MICHAEL D. SHIELDS

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EDUCATION

Columbia University, New York, NY
Ph.D., Civil Engineering & Engineering Mechanics 2010
Thesis: "Simulation of Stochastic Processes: Applications in Civil Engineering"
Advisor: George Deodatis
M.Phil., Civil Engineering 2009
M.S., Civil Engineering 2007
B.S., Civil Engineering *2006

Loyola University, Chicago, IL
B.S. (Honors), Physics (Mathematics minor) *2006

EMPLOYMENT

Johns Hopkins University: Baltimore, MD
Assistant Professor 7/2013 – present

Weidlinger Associates: New York, NY
Research Engineer 7/2011 – 7/2013
NSF/ASEE Corporate Research Postdoctoral Fellowship 7/2010 – 7/2011

Columbia University: New York, NY
Adjunct Associate Research Scientist 5/2011 – 5/2013

Bartold Ltd.: Nsawam, Ghana
Founding Director 5/2008 – present

Thornton Tomasetti: New York, NY
Intern Structural Engineer 1/2005 – 8/2007

Argonne National Laboratory: argonne, IL
Research Assistant 5/2002 – 8/2004

RESEARCH INTERESTS

Stochastic Simulation · Computational Stochastic Mechanics · Probabilistic Methods · Monte Carlo Simulation · Statistical Sampling · Structural Reliability · Multi-Scale Material Modeling · Simulation of Random Heterogeneous Materials · Stochastic Optimization · Verification & Validation · Structural Dynamics · Stochastic Finite Element Methods

RESEARCH FUNDING

FUNDED RESEARCH

ONR SBIR N121-091-0723:Increased Capability and Interface for Computational Code for Implosion – Office of Naval Research. (Co-PI, PI – Najib Abboud, Weidlinger Associates, Inc.) Phase 1: $150,000. Phase II: $250,000.

* Dual Bachelor's Degrees earned through a combined plan of study between universities.

NSF/ASEE Corporate Research Postdoctoral Fellowship: American Society for Engineering Education. $75,000. In cooperation with Weidlinger Associates. 7/12/10 – 7/11/11.

PENDING PROPOSALS

GOALI: Improving the Reliability of Aluminum Structures During Fire Through Computational Modeling – National Science Foundation (co-PI: Pawel Woelke, Weidlinger Associates, Inc.), $349,146. 1/1/14 – 12/31/17.

Collaborative Research: Connecting Atomistic and Continuum Amorphous Solid Mechanics via Non-Equilibrium Thermodynamics – National Science Foundation (Co-PI, PI: Michael Falk), $382,368. 7/1/14 – 6/30/17.

Energy Frontier Research Center for Integrated Science & Engineering of Defect Evolution in Extreme Environments (EFRC-ISEDEEE) – Dept. of Energy (Co-PI, PI: Somnath Ghosh), $20,000,000. 9/1/14 – 8/31/19.

Random Material Morphology Characterization and Simulation for Nonlinear Mechanics – National Science Foundation (Co-PI: Lori Graham-Brady), $378,996. 9/1/14 – 8/31/17.

Targeting Failures: Evaluating Structural Reliability by Simulating What Matters – National Science Foundation. $347,396. 9/1/14 – 8/31/17.

Improving Probabilistic Reliability of Aluminum Naval Structures and Components in Extreme Environments – Hopkins Extreme Materials Institute Seed Grant. $37,500. 9/1/14 – 8/31/15.

TEACHING

Johns Hopkins University

Graduate Courses:

EN.560.630 – Structural Dynamics, Fall 2013 (19)

EN.560.618 – Probabilistic Methods in Civil Eng. & Mechanics, Fall 2014 (in development)

Columbia University

Undergraduate Courses:

CIEN E3126 – Computer-Aided Structural Design, Spring 2009 (~40); Spring 2010 (~50)

STUDENTS & ADVISING

CURRENT PH.D. CANDIDATES

Hwanpyo Kim (1st year)

Adam Hinkle (informal co-advisor, Ph.D. Advisor: Michael Falk – Materials Sci. & Eng.)

