

# Siniša Vukelić

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Mechanical Engineering Department  
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## Experience

**Columbia University**, New York, NY 9/2013 – present  
Lecturer in Discipline

**Bucknell University**, Lewisburg, PA 08/2009 – 8/2013  
Swanson Fellow Assistant Professor

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## Affiliation

**Hospital for Special Surgery**, New York, NY 06/2010 – 9/2013  
Adjunct Assistant Scientist

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## Education

**Columbia University**, New York, NY 04/2009  
*Ph.D.* Mechanical Engineering  
Thesis: “Laser Induced Deformation and Structural Modification of Crystalline and Amorphous Materials”  
Advisors: Profs. Y. Lawrence Yao and Jeffrey W. Kysar

**Columbia University**, New York, NY 05/2005  
*M.S.* Mechanical Engineering

**University of Belgrade**, Belgrade, Serbia 06/2004  
*Dipl. Ing.* Aeronautical Engineering  
Thesis: “Parameter Computation of Dynamic Stability in Contemporary Aircrafts Using Differential Equations of Small Perturbations”  
Advisor: Prof. Boško Rašuo

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## Research Interests

- Structural Modification of Transparent Biological Media
- Spectroscopic Characterization of Biomaterials
- Optical Diagnostics and Treatment monitoring
- Laser Induced Mechanical Deformation

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## Publications

1. Wang, C., Durney, KM, Fomovsky, G, Ateshian, GA, **Vukelić, S**, (2016) Quantitative Raman Characterization of Cross-linked Collagen Thin Films as a Model System for Diagnosing Early Osteoarthritis, *Accepted to Proceedings of SPIE*
2. Guo, Y, **Vukelić, S**, (2015) “Evolution of cavitation bubbles in corneal stroma subject to micro-Joule femtosecond laser Pulses,” *Proc. of SPIE Optical Interactions with Tissue and Cells 9321: 932106*.
3. Guo, Y, Wang, C, Celi, NG, **Vukelić, S.**, (2015) “Femtosecond laser collagen cross-linking without traditional photosensitizers,” *Proc. of SPIE Optical Interactions with Tissue and Cells 9321: 932103*.

4. Wander, J, **Vukelić, S**, (2013) "Influence of tissue treatment onto the Raman spectra obtained from prostate histopathological slides for diagnostics purposes," Proc. of SPIE 8565, 85651F
5. **Vukelić, S**, Kongsuwan, P, Yao, YL, (2013) "Investigation of the morphology of the features generated via femtosecond lasers in the interior of a bovine cornea sections," Proceedings of the SPIE, Vol. 8579, 857904, 10 pp.
6. **Vukelić, S**, Noyan, IC, Kysar, JW, Yao, YL, (2011) "Characterization of Heterogeneous Response of Al Bicrystal Subject to Micro Scale Laser Shock Peening," Experimental Mechanics, 51(5), 793-796.
7. **Vukelić, S**, Kongsuwan, P, Yao, YL, (2010) "Ultra-Fast Laser Induced Structural Modification of Fused Silica. Part I: Feature Formation Mechanisms," Journal of Manufacturing Science and Engineering, Vol. 132, 061012-1.
8. **Vukelić, S**, Ryu, S, Yao, YL, (2010) "Ultra Fast Laser Induced Structural Modification of Fused Silica. Part II: Spatially Resolved and Decomposed Raman Spectral Analysis" Journal of Manufacturing Science and Engineering, Vol. 132, 061013-1.
9. Kongsuwan, P, **Vukelić, S**, Yao, YL, (2010) "Characterization of Morphology and Mechanical Properties of Glass Interior Irradiated by Femtosecond Laser," Journal of Manufacturing Science and Engineering, 132(4), 041009
10. Wang, Y., Kysar, JW, **Vukelić, S**, and Yao, YL, (2009) "Spatially Resolved Characterization of Geometrically Necessary Dislocation Dependent Deformation in Microscale Laser Shock Peening," Journal of Manufacturing Science and Engineering, 131(4), 41014
11. **Vukelić, S**, Kysar, JW., and Yao, YL, (2008) "Grain Boundary Response of Aluminum Bicrystal Under Microscale Laser Shock Peening," International Journal of Solids and Structures, 46, 3323-3335.
12. **Vukelić, S**, Wang, Y, Kysar, JW, and Yao, YL, (2008) "Dynamic Material Response of Aluminum Single Crystal Under Micro Scale Laser Shock Peening," ASME Journal of Manufacturing Science and Engineering, 131, 031015-1 - 031015-10.
13. **Vukelić, S**, Wang, Y, Kysar, JW, and Yao, YL, (2008) "Comparative Study of Symmetric and Asymmetric Deformation of Al Single Crystal Under Micro Scale Laser Shock Peening," Journal of Mechanics of Materials and Structures, 4, 89-105.
14. Wang, Y, Fan, Y, Kysar, JW, **Vukelić, S**, and Yao, YL, (2008) "Micro-Scale Laser Peen Forming of Single Crystal," J. Appl. Physics, 103, 063525.
15. Wang, Y, Fan, Y, **Vukelić, S**, and Yao, YL, (2007) "Energy Level Effects on Deformation Mechanism in Micro-scale Laser Peen Forming," SME J. of Manufacturing Process, 9(1), 1-12.
16. Fan, Y, Wang, Y, **Vukelić, S**, and Yao, YL (2007) "Numerical Investigation of Opposing Dual Sided Microscale Laser Shock Peening" Transactions of the ASME J. of Manufacturing Science and Engineering 129, 256-264.
17. Fan, Y, Wang, Y, **Vukelić, S**, and Yao, YL, (2005) "Wave-solid Interactions in Shock Induced Deformation Processes," J. Appl. Physics, 98, 104904

