natural knee kinematics with single-plane fluoroscopy. *Transactions of the 50th Annual Meeting of the Orthopaedic Research Society*, p. 86, San Francisco, CA.
  130. Fregly, B.J., Sawyer, W.G., Harman, M.K., and Banks, S.A. (2003) Computational prediction of in vivo wear in total knee replacements. *Proceedings of the ASME Summer Bionengineering Conference*, June 25-29, pp. 1171-1172, Key Biscayne, Florida.
  131. Rahman, H.\*, Fregly, B.J., and Banks, S.A. (2003) Accurate measurement of three-dimensional natural knee kinematics using single-plane fluoroscopy. *Proceedings of the ASME Summer Bionengineering Conference*, June 25-29, pp. 465-466, Key Biscayne, Florida
  132. Reinbolt, J.A.\*, Schutte, J.F.\*, Haftka, R.T., George, A.D., Mitchell, K.H., and Fregly, B.J. (2003) Determination of patient-specific functional axes through two-level optimization. *Proceedings of the ASME Summer Bionengineering Conference*, June 25-29, pp. 317-318, Key Biscayne, Florida
  133. Sawyer, W.G., Hamilton, M.A., Sucec, M.C., Fregly, B.J., and Banks, S.A. (2003) Analysis of in vivo crossing motion in total knee replacements. *Proceedings of the ASME Summer Bionengineering Conference*, June 25-29, pp. 549-550, Key Biscayne, Florida
  134. Schutte, J.F.\*, Koh, B.\*, Reinbolt, J.A.\*, Haftka, R.T., George, A.D., and Fregly, B.J. (2003) Scale-independent biomechanical optimization. *Proceedings of the ASME Bionengineering Conference*, June 25-29, pp. 55-56, Key Biscayne, Florida
  135. Schutte, J.F.\*, Fregly, B.J., Haftka, R.T., and George, A. (2003) A parallel particle swarm algorithm. *Proceedings of the Fifth World Congress of Structural and Multidisciplinary Optimization*, Venice, Italy.
  136. Banks, S.A., Boniforti, F., Fregly, B.J., Rahman, H.\*, Reinschmidt, C., and Romagnoli, S. (2003) The kinematics of deep flexion in bi-cruciate retaining resurfacing knee arthroplasty. *Transactions of the 49<sup>th</sup> Annual Meeting of the Orthopaedic Research Society*, p. 1323, New Orleans, LA.
  137. Fregly, B.J. (2000) Effect of femoral component malrotation on contact stress in total knee replacements. *Proceedings of the 24th Annual Meeting of the American Society of Biomechanics*, pp. 101-102, University of Illinois at Chicago, Chicago, IL.
  138. Fregly, B.J. (1999) A three-dimensional compliant contact model for dynamic simulation of total knee replacements. *Proceedings of the VIIth International Symposium on Computer Simulation in Biomechanics*, pp. 10-13, University of Calgary, Calgary, Alberta, Canada.
  139. Fregly, B.J. (1997) A measurement procedure to reduce pedaling inverse dynamics errors due to linkage model inaccuracies. *Proceedings of the ASME Summer Bioengineering Conference*, June 11-15, pp. 449-450, Sun River, Oregon.

140. Fregly, B.J. and Whalen, R.T. (1995) Simulated changes in control strategy during altered gravity pedaling. *Proceedings of the 19th Annual Meeting of the American Society of Biomechanics*, pp. 67-68, Stanford University, Stanford, CA.

## RESEARCH SUPPORT

Total research funding: \$11,563,169, primarily as PI

*Largest NIH R01 grant in the Univ. of Florida College of Engineering in the past 10 years (evaluated Sept. 2015)*

### *Funded*

1. *Optimizing Surgical and Rehabilitation Treatment of Pelvic Sarcomas* 6/1/17-5/30/22  
Cancer Prevention Research Institute of Texas (CPRIT)  
“Recruitment of Established Investigators” grant to develop patient-specific computational walking models that facilitate the design of surgical interventions and 3D printed custom implants that optimize post-surgery walking function in individuals with pelvic sarcoma.  
Role: PI (Fred Higgs - Rice University, Valerae Lewis - MD Anderson Cancer Center, Scott Tashman, UT Health, Co-Is)  
Amount: \$5,104,127
2. *Computational Design of FastFES Rehabilitation to Improve Post-Stroke Gait* 1/1/17-12/31/17  
National Institutes of Health National Center for Simulation in Rehabilitation Research Pilot Project  
Design of optimal functional electrical stimulation prescriptions (which muscles to stimulate, when, and how much during walking) for two individuals post-stroke using a patient-specific neuromusculoskeletal model.  
Role: PI (Lena Tina and Trisha Kesar - Emory University/Georgia Tech, collaborators)  
Amount: \$30,000
3. *Development of a Muscle Adaptation in Space-flight Simulator (“MASS”)* 9/1/16-8/31/20  
National Aeronautics and Space Administration HERO Program  
Development of multiscale computational models that can predict changes in lower limb muscle structure and function in response to exercise under microgravity conditions during extended spaceflight.  
Role: Co-I (Silvia Blemker - University of Virginia, PI)  
Amount: \$750,000
4. *CDS&E: A Next-Generation Computation Framework for Predicting Optimal Walking Motion* 8/15/14-8/14/17  
National Science Foundation CBET Division  
Development of a computational framework for calibrating patient-specific neuromusculoskeletal models and predicting muscle forces and walking motions using customized optimal control methods.  
Role: PI (Anil Rao, Co-I)  
Amount: \$499,994
5. *REU: Computational Neuromechanics for Stroke Rehabilitation* 1/1/14-8/15/14  
National Science Foundation CBET Division BME Program  
Use of muscle synergy analysis methods to evaluate whether EMG signals collected from a small number of muscles can be used to construct EMG signals for other muscles without experimental data.  
Role: PI  
Amount: \$7,000
6. *Driving Biological Problem: Predictive Simulations to Improve Walking in Patients Post Stroke* 1/1/14-8/15/14  
Stanford University (National Institutes of Health subcontract)  
Development of computationally efficient methods for accessing OpenSim musculoskeletal models through Matlab to calibrate model parameter values and generate walking motion predictions.  
Role: PI  
Amount: \$34,885

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7. *Computational Neuromechanics for Stroke Rehabilitation*  
National Science Foundation CBET Division BME Program 8/15/12-8/14/15  
Development of a novel computational method to predict best achievable gait patterns for subjects post-stroke, accounting for patient-specific neural control capabilities and limitations.  
Role: PI (Carolynn Patten, Co-I)  
Amount: \$330,000
  8. *Computational Wear Assessment for BiCR Knee Designs*  
Biomet Corporation 10/1/10-4/1/11  
Computational evaluation of wear performance in new knee replacement designs.  
Role: PI  
Amount: \$27,132
  9. *EAGER: Treatment Planning for Gait Pathologies Based on Whole-Body Angular and Linear Momentum*  
National Science Foundation CBET Division RAPD Program 8/15/10-8/14/13  
Development and evaluation of a novel computational methodology that uses specified whole-body momentum variations to generate different gait patterns on a patient-specific basis.  
Role: PI  
Amount: \$116,841
  10. *Evaluation of In Vivo Knee Load Predictions using Instrumented Implants*  
National Institutes of Health NIBIB R01 Program (EB009351) 8/1/10-4/30/15  
Evaluation of different computational methods for predicting muscle and contact forces in the knee based on in vivo contact force measurements made with instrumented knee replacements.  
Role: PI (Darryl D'Lima - Scripps Clinic, M-PI; Scott Banks - University of Florida, Co-I; Scott Delp - Stanford University, Co-I; David Lloyd - Griffith University, Co-I)  
Amount: \$2,265,174
  11. *Estimating Probability of Gain in Next Cycle of Surrogate Based Design Optimization*  
National Science Foundation CMMI Division 9/1/09-8/31/12  
Development of a surrogate-based design optimization methodology to predict whether a target level of design improvement can be obtained by performing an additional costly design cycle.  
Role: Co-I (Raphael Haftka, PI)  
Amount: \$250,000
  12. *Computational Simulation of Knee Osteoarthritis Development*  
National Science Foundation CBET Division BME Program 1/1/09-12/31/11  
Adaptive computational simulation of how knee osteoarthritis develops progressively over time due to alterations in joint motions and loads caused by anterior cruciate ligament injury.  
Role: PI (Scott Banks and BaryBeth Horodyski, Co-Is)  
Amount: \$239,989
  13. *Real-Time Model-Based Gait Retraining for Knee Osteoarthritis Rehabilitation*  
National Institutes of Health NCMRR R21 Program 9/12/07-8/31/10  
Gait retraining of 10 knee osteoarthritis patients using real-time feedback techniques with a customized motion "target" for each patient provided by a patient-specific computational model.  
Role: PI (Raphael Haftka, Terese Chmielewski, and Michael Moser, Co-Is)  
Amount: \$384,368
  14. *IREE: Surrogate-Based Modeling of Joint Contact Mechanics*  
National Science Foundation CBET Division BME Program 8/16/07-4/30/09  
Funding for international travel to collaborate with researchers at the University of Melbourne in Melbourne, Australia.  
Role: PI  
Amount: \$15,318