CURRENT POST-DOCTORAL SCHOLARS

VS Sundar (Starting May 2014)

OTHER

Graduate Board Oral Examination committee: Mu Zhu (2013)

6 Doctoral Qualifying Exam committees

PROFESSIONAL SERVICE, ACTIVITIES, & QUALIFICATIONS

PROFESSIONAL MEMBERSHIPS

American Society of Civil Engineers: Associate Member

American Society of Mechanical Engineers: Member

Engineers Without Borders – USA: Professional Member

TECHNICAL COMMITTEES
Probabilistic Methods Committee – ASCE
V&V-10 Committee on Verification & Validation in Computational Solid Mechanics – ASME

JOURNAL REVIEWER
Comp. Methods in Applied Mech. & Eng. *Probabilistic Engineering Mechanics*
Engineering Structures

CONFERENCE SESSIONS ORGANIZED & CHAIRED

Session Organizer
"Stochastic Methods for Material Characterization & Simulation." *2014 Conference of the Engineering Mechanics Institute*. Montreal, CA. (Co-organizer Prof. S. Arwade)

"Simulation of Non-Gaussian Stochastic Processes and Fields and its Applications." *2013 International Conference on Structural Safety and Reliability*. New York, NY. (Co-organizers Prof. G. Deodatis, Prof. S. Arwade)

"Uncertainty Quantification Methods for Large-scale Computational Models." *2013 International Conference on Structural Safety and Reliability*. New York, NY. (Co-organizers K. Teferra, N. Abboud, R. Daddazio)

"Uncertainty Quantification / Verification and Validation of Large Structures to Shock Loading." *83rd Shock and Vibration Symposium*. 2012, New Orleans, LA. (Co-organizer E.T. Moyer)

Session Chair
"Uncertainty Quantification, Sensitivity Analysis, and Prediction" *2014 ASME Verification & Validation Symposium*. Las Vegas, NV.

INTERNATIONAL SERVICE
EWB-USA: Proj. Man. – Water and sanitation infrastructure development for Obodan, Ghana.

QUALIFICATIONS
Engineer in Training, New York State
Department of Defense Security Clearance Level: Secret

UNIVERSITY SERVICE & ACTIVITIES

COMMITTEES – JOHNS HOPKINS UNIVERSITY
Graduate Studies Committee
Student Recruitment Committee

INSTITUTE PARTICIPATION & MEMBERSHIP – JOHNS HOPKINS UNIVERSITY
Hopkins Extreme Materials Institute (HEMI) – Faculty Member
Center for Integrated Structures and Materials Modeling (CISMM) – Faculty Member
Johns Hopkins Systems Institute – Affiliate

AWARDS

Guggenheim Fellowship (2008-2010) · Teaching Assistant (2007-2008) · Research Assistant (2006-2007) · Structural Engineers Foundation Graduate Scholarship (2006) · Jewel M. Garrelts Award (2006) · ASCE Younger Member Forum Award (2006) · Concrete Industry Foundation Jack W. Weber Scholarship (2006) · Sigma Pi Sigma Physics Honor Society (2006) · Magna Cum Laude (2006) · Physics Department Honors (2006) · CESAA Prentis Scholarship (2005) ·

Doherty Memorial Award (2004) · Golden Key International Honor Society (2003) · National Society of Collegiate Scholars (2002) · Presidential Scholarship (2001) · Damen Scholarship (2000)

SOFTWARE DEVELOPMENT

Implosion Evaluator: Proprietary, Weidlinger Associates, Inc. Developed for ONR under Implosion Future Naval Capabilities program.

Dice: Open-source. General purpose stochastic simulation and sampling code under development with Naval Surface Warfare Center – Carderock Division.

PUBLICATIONS

JOURNAL ARTICLES IN REVIEW

Shields, M.D. "Simulation of spatially correlated non-stationary response spectrum compatible ground motion time histories." *Journal of Engineering Mechanics*. (January 2014)

Shields, M.D., Teferra, K., Hapij, A., and Daddazio, R.P. "Refined Stratified Sampling for efficient Monte Carlo based uncertainty quantification." *Technometrics.* (December 2013)

Teferra, K., Shields, M.D., Hapij, A., and Daddazio, R.P. "Mapping model validation metrics to Subject Matter Expert scores for model adequacy assessment." *Reliability Engineering & System Safety*. (November 2013)

PEER REVIEWED JOURNAL ARTICLES

Woelke, P.B., Shields, M.D., Abboud, N., and Hutchinson, J.W. (2013). "Simulations of ductile fracture in the idealized ship grounding scenario using phenomenological damage and cohesive zone models." *Computational Materials Science.* Topical special issue on "Recent Advances in Computational Mechanics of Materials." 80: 79-95.

Shields, M.D. and Deodatis, G. (2013). "Estimation of evolutionary spectra for simulation of non-stationary and non-Gaussian stochastic processes." *Computers and Structures.* Invited paper: Special Issue in Honor of G.I. Schuëller. 126: 149-163.

Shields, M.D. and Deodatis, G. (2013). "A simple and efficient methodology to approximate a general non-Gaussian stationary stochastic vector process by a translation process with applications in wind velocity simulation." *Probabilistic Engineering Mechanics*. 31: 19-29.

Shields, M.D., Deodatis, G., and Bocchini, P. (2011). "A simple and efficient methodology to approximate a general non-Gaussian stochastic process by a translation process." *Probabilistic Engineering Mechanics.* 26: 511-519.

PEER REVIEWED CONFERENCE PAPERS

Shields, M.D. (2014). "Targeted random sampling for reliability assessment: A demonstration of concept." *Proceedings of the 6th International Workshop on Reliable Engineering Computing*. Illinois Institute of Technology, Chicago, IL. (abstract accepted).

Shields, M.D., Falk, M.L., Hinkle, A.R., and Rycroft, C.H. (2014). "Stochastic coarse-graining to connect atomistic and continuum amorphous solid mechanics." *Proceedings of the 7th International Conference on Computational Stochastic Mechanics*. Sanorini, Greece (abstract accepted)

Shields, M.D. and Deodatis, G. (2013). "Estimation of evolutionary power spectral density for non-stationary and non-Gaussian translation processes." *Proceedings of the 2013 International Conference on Structural Safety and Reliability (ICOSSAR)*. New York, NY.

Shields, M.D., Teferra, K., and Hapij, A. (2013). "Bootstrap Monte Carlo method utilizing an adaptive stratified sampling routine for uncertainty quantification of very large transient dynamic computational models." *Proceedings of the 2013 International Conference on Structural Safety and Reliability (ICOSSAR)*. New York, NY

Benowitz, B.A., Deodatis, G. and Shields, M.D. (2013). "Simulation of non-Gaussian, non-stationary stochastic processes with evolutionary power." *Proceedings of the 2013 International Conference on Structural Safety and Reliability (ICOSSAR)*. New York, NY.

Teferra, K. and Shields, M.D. (2013). "A reduced-order and sub-structuring approach for uncertainty quantification of heavy equipment response." *Proceedings of the 2013 International Conference on Structural Safety and Reliability (ICOSSAR)*. New York, NY.

Shields, M.D., Woelke, P.B., and Abboud, N. (2012). "Characterization of the pressure wave emitted from implosion of submerged cylindrical shell structures." *Proceeding of the Internoise 2012/ASME NCAD meeting*. New York, NY.

Shields, M.D. and G. Deodatis. (2011). "Simulation of strongly non-Gaussian stochastic vector processes using translation process theory." *Proceedings of the 11th International Conference on Applications of Statistics and Probability in Civil Engineering*. Zurich, Switzerland.

Benowitz, B.A., Deodatis, G., and Shields, M.D. (2011). "Determining evolutionary spectra for non-stationary stochastic processes from correlation functions." *Proceedings of the 2011 Conference of the Engineering Mechanics Institute*. Boston, MA. **Winner, Best Paper, Probabilistic Mechanics Student Paper Competition.**

Shields, M.D., Deodatis, G., and Bocchini, P. (2010). Translation process approximation of a general non-Gaussian stochastic process. *Proceedings of the 6th Computational Stochastic Mechanics Conference*. Rhodos, Greece.

INVITED PRESENTATIONS

"Computationally efficient Monte Carlo simulation algorithms for the quantification of uncertainty and probability of failure analysis of complex systems." Sandia National Laboratory. April 21, 2014.

CONFERENCE PRESENTATIONS

Shields, M.D., Zhu, M., and Guest, J.K. (2014). "Topology optimization of linear structural systems under stochastic excitation." *International Mechanical Engineering Congress and Exposition*. Montreal, CA. (abstract accepted).