### Conference Publications

1. Wang, C, Durney, KM, Kuo, JM, Fomovsky, G, Norton, JR, Ateshian, GA, **Vukelić, S**, (2015) "Quantitative Analysis of Raman Spectra for Assessment of Crosslink Concentrations Toward Diagnosing Early Arthritis," 2015, SB<sup>3</sup>C Summer Biomechanics, Bioengineering and Biotransport Conference, Snowbird Resort, UT, June 17-20.
2. Durney KM, Nims RJ, Albro MB, Gu T, Karbowski L, Singh A, **Vukelic S**, Hung CT, Ateshian GA, Raman Spectrographic Characterization of Cartilage Matrix Swelling via Lysyl Oxidase Inhibition in Immature Explants and Tissue Constructs, 2015 Annual Meeting of the Orthopaedic Research Society, poster 0323, Las Vegas, NV, March 27-31

3. Durney KM, Nims RJ, Albro MB, Gu, T, Karbowski, L, Singh, A, **Vukelić, S**, Hung, CT, Ateshian, GA (2015) “Raman Spectrographic Characterization of Cartilage Matrix Swelling via Lysyl Oxidase Inhibition in Immature Explants and Tissue Constructs,” *ORS Annual Meetings*
4. Fan, Y, Wang, Y, **Vukelić, S**, Yao, YL, “Wave-Solid Interactions in Shock Induced Deformation Processes,” 24th International Congress on Applications of Lasers & Electro-Optics, ICALEO, October 31 - November 3, 2005, Miami, FL
5. Wang, Y, Fan, Y, **Vukelić, S**, Yao, YL., “Energy Level Effects on Deformation Mechanism in Micro-scale Laser Peen Forming,” Transactions of 2006 North America Manufacturing Research Institute/SME, NAMRC 34, Vol. 34, 2006, May 23 - May 26, Milwaukee, WI
6. **Vukelić, S**, Wang, Y, Kysar, JW, Yao, YL, “Comparative Study of Symmetric and Asymmetric Deformation of Al Single Crystal Under Micro Scale Laser Shock Peening,” 25th International Congress on Applications of Lasers & Electro-Optics, ICALEO, October 30 - November 2, 2006, Scottsdale, AZ
7. **Vukelić, S**, Kysar, JW, Yao, YL, “Grain Boundary Response of Aluminum Bicrystal Under Microscale Laser Shock Peening,” ASME International Conference on Manufacturing Science & Engineering (MSEC), October 15 - October 18, 2007, Atlanta, GA
8. Wang, Y, Fan, Y, Kysar, JW, **Vukelić, S**, Yao, YL, “Micro-Scale Laser Peen Forming of Single Crystal,” 26th International Congress on Applications of Lasers & Electro-Optics, ICALEO, October 29 - November 1, 2007, Orlando, FL
9. Wang, Y, Kysar, JW, **Vukelić, S**, Yao, YL, "Spatially Resolved Characterization of Geometrically Necessary Dislocation Dependent Deformation in Micro-Scale Laser Shock Peening," International Conference on Manufacturing Science and Engineering (MSEC), October 7 - October 10, 2008, Evanston, IL
10. **Vukelić, S**, Gao, B, Ryu, S, Yao, YL, “Structural Changes of Amorphous Fused Silica Under Femtosecond Laser Irradiation,” International Conference on Manufacturing Science and Engineering (MSEC), October 7 –October 10, 2008, Evanston, IL
11. **Vukelić, S**, Kysar, JW, Yao, YL, “Comparison of Anisotropic and Inertial Effects in Single Crystals Under Micro Scale Laser Shock Peening,” Transactions of North America Manufacturing Research Institute/SME, NAMRC 37 Clemson University, May 19-22, 2009, Greenville, S.C.
12. Kongsuwan, P, Wang, H, **Vukelić, S**, Yao, YL, “Characterization of Morphology and Mechanical Properties of Glass Irradiated by Femtosecond Laser,” Proc. 28th Int. Congress on Applications of Lasers and Electro-Optics (ICALEO '09), Orlando FL, Nov. 2009, pp 1214-1223