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15. *Computational Contact Pressure Testing of Knee Replacement Design Concepts*  
Encore Medical Corporation 1/1/07-6/1/07  
Computational evaluation of a new knee replacement design.  
Role: PI  
Amount: \$24,000
  16. *Surrogate-Based Modeling of Joint Contact Mechanics*  
National Science Foundation CBET Division BME/RAPD Program 5/1/06-4/30/09  
Development of surrogate contact modeling approaches to greatly improve the computational speed of dynamic contact analyses of human joints.  
Role: PI (Raphael Haftka, Co-I)  
Amount: \$270,000
  17. *Design and Computational Analysis of Novel Knee Replacement Concept*  
MAKO Surgical Corporation 7/1/05-8/15/08  
Development of virtual prototyping capabilities for predicting the in vivo function and wear of current and future artificial knee designs.  
Role: Co-I (Scott Banks, PI)  
Amount: \$223,488
  18. *Surgery Simulation of High Tibial Osteotomy - Transitional*  
Whitaker Foundation Biomedical Engineering Supplemental Research Grant 5/1/05-4/30/06  
Refinement of patient-specific dynamic musculoskeletal computer modeling methods to predict how high tibial osteotomy wedge angle affects clinical outcome as measured by the peak knee adduction moment during gait  
Role: PI  
Amount: \$80,000
  19. *Virtual Testing of a Unicondylar Knee Replacement Design*  
Exactech Corporation 10/8/04-1/1/05  
Computational evaluation of contact pressures and areas for FDA approval of a new unicondylar knee replacement design.  
Role: PI  
Amount: \$29,000
  20. *CAREER: Virtual Prototyping of Artificial Knees*  
National Science Foundation CBET Division CAREER Program 5/1/03-4/30/08  
Development of virtual prototyping capabilities for predicting the in vivo function and wear of current and future artificial knee designs.  
Role: PI  
Amount: \$400,000
  21. *Virtual Testing of a Total Knee Replacement Design*  
Stryker-Howmedica Osteonics Corporation 4/1/03-12/1/03  
Computational testing of contact loads following ligament balancing for a new total knee replacement design.  
Role: PI  
Amount: \$12,500
  22. *A Computational Framework for Simulating Joint Mechanics*  
National Institutes of Health NLM R03 Program 5/1/02-4/30/05  
Development of parallel processing capabilities for optimizing human movement and predicting knee joint contact pressures within a larger gross movement musculoskeletal model.  
Role: PI  
Amount: \$206,874



23. *Contact Stress Testing of Artificial Knees*  
 Exactech Corporation 9/18/01-12/15/02  
 Experimental contact pressure testing of a different knee replacement designs for FDA approval.  
 Role: PI  
 Amount: \$22,500

24. *Surgery Simulation of High Tibial Osteotomy*  
 Whitaker Foundation Biomedical Engineering Research Grant 9/1/01-8/31/04  
 Development of patient-specific dynamic musculoskeletal computer models to predict how high tibial osteotomy wedge angle affects clinical outcome measured by the peak knee adduction moment during gait.  
 Role: PI  
 Amount: \$239,979

## GRADUATE STUDENTS

### *Ph.D. Students*

\* = Estimated graduation date

<i>Name</i>	<i>Research Topic</i>	<i>Department</i>	<i>Graduation Date</i>
1. Yanhong Bei	Dynamic simulation of knee joint contact during human movement	Mechanical & Aerospace Engineering (chair)	May 2004
2. Byung-II Koh	Parallel algorithms for biomechanical optimization problems	Electrical & Computer Engineering (co-chair, 50% responsibility)	December 2005
3. Jaco Schutte	Decomposition and optimization of large scale systems with the particle swarm algorithm	Mechanical & Aerospace Engineering (co-chair, 35% responsibility)	December 2005
4. Jeffrey Reinbolt	Patient-specific musculoskeletal models for predicting post-surgical functional outcomes	Mechanical & Aerospace Engineering (chair)	May 2006
5. Dong Zhao	Analysis of in vitro and in vivo function of total knee replacements using dynamic contact models	Mechanical & Aerospace Engineering (chair)	August 2006
6. Yi-Chung Lin	Three-dimensional surrogate contact modeling for computationally efficient dynamic simulation of human joints	Mechanical & Aerospace Engineering (chair)	December 2008
7. Cameron Nott	Angular momentum during gait - a computational simulation	Mechanical & Aerospace Engineering (chair)	August 2010
8. Jonathan Walter	Neural modules to predict muscle and contact forces during gait	Mechanical & Aerospace Engineering (chair)	December 2012
9. Jennifer Jackson	Treatment planning for gait pathologies based on whole-body angular and linear momentum	Biomedical Engineering (chair)	December 2013
10. Lingmin Li	Computational simulation of osteoarthritis development in the ACL-deficient knee	Mechanical & Aerospace Engineering (chair)	August 2014
11. Gil Serrancolí	Optimization and muscle synergy approaches for studying muscle redundancy during walking	Biomedical Engineering <sup>†</sup> (co-chair, 50% responsibility)	May 2015
12. Ilan Eskinazi	Computationally efficient prediction of muscle forces, joint contact forces, and leg motion during walking	Mechanical & Aerospace Engineering (chair)	December 2015

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13. Andrew Meyer	Prediction of optimal rehabilitation outcomes post-stroke	Mechanical & Aerospace Engineering (chair)	May 2016
14. Nathan Sauder	Calibration and optimization of patient-specific neuromusculo-skeletal models using optimal control methods	Mechanical & Aerospace Engineering (chair)	December 2017*
15. Michael Fattey	Measurement of walking motion outdoors using inertial measurement units and full-body kinematic models	Mechanical & Aerospace Engineering (chair)	December 2018*
16. Míriam Febrer-Nafria	Prediction of assisted walking using subject-specific biomechanical models	Biomedical Engineering <sup>†</sup> (co-chair, 50% responsibility)	May 2019*
17. Marleny Arones	Design of patient-specific neuro-rehabilitation treatments using optimal control methods	Mechanical Engineering (chair)	May 2021*
18. Di Ao	Prediction of post-surgery walking function using EMG-driven neuromusculoskeletal models	Mechanical Engineering (chair)	May 2022*
19. Ata Babazadeh	Design of patient-specific pelvic implants using finite element methods	Mechanical Engineering (co-chair, 50% responsibility)	May 2022*
20. Grant Boggess	Computational modeling and simulation of upper extremity robotic neurorehabilitation	Mechanical Engineering (chair)	May 2022*
21. Geng Li	Calibration of patient-specific neuromusculoskeletal models for clinical treatment design	Mechanical Engineering (chair)	May 2022*
22. Hanna Matry	Computational simulation of muscle forces for exercise countermeasures under microgravity conditions	Mechanical Engineering (chair)	May 2022*

<sup>†</sup>Universitat Politècnica de Catalunya – BarcelonaTech

### ***M.S. Students***

<i>Name</i>	<i>Research Topic</i>	<i>Department</i>	<i>Graduation Date</i>
1. Iona Dy-Liacco	Creation of kinematic models of human movement from video motion data	Biomedical Engineering (chair)	August 2001
2. Yanhong Bei	Multibody contact model formulations for simulating human joints	Mechanical & Aerospace Engineering (chair)	December 2001
3. Priya Prasad	Determination of patient-specific inertial parameters through two-level optimization	Biomedical Engineering (chair)	August 2002
4. Mona McCullough	Estimation of subject-specific inertial parameters from anthropometric data	Biomedical Engineering (chair)	August 2002
5. Jeffrey Reinbolt	Determination of patient-specific functional axes through two-level optimization	Biomedical Engineering (chair)	August 2003
6. Haseeb Rahman	Accurate measurement of three-dimensional natural knee kinematics using single-plane fluoroscopy	Biomedical Engineering (chair)	August 2004