Hinkle, A.R., Falk, M.L., Rycroft, C.H., and Shields, M.D. (2014). "Combined atomistic/ continuum modeling of strain localization in metallic glass." *7th International Conference on Multiscale Materials Modelling*. (abstract accepted).

Teferra, K., Shields, M.D., Hapij, A., and Daddazio, R.P. (2014). "Enhancing model validation decision making using probabilistic neural networks." *ASME Verification & Validation Symposium*. Las Vegas, NV. (abstract accepted).

Shields, M.D., Falk, M.L., Hinkle, A.R., and Rycroft, C.H. (2014). "Connecting atomistic and continuum amorphous solid mechanics using stochastic fields." *Mach Conference*. Annapolis, MD. (abstract accepted).

Abboud, N., Woelke, P.B., Shields, M.D., Stultz, K., Hapij, A., and Rubin, D. (2013). "A fast running implosion evaluation tool." *Symposium of the Shock and Vibration Exchange*. Atlanta, GA.

Shields, M.D., Teferra, K., Hapij, A., and Daddazio, R.P. (2013). "A wavelet-based time-frequency metric for validation of computational models for shock problems." *ASME Verification & Validation Symposium*. Las Vegas, NV.

Teferra, K., Shields, M.D., Hapij, A., and Daddazio, R.P. (2013). "Formalizing and codifying uncertainty quantification based model validation procedures for naval shock applications." *ASME Verification & Validation Symposium*. Las Vegas, NV.

Shields, M.D., Woelke, P.B., and Abboud, N. (2013). "Practical applications of advanced constitutive and failure models: Examples in ductile fracture." *2013 HEMI Mach Conference*. Annapolis, MD.

Teferra, K., Shields, M.D., Hapij, A., and Daddazio, R.P. (2012). "A reduced order and sub-structuring approach for uncertainty quantification of equipment response due to shock loading." *ASME 2012 International Mechanical Engineering Congress & Exposition*. Houston, TX.

Shields, M.D., Cipolla, J., Woelke, P.B., and Abboud, N. (2012). "Use of a neural net for response surface based prediction of the pressure wave emitted by hydrostatic implosion of submerged cylinders." *83rd Shock and Vibration Symposium*. New Orleans, LA.

Shields, M.D., Teferra, K., Abboud, N., Hapij, A., and Daddazio, R.P. (2012). "Bootstrap Monte Carlo using adaptive stratified sampling for UQ/V&V of large structures subjected to shock loading." *83rd Shock and Vibration Symposium*. New Orleans, LA.

Cipolla, J., Shields, M.D., Woelke, P.B., and Abboud, N. (2012). "Parameterization of the pressure wave emitted by hydrostatic implosion of submerged cylinders." *83rd Shock and Vibration Symposium*. New Orleans, LA.

Teferra, K., Shields, M.D., Hapij, A., and Daddazio, R.P. (2012). "A combined reduced order and sub-structuring approach for uncertainty quantification of heavy equipment response." *83rd Shock and Vibration Symposium*. New Orleans, LA.

Shields, M.D. and Deodatis, G. (2012). "Simple and efficient approximation of a general non-Gaussian stochastic vector process by a translation vector process." *Joint Conference of the Engineering Mechanics Institute and the 11th ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability*. Notre Dame, IN.

Benowitz, B.A., Deodatis, G, and Shields, M.D. (2012). "Simulation of non-stationary and non-Gaussian processes: efficient methodology for determining evolutionary spectra from autocorrelation functions and application to a translation model-based algorithm." *Joint Conference of the Engineering Mechanics Institute and the 11th ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability*. Notre Dame, IN

Shields, M.D., Teferra, K., Hapij, A., Abboud, N., and Daddazio, R.P. (2012). "A methodology for verifying and validating computational models of the response of highly uncertain, large-scale structures subject to dynamic impulsive loading." *Joint Conference of the Engineering Mechanics Institute and the 11th ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability*. Notre Dame, IN.

Shields, M.D., Teferra, K., Hapij, A., Abboud, N., and Daddazio, R.P. (2012). "Validating computational models in the presence of uncertainty for the response of large-scale structures subject to impulsive dynamic loading with limited data." *2012 ASME Verification & Validation Symposium*. Las Vegas, NV.