### **Book Chapter**

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- A.J. Birnbaum (*equally contributed*), **S. Vukelić** (*equally contributed*) and Y.L. Yao, “Laser Induced Plastic Deformation” in *Advances in Laser Materials Processing Technology* Woodhead Publishing, Cambridge, Great Britain and CRC Press, Boca Raton, USA 2010

### **Invited Talks/Papers**

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- Invited Talk: “Structuring and Joining Transparent Materials with Ultra Short Pulse Lasers” 32<sup>nd</sup> Int. Congress on Applications of Lasers and Electro-Optics (ICALEO '13), Miami FL, Oct. 2013
- *Keynote Speaker*  
International Conference on Advances in Mechanical and Building Sciences 12/2009

### **Grant Awards**

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- Principal Investigator: Coulter Foundation/Columbia Technology Ventures (CTV) PG004249 - WHCF CU12-0369 *Laser-Assisted Noninvasive Permanent Vision Correction*, 1/11/15-31/12/16 (\$62,000).

- Co-Investigator: NSF PD 14-7479 ‘*Damage Mechanics and Repair of Articular Cartilage Under Frictional Loading*, 1/9/16-8/31/19 (\$373,572) - *PENDING*
- Principal Investigator: Instrumentation Grant at Center for Functional Nanomaterials (CFN) of Brookhaven National Lab (BNL) “Development of Automated, High Throughput Diagnostics Tool for Prostate Cancer Diagnostics”
- Principal Investigator: Instrumentation Grant at Center for Functional Nanomaterials (CFN) of Brookhaven National Lab (BNL) “Femtosecond Laser Treatment of the Interior of Bulk Transparent Dielectrics”
- NSF DMR 0820404 Material Facilities Research Network Faculty Fellowship

**Patent**

- U.S. Provisional Application No. 62/245,805, “METHODS AND SYSTEMS FOR MODIFICATION OF THE CORNEAL CURVATURE” filed on October 23, 2015.

**Teaching Experience**

**Mechanical Engineering Department, Columbia University, New York, NY** 9/2013 – present

Lecturer in Discipline

Teaching wide variety of mechanical engineering classes

- Thermodynamics
- Fluid Mechanics
- Special Topics in Mechanical Engineering
- Computer Graphics and Design
- Theory of Elasticity
- Thermo-fluids Systems Design

**Mechanical Engineering Department, Bucknell University, Lewisburg, PA** 08/2009 – 9/2013

*Swanson Fellow Assistant Professor*

Teaching wide variety of mechanical engineering classes

- Lasers and Optics in Biomedical Applications
- Senior Design
- Manufacturing Processes
- Mechanics
- Graphics for Design and Manufacture

**Mechanical Engineering Department, Columbia University, New York, NY** 08/2004 – 05/2005

*Graduate Teaching Assistant*

Thermodynamics

Fall 2004

Manufacturing Processes

Spring 2005

- Led weekly recitations for junior level mechanical engineering students
- Held regular office hours to help students overcome studying hurdles
- Graded weekly assigned homework, midterms and final exams

**Athletics Department, Columbia University, New York, NY** 01/2005 – 06/2009

*Tutor*

- Tutored student athletes individually and in groups in Calculus, Physics and Statistics

**University of Belgrade, Belgrade, Serbia**

01/2002 – 05/2004

*Tutor*

- Tutored undergraduate students in Solid Mechanics, Dynