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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-present **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-present **Adjunct Associate Professor**, Department of Mechanical Engineering, University of Melbourne,
Melbourne, Australia.

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.
- 2003-2008 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.

PUBLICATIONS

*Graduate student supervised by Dr. Fregly

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Publications can be downloaded from <http://www.mae.ufl.edu/~fregly/Publications.htm>

Journal Articles

Times cited: 358, h-index: 12

1. Fregly, B.J.[†] (2008) Design of optimal treatments for neuromusculoskeletal disorders using patient-specific multibody dynamic models. *International Journal of Computational Vision and Biomechanics* (in press).
2. Fregly, B.J.[†], D'Lima, D.D., and Colwell, C.W. Jr. (2008) Effective gait patterns for offloading the medial compartment of the knee. *Journal of Orthopaedic Research* (in press).
3. Koh, B.-I.*^{*}, Reinbolt, J.A.*^{*}, George, A.D., Haftka, R.T., and Fregly, B.J.[†] (2008) Limitations of parallel global optimization for large-scale human movement problems. *Medical Engineering & Physics* (in press).
4. Lin, Y.C.*^{*}, Queipo, N.V., Haftka, R.T., and Fregly, B.J.[†] (2008) Two-dimensional surrogate contact modeling for computationally efficient dynamic simulations of total knee replacements. *Journal of Biomechanical Engineering* (in press).
5. 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.
6. Fregly, B.J.[†] (2008) Computational assessment of combinations of gait modifications for knee osteoarthritis rehabilitation. *IEEE Transactions on Biomedical Engineering* **55**, 2104-2106.
7. 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.
8. 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.
9. 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.
10. 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.
11. Schache, A.G.[†], Fregly, B.J., Crossley, K.M, Hinman, R.S., and Pandy, M.G. (2008) The effect of gait modification on the external knee adductor moment is reference frame dependent. *Clinical Biomechanics* **23**, 601-608.
12. 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.
13. 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**, 011004-1 - 011004-10.
14. 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.
15. 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.
16. 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.
17. 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.
18. 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).

19. 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.
20. 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.
21. 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.
22. 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.
23. 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.
24. 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.
25. 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.
26. 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.
27. 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.
28. 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.
29. 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.
30. Bei, Y.* and Fregly, B.J.† (2004) Multibody dynamic simulation of knee contact mechanics. *Medical Engineering & Physics* **26**, 777-789.
31. 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.
32. 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.
33. 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.
34. Fregly, B.J.† and Sawyer, W.G. (2003) Estimation of discretization errors in contact pressure measurements. *Journal of Biomechanics* **36**, 609-613.
35. 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.
36. 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.
37. 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.
38. 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.
39. 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.
40. 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.
41. 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.

42. 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.

Submitted Journal Articles

1. Hamai, S., Moro-oka, T., Miura, H., Shimoto, T., Higaki, H., Fregly, B.J., Iwamoto, Y., and Banks, S.[†] (2008) Knee kinematics in medial osteoarthritis during in vivo weight-bearing activities. *Journal of Orthopaedic Research* (in review).
2. Kim, H.J, Fernandez, J.W., Akbarshahi, M., Walter, J.P., Fregly, B.J., and Pandy, M.G.[†] (2008) Evaluation of predicted knee-joint muscle and contact forces during gait using an instrumented knee implant. *Journal of Orthopaedic Research* (recommended for publication pending minor revisions).
3. Lin, Y.C., Haftka, R.T., Queipo, N.V., and Fregly, B.J.[†] (2008) Three-dimensional surrogate contact models for computationally-efficient multibody dynamic simulations. *International Journal for Numerical Methods in Engineering* (in review).
4. Marquez-Barrientos, C., Banks, S.A., DesJardins, J.D., and Fregly, B.J.[†] (2008) Increased conformity offers diminishing returns for total knee replacement wear. *Journal of Biomechanical Engineering* (in review).

Conference Papers

1. 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. In *Proceedings of the Tenth International Symposium on the 3-D Analysis of Human Movement*, October 28-31, Santpoort-Amsterdam, Netherlands.
2. 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. In *Proceedings of the 16th International Conference of Mechanics in Medicine and Biology*, July 23-25, Pittsburgh, PA.
3. Fattey, M.G. and Fregly, B.J. (2008) Simultaneous determination of skeletal model parameter values, motions, and controls from noisy measurement data. In *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-192605, June 25-29, Marco Island, FL, The American Society of Mechanical Engineers, New York.
4. Fernandez, J.W., Kim, H.J., Akbarshahi, M., Walter, J.P., Fregly, B.J., and Pandy, M.G. (2008) Evaluation of predicted knee joint muscle forces during gait using an instrumented knee implant. In *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-191839, June 25-29, Marco Island, FL, The American Society of Mechanical Engineers, New York.
5. 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. In *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-190966, June 25-29, Marco Island, FL, The American Society of Mechanical Engineers, New York.
6. 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. In *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-193169, June 25-29, Marco Island, FL, The American Society of Mechanical Engineers, New York.
7. Fregly, B.J., D'Lima, D.D., and Colwell, C.W. (2008) Effective gait modification strategies for offloading the medial compartment of the knee. In *Proceedings of the ASME Summer Bioengineering Conference*, SBC2008-192701, June 25-29, Marco Island, FL, The American Society of Mechanical Engineers, New York.
8. Fregly, B.J. (2008) Effect of foot path alterations on adduction moment reductions produced by knee medialization during gait. In *Proceedings of the 13th Annual Meeting of the Gait and Clinical Movement Analysis Society*, April 2-5, Richmond, Virginia.
9. 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. In *Proceedings of the XXI Congress of the International Society of Biomechanics*, July 1-5, Taipei, Taiwan.
10. 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. In *Proceedings of the XXI Congress of the International Society of Biomechanics*, July 1-5, Taipei, Taiwan.
11. 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. In *Proceedings of the XXI Congress*

- of the *International Society of Biomechanics*, July 1-5, Taipei, Taiwan.
12. 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. In *Proceedings of the 53rd Annual Meeting of the Orthopaedic Research Society*, February 11-14, 2007, San Diego, CA.
 13. DiGiovanna, J., Sanchez, J.C., Fregly, B.J., and Principe, J.C. (2006) Arm motion reconstruction via feature clustering in joint angle space. In *Proceedings of the International Joint Conference on Neural Networks*, July 16-21, pp. 4678 - 4683, Vancouver, Canada.
 14. Fregly, B.J. and Reinbolt, J.A.* (2006) Simulation-based treatment planning for knee osteoarthritis. In *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).
 15. 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. In *Proceedings of the 5th World Congress of Biomechanics*, July 29-August 4, Munich, Germany.
 16. 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. In *Proceedings of the 2006 Summer Bioengineering Conference*, BIO2006-157789, Amelia Island, Florida, The American Society of Mechanical Engineers, New York.
 17. 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. In *Proceedings of the 2006 Summer Bioengineering Conference*, BIO2006-158085, Amelia Island, Florida, The American Society of Mechanical Engineers, New York.
 18. Reinbolt, J.A.* and Fregly, B.J. (2006) Benefits of automatic differentiation for biomechanical optimizations. In *Proceedings of the 2006 Summer Bioengineering Conference*, BIO2006-157681, Amelia Island, Florida, The American Society of Mechanical Engineers, New York.
 19. 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. In *Proceedings of the 2006 Summer Bioengineering Conference*, BIO2006-158035, Amelia Island, Florida, The American Society of Mechanical Engineers, New York.
 20. 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 2006 Summer Bioengineering Conference*, BIO2006-157865, Amelia Island, Florida, The American Society of Mechanical Engineers, New York.
 21. 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. In *Proceedings of the 7th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, manuscript 174, Juan-les-Pins, France.
 22. 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. In *Proceedings of the 7th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, manuscript 173, Juan-les-Pins, France.
 23. Lin, Y.C.*, Haftka, R.T., Queipo, N.V., and Fregly, B.J. (2006) A generalized analytical joint contact model for dynamic musculoskeletal simulations. In *Proceedings of the 7th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, manuscript 172, Juan-les-Pins, France.
 24. Banks, S.A., Zhao, D.*, Fregly B.J., D'Lima, D.D., and Colwell, C.W. Jr. (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.
 25. Zhao, D.*, Fregly, B.J., Mitchell, K., D'Lima, D.D., Colwell, C.W. Jr., and Banks, S.A. (2006) Sensitivity of joint contact model predictions to imperfectly synchronized motion data inputs. In *Proceedings of the 52nd Annual Meeting of the Orthopaedic Research Society*, p. 590, Chicago, IL.
 26. Zhao, D.*, Fregly, B.J., Banks, S.A., D'Lima, D.D., and Colwell, C.W. Jr. (2006) In vivo medial and lateral tibial loads during gait, stair, kneel, and lunge activities. In *Proceedings of the 52nd Annual Meeting of the Orthopaedic Research Society*, p. 277, Chicago, IL.
 27. 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.

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28. Fregly, B.J., Rooney, K.L.*, and Reinbolt, J.A.* (2005) Predicted gait modifications to reduce the peak knee adduction torque. In *Proceedings of the XXth Congress of the International Society of Biomechanics*, p. 283, Cleveland, OH.
 29. Koh, B.-I.*, Fregly, B.J., George, A.D., and Haftka, R.T. (2005) Parallel asynchronous particle swarm for global biomechanical optimization. In *Proceedings of the 10th International Symposium on Computer Simulation in Biomechanics*, pp. 86-87, Cleveland, OH.
 30. 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. In *Proceedings of the 10th International Symposium on Computer Simulation in Biomechanics*, pp. 23-24, Cleveland, OH.
 31. Reinbolt, J.A.* and Fregly, B.J. (2005) Creation of patient-specific dynamic models from three-dimensional movement data using optimization. In *Proceedings of the 10th International Symposium on Computer Simulation in Biomechanics*, pp. 11-12, Cleveland, OH.
 32. Zhao, D.*, Fregly, B.J., Banks, S.A., D'Lima, D.D., and Colwell, C.W. (2005) Computational determination of in vivo medial and lateral tibial forces during gait. In *Proceedings of the 10th International Symposium on Computer Simulation in Biomechanics*, pp. 53-54, Cleveland, OH.
 33. Zhao, D.*, Fregly, B.J., and Sawyer, W.G. (2005) Dynamic simulation of a simulator machine for knee implant damage prediction. In *Proceedings of the IMechE Knee Arthroplasty Technology Conference*, pp. 237-240, London, England.
 34. Zhao, D.*, Sawyer, W.G., and Fregly, B.J. (2005) Computational wear prediction of UHMWPE in knee replacements. In *Proceedings of the ASTM Conference on Medical and Surgical Materials and Devices*, Winner of the Student Paper Competition sponsored by ASTM International Committee F04 on Medical and Surgical Materials and Devices, Dallas, TX.
 35. Fregly, B.J. and Reinbolt, J.A.* (2004) Estimation of body segment parameters from three-dimensional gait data using optimization. In *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 13-16, Tampa, FL.
 36. Koh, B.I.*, Reinbolt, J.A.*, Fregly, B.J., and George, A.D. (2004) Parallel decomposition methods for biomechanical optimization. In *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 69-72, Tampa, FL.
 37. 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. In *Proceedings of the 71st Annual Meeting of the American Academy of Orthopedic Surgeons*, San Francisco, CA, March 10-14.
 38. Lin, Y.-C.* and Fregly, B.J. (2004) Experimental evaluation of a three-dimensional knee contact model using response surface optimization. In *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 29-32, Tampa, FL.
 39. Rooney, K.* and Fregly, B.J. (2004) An inverse dynamics optimization approach for predicting human movement. In *Proceedings of the Eighth International Symposium on the 3D Analysis of Human Movement*, pp. 85-88, Tampa, FL.
 40. 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. In *Transactions of the 50th Annual Meeting of the Orthopaedic Research Society*, p. 243, San Francisco, CA.
 41. 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. In *Transactions of the 50th Annual Meeting of the Orthopaedic Research Society*, p. 1465, San Francisco, CA.
 42. Fregly, B.J., Rahman, H.*, and Banks, S.A. (2004) An automated image matching procedure for measuring natural knee kinematics with single-plane fluoroscopy. In *Transactions of the 50th Annual Meeting of the Orthopaedic Research Society*, p. 86, San Francisco, CA.
 43. Fregly, B.J., Sawyer, W.G., Harman, M.K., and Banks, S.A. (2003) Computational prediction of in vivo wear in total knee replacements. In *Proceedings of the 2003 Summer Bionengineering Conference* (Edited by Soslow, L.J., Skalak, T.C., Wayne, J.S., and Livesay, G.A.), pp. 1171-1172, The American Society of Mechanical Engineers, New York.

44. Rahman, H.*, Fregly, B.J., and Banks, S.A. (2003) Accurate measurement of three-dimensional natural knee kinematics using single-plane fluoroscopy. In *Proceedings of the 2003 Summer Bionengineering Conference* (Edited by Soslowky, L.J., Skalak, T.C., Wayne, J.S., and Livesay, G.A.), pp. 465-466, The American Society of Mechanical Engineers, New York.
45. 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. In *Proceedings of the 2003 Summer Bionengineering Conference* (Edited by Soslowky, L.J., Skalak, T.C., Wayne, J.S., and Livesay, G.A.), pp. 317-318, The American Society of Mechanical Engineers, New York.
46. 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. In *Proceedings of the 2003 Summer Bionengineering Conference* (Edited by Soslowky, L.J., Skalak, T.C., Wayne, J.S., and Livesay, G.A.), pp. 549-550, The American Society of Mechanical Engineers, New York.
47. Schutte, J.F.*, Koh, B.*, Reinbolt, J.A.*, Haftka, R.T., George, A.D., and Fregly, B.J. (2003) Scale-independent biomechanical optimization. In *Proceedings of the 2003 ASME Bionengineering Conference* (Edited by Soslowky, L.J., Skalak, T.C., Wayne, J.S., and Livesay, G.A.), pp. 55-56, The American Society of Mechanical Engineers, New York.
48. Schutte, J.F.*, Fregly, B.J., Haftka, R.T., and George, A. (2003) A parallel particle swarm algorithm. In *Proceedings of the Fifth World Congress of Structural and Multidisciplinary Optimization*, 6 pages, Venice, Italy.
49. 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. In *Transactions of the 49th Annual Meeting of the Orthopaedic Research Society*, p. 1323, New Orleans, LA.
50. Fregly, B.J. (2000) Effect of femoral component malrotation on contact stress in total knee replacements. In *Proceedings of the 24th Annual Meeting of the American Society of Biomechanics*, pp. 101-102, University of Illinois at Chicago, Chicago, IL.
51. Fregly, B.J. (1999) A three-dimensional compliant contact model for dynamic simulation of total knee replacements. In *Proceedings of the VIIth International Symposium on Computer Simulation in Biomechanics*, pp. 10-13, University of Calgary, Calgary, Alberta, Canada.
52. Fregly, B.J. (1997) A measurement procedure to reduce pedaling inverse dynamics errors due to linkage model inaccuracies. In *Proceedings of the 1997 Summer Bioengineering Conference* (Edited by Chandran, K. B., Vanderby, R., and Hefzy, M. S.), BED-vol 35, pp. 449-450, The American Society of Mechanical Engineers, New York.
53. Fregly, B.J. and Whalen, R.T. (1995) Simulated changes in control strategy during altered gravity pedaling. In *Proceedings of the 19th Annual Meeting of the American Society of Biomechanics*, pp. 67-68, Stanford University, Stanford, CA.

RESEARCH SUPPORT

Total research funding: \$2,148,016, primarily as PI

Funded Proposals

1. *Computational Simulation of Knee Osteoarthritis Development* 1/1/09-12/31/12
National Science Foundation CBET Division BME Program
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-PIs)
Amount: \$239,989
2. *Real-Time Model-Based Gait Retraining for Knee Osteoarthritis Rehabilitation* 9/12/07-8/31/09
National Institutes of Health NCMRR R21 Program
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 and Terese Chmielewski, Co-Is)
Amount: \$384,368

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3. *IREE: Surrogate-Based Modeling of Joint Contact Mechanics* 8/16/07-4/30/09
National Science Foundation CBET Division BME Program
Funding for international travel to collaborate with researchers at the University of Melbourne in Melbourne, Australia.
Role: PI
Amount: \$15,318
 4. *Computational Contact Pressure Testing of Knee Replacement Design Concepts* 1/1/07-6/1/07
Encore Medical Corporation
Computational evaluation of a new knee replacement design.
Role: PI
Amount: \$24,000
 5. *Surrogate-Based Modeling of Joint Contact Mechanics* 5/1/06-4/30/09
National Science Foundation CBET Division BME/RAPD Program
Development of surrogate contact modeling approaches to greatly improve the computational speed of dynamic contact analyses of human joints.
Role: PI (Raphael Haftka, Co-PI)
Amount: \$270,000
 6. *Design and Computational Analysis of Novel Knee Replacement Concept* 7/1/05-8/15/08
MAKO Surgical Corporation
Development of virtual prototyping capabilities for predicting the in vivo function and wear of current and future artificial knee designs.
Role: Co-PI (Scott Banks, PI)
Amount: \$223,488
 7. *Surgery Simulation of High Tibial Osteotomy - Transitional* 5/1/05-4/30/06
Whitaker Foundation Biomedical Engineering Supplemental Research Grant
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
 8. *Virtual Testing of a Unicondylar Knee Replacement Design* 10/8/04-1/1/05
Exactech Corporation
Computational evaluation of contact pressures and areas for FDA approval of a new unicondylar knee replacement design.
Role: PI
Amount: \$29,000
 9. *CAREER: Virtual Prototyping of Artificial Knees* 5/1/03-4/30/08
National Science Foundation CBET Division CAREER Program
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
 10. *Virtual Testing of a Total Knee Replacement Design* 4/1/03-12/1/03
Stryker-Howmedica Osteonics Corporation
Computational testing of contact loads following ligament balancing for a new total knee replacement design.
Role: PI
Amount: \$12,500

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11. *A Computational Framework for Simulating Joint Mechanics* 5/1/02-4/30/05
National Institutes of Health NLM R03 Program
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
 12. *Contact Stress Testing of Artificial Knees* 9/18/01-12/15/02
Exactech Corporation
Experimental contact pressure testing of a different knee replacement designs for FDA approval.
Role: PI
Amount: \$22,500
 13. *Surgery Simulation of High Tibial Osteotomy* 9/1/01-8/31/04
Whitaker Foundation Biomedical Engineering Research Grant
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

Pending Proposals

1. *Evaluation of In vivo Muscle Force Predictions Using Instrumented Knee Implants* 9/1/09-8/31/13
National Institutes of Health R01 Program
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, M-PI, Thor Besier, Marcus Pandy, and David Lloyd, co-Is)
Amount: \$2,576,579
2. *Computational Design of Treadmill Exercise Countermeasures for Extended Spaceflight* 5/1/09-4/30/12
National Science Foundation CBET Division BME Program
Development and evaluation of a computational model of treadmill exercise under microgravity conditions and subsequent design optimization to identify improved astronaut loading systems to maintain bone mass in space.
Role: PI
Amount: \$283,594
3. *Estimating Probability of Gain in Next Cycle of Surrogate Based Design Optimization* 5/1/09-4/30/12
National Science Foundation CMMI Division Design Program
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-PI (Raphael Haftka, PI)
Amount: \$299,994

GRADUATE STUDENTS

Ph.D. Students

Name	Research Topic	Department	Graduation Date
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	Computationally efficient dynamic contact simulations using surrogate modeling techniques	Mechanical & Aerospace Engineering (chair)	December 2008
7. Michael Fattley	Simultaneous determination of musculoskeletal model parameters, motion, and loads using filtering techniques	Mechanical & Aerospace Engineering (chair)	May 2010
8. Lingmin Li	Computational simulation of osteoarthritis development in the ACL-deficient knee	Mechanical & Aerospace Engineering (chair)	May 2010
9. Jennifer Jackson	Development of an optimized loading system for treadmill exercise countermeasures in space	Biomedical Engineering (chair)	May 2011
10. Jonathan Walter	Predicting the outcome of gastrocnemius botox injection on the gait of patients with cerebral palsy	Mechanical & Aerospace Engineering (chair)	May 2011
11. Cameron Nott	Stability analysis of stroke patients and healthy subjects during overground and treadmill gait	Mechanical & Aerospace Engineering (chair)	May 2012

M.S. Students

Name	Research Topic	Department	Graduation Date
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 measurements	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

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

TEACHING EXPERIENCE*Undergraduate Courses*

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

Average teaching evaluation: 4.66 out of 5.00

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: 4.67 out of 5.00

PROFESSIONAL SERVICE*Departmental Service*

Member, Undergraduate Curriculum Committee (2008-present)
Chair, Graduate Admissions and Awards Committee (2006-2007)
Chair, Graduate Recruiting, Admissions, and Awards Committee (2005-2006)
Member, Faculty Search Committee (2005-2006)
Member, Graduate Curriculum and Policy Committee (2005-2006)
Midterm Tenure Packet Reviewer (2006)
Coordinator, Undergraduate and Graduate Biomechanics Courses (2004-2007)
Member, Chair Search Committee (2004-2005)
Departmental Representative, BME Graduate Curriculum Coordination Committee (2004-present)
Member, Faculty Search Committee (2004)

Professional Memberships

Member, American Society of Mechanical Engineers (1987-present)
Member, American Society of Biomechanics (1988-present)
Executive Board, Technical Group on Computer Simulation, International Society of Biomechanics (2005-present)
Member, New Directions Committee, Bioengineering Division, American Society of Mechanical Engineers (2006-present)

Grant Reviewer

National Institutes of Health
National Science Foundation
Orthopaedic Research & Education Foundation

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

Editorial Board

Medical Engineering & Physics