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7. Yi-Chung Lin	Experimental evaluation of a natural knee contact model using response surface optimization	Mechanical & Aerospace Engineering (chair)	August 2004
8. Kelly Rooney	Human movement prediction using inverse dynamic optimization	Biomedical Engineering (chair)	December 2004
9. Michael McDowell	Piezoresistive sensor equilibration for contact pressure measurements	Mechanical & Aerospace Engineering (chair)	May 2005
10. Carlos Marquez	Computational assessment of sagittal and coronal conformity on knee implant wear	Biomedical Engineering (chair)	May 2008
11. Oliver Oyama	A Matlab toolbox for creating surrogate contact models	Mechanical & Aerospace Engineering (chair)	December 2010
12. Mihir Pai	Prediction of stroke rehabilitation responders and non-responders based on muscle synergy analysis	Mechanical & Aerospace Engineering (chair)	May 2014
14. Feiyu Yang	Maximum robustness versus minimum effort for estimating muscle forces during walking	Mechanical & Aerospace Engineering (chair)	December 2016
13. Caitlin Banks	Muscle synergy variations at baseline differentiate responders from non-responders to walking rehabilitation post-stroke	Biomedical Engineering (chair)	December 2016

## TEACHING EXPERIENCE

### *Undergraduate Courses*

1. Biodynamics
2. Introduction to Numerical Methods of Engineering Analysis
3. Engineering Mechanics - Dynamics

Average teaching evaluation: 4.6 out of 5.0

### *Graduate Courses*

1. Analytical Dynamics
2. Numerical Methods of Engineering Analysis
3. Mechanics of the Human Locomotor System
4. Effective Technical Presentations

Average teaching evaluation: 4.7 out of 5.0

## PROFESSIONAL SERVICE

### *Service – University of Florida*

Co-Chair, Graduate Recruiting and Admissions Committee, Dept. of Mechanical & Aerospace Engineering (2015-2017)

Member, Dean's Operations Advisory Committee, College of Engineering (2012-2013)

Chair, Graduate Admissions and Awards Committee, Dept. of Mechanical & Aerospace Engineering (2009-2014)

Member, Undergraduate Curriculum Committee, Dept. of Mechanical & Aerospace Engineering (2008-2009)

Member, Teaching Advisory Committee, College of Engineering (2008-2010)

Chair, Graduate Admissions and Awards Committee, Dept. of Mechanical & Aerospace Engineering (2006-2007)

Chair, Graduate Recruiting, Admissions, and Awards Committee, Dept. of Mechanical & Aerospace Engineering (2005-2006)

Member, Faculty Search Committee, Dept. of Mechanical & Aerospace Engineering (2005-2006)

Member, Graduate Curriculum and Policy Committee, Dept. of Mechanical & Aerospace Engineering (2005-2006)

Midterm Tenure Packet Reviewer, Dept. of Mechanical & Aerospace Engineering (2006)

Coordinator, Undergraduate and Graduate Biomechanics Courses, Dept. of Mechanical & Aerospace Engineering (2004-2007)

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Member, Chair Search Committee, Dept. of Mechanical & Aerospace Engineering (2004-2005)  
Departmental Representative, BME Graduate Curriculum Coordination Committee, Dept. of Mechanical & Aerospace Engineering (2004-2007)  
Member, Faculty Search Committee, Dept. of Mechanical & Aerospace Engineering (2004)

***Professional Memberships***

American Society of Mechanical Engineers (1987-present)  
International Society of Biomechanics Technical Group on Computer Simulation (2005-present)