Shields, M.D., Abboud, N., Woelke, P.W., and Stultz, K. (2011). "Parametric characterization of pressure pulses resulting from UNDEX induced cylinder implosion." *82nd Shock and Vibration Symposium*. October, 2011. Baltimore, MD.

Shields, M.D. and Deodatis, G. (2011). "A translation-based methodology for simulation of multi-variate strongly non-Gaussian stochastic processes." *Conference of the Engineering Mechanics Institute*. Boston, MA.

Shields, M.D., Woelke, P.B., Abboud,N., and Hutchinson, J.W. (2011). "Modeling large scale ductile fracture in welded aluminum structures using a cohesive zone." *Conference of the Engineering Mechanics Institute*. Boston, MA.

Shields, M.D., Woelke, P.B., Abboud, N., and Hutchinson, J.W. (2011). "Modeling large scale ductile fracture in welded aluminum structures using a cohesive zone." *ASME Applied Mechanics and Materials Conference.* May, 2011. Chicago, IL.

Yin, H.M., Saleh, A., and Shields, M.D. (2011). "Design and payoff prediction for the open mode integrated transit system." *Transportation Research Board 90th Annual Meeting.* January, 2011. Washington, D.C.

Shields, M.D., Deodatis, G., and Bocchini, P. (2010). "A simple and efficient methodology for simulation of strongly non-Gaussian stochastic processes and fields." *Conference of the Engineering Mechanics Institute*. Los Angeles, CA.

Shields, M.D. and Deodatis, G. (2009). "Simulation of non-stationary random processes with time and frequency modulation for seismic ground motion applications." *Joint ASCE-ASME-SES Conference on Mechanics and Materials*. Blacksburg, VA.

Visher, R.J., Shields, M.D., Ellingson, W.A., and Feuerstein, A. (2004). "Laser-based inspection of thermal barrier coatings." *Proceedings of ASM International Surface Engineering Conference*. ASM International, Materials Park, OH.

Ellingson, W.A., Visher, R.J., Shields, M.D., and Deemer, C.M. (2004). "Development of nondestructive evaluation methods for ceramic coatings." *Proceedings of the 18th DOE-Fossil Energy Materials Meeting*. US National Aeronautics and Space Administration "Thermal Barrier Coating Workshop," NASA Conference Publication 3312, 1995.

Visher, R.J., Shields, M.D., and Ellingson, W.A. (2004). "Initial investigation of optical coherence tomography for nondestructive evaluation of ceramic coatings." *28th International Conference and Exposition on Advanced Ceramics and Composites*. American Ceramic Society. Cocoa Beach, FL.

Parikh, A.A., Ellingson, W.A., Deemer, C.M., Christensen, J., and Shields, M.D. (2003). "Use of a 6-Axis articulated-arm robot for NDE of complex shapes." *27th International Conference and Exposition on Advanced Ceramics and Composites*. American Ceramic Society. Cocoa Beach, FL.

CODES & STANDARDS

"Role of Uncertainty Quantification in Verification and Validation of Computational Solid Mechanics Models." UQ Supplement to ASME V&V 10-2006. ASME Subcommittee on V&V for Computational Solid Mechanics Models. Draft in process. (Contributing Author).

POSTER PRESENTATIONS

Benowitz, B.A., Deodatis, G. and Shields, M.D. (2012). "Simulation of non-Gaussian, non-stationary stochastic processes with evolutionary power." Poster presented at the Uncertainty Quantification Summer School, USC, Los Angeles, CA.

Shields, M.D., Culligan, P.J., Forbes, S. (2007). "Development plan of a sustainable water management plan for a rapidly urbanizing Ghanaian village." *National Sustainable Design Expo*. U.S. Environmental Protection Agency. Washington, D.C.

Ellingson, W.A., Visher, R.J., Shields, M.D., and Deemer, C.M. "Development of nondestructive evaluation methods for ceramic coatings." *17th Annual Conference on Fossil Energy Materials*. April 22-24, 2003. Baltimore, MD.

Shields, M.D. (2003). "Nondestructive evaluation of ceramic bearing balls using optical coherence tomography." *2nd Annual Argonne Young Scientist Day*. Argonne, IL.

Shields, M.D. "Nondestructive evaluation of advanced ceramics using elastic optical laser backscatter." *1st Annual Argonne Young Scientist Day*. October 24, 2002. Argonne, IL.