***Professional Service***

Organizer, Annual International “Grand Challenge Competition to Predict In Vivo Knee Loads,” ASME Bioengineering Division (2009-2015)  
Executive Committee, Technical Group on Computer Simulation, International Society of Biomechanics (2005-2013)  
Design, Dynamics, & Rehabilitation Committee, Bioengineering Division, American Society of Mechanical Engineers (2008-present)  
Program Committee, 11th International Symposium on Computer Simulation in Biomechanics, Taipei, Taiwan (2007)  
Editorial Board, Medical Engineering & Physics (2008-present)  
Program Committee, 12th International Symposium on Computer Simulation in Biomechanics, Cape Town, South Africa (2009)  
Program Chair, Gait & Clinical Movement Analysis Society Annual Conference, Bethesda, MD (2011)  
Program Committee, 13th International Symposium on Computer Simulation in Biomechanics, Leuven, Belgium (2011)  
Program Committee, 14th International Symposium on Computer Simulation in Biomechanics, Natal, Brazil (2013)  
Workshop Organizer, Optimal Control Workshop, 15th International Symposium on Computer Simulation in Biomechanics, Edinburgh, Scotland (2015)

***Grant Reviewer***

National Aeronautics and Space Administration  
National Institutes of Health  
National Science Foundation  
Orthopaedic Research & Education Foundation

***Scientific Advisory Boards***

*Scientific Advisory Board Member, National Science Foundation Mobility Panel, General and Age-related Disabilities Engineering within the Chemical, Bioengineering, Environmental, and Transport Systems Division. Identified cutting-edge research directions in Europe in the area of “Technology to Improve Mobility” to inform future funding emphases for the program (2010-2012).*  
*Scientific Advisory Board Chair, National Institutes of Health Center for Biomedical Computation, Stanford University. Provide scientific advice, evaluation of ongoing center activities, and direction for future center activities related to biological simulation, software engineering, and technology dissemination. (2013).*

***Journal Manuscript Reviewer***

Clinical Orthopaedics and Related Research  
Computer Methods in Biomechanics and Biomedical Engineering  
Gait and Posture  
IEEE Transactions on Biomedical Engineering  
IEEE Transactions on Systems, Man and Cybernetics - Part B  
International Journal for Numerical Methods in Engineering  
Journal of Aerospace Computing, Information, and Communication  
Journal of Applied Biomechanics  
Journal of Biomechanical Engineering  
Journal of Biomechanics  
Journal of Orthopaedic Research

Medical Engineering & Physics  
 Medicine and Science in Sports & Exercise  
 PLOS Computational Biology

### Patents

#### *Prosthetic Device and System and Method for Implanting Prosthetic Device*

Inventors: Binyamin Hajaj, Jason Otto, Rony Abovitz, Steven B. Brown, Scott A. Banks, Benjamin J. Fregly, and Dana C. Mears.

This invention relates to orthopedic joint replacement and, more particularly, to a prosthetic device for use in orthopedic joint replacement for resurfacing an articular surface of a bone and a system and method for implanting the prosthetic device. U.S. Patent Number US20080058945.

#### *Computational Algorithm for Measuring Movement with Minimal Number of IMUs*

Inventors: Benjamin J. Fregly and Thor F. Besier

This invention relates to measurement of full-body human movement using as few inertial measurement units (IMUs) as possible through implementation of a novel computational algorithm. Invention disclosure currently under evaluation by the University of Florida Office of Technology and Licensing.

### International Competition Organizer

*Grand Challenge Competition to Predict In Vivo Knee Loads.* The goal of this conference-based annual competition funded by NIH was to evaluate musculoskeletal model predictions of in vivo muscle and contact forces in the knee using movement data collected from subjects implanted with force-measuring knee replacements. The predictions were performed in a blinded fashion, as competitors did not know the in vivo force measurements until after submitting their predictions. Since its establishment in September of 2009, the competition website has received over 20,000 page hits by over 2,000 unique visitors on six continents. Five competitions were held at the ASME Summer Bioengineering Conference from 2010 to 2014, and a sixth and final competition was completed through the ASME Journal of Biomechanical Engineering in 2015. In all, research teams from 12 countries participated. Competition data sets and models have already played a central role in over 100 journal articles, 2 book chapters, 12 PhD dissertations, over 100 conference papers, 12 invited lectures, 6 university courses, and 12 funded grant proposals worth over \$12 million. The competition has *raised awareness* in the musculoskeletal modeling research community of the need for more thorough validation of model-based predictions of muscle and joint contact forces, and it has *raised the bar* on the extent of model validation required before model-based predictions can be published in high impact journals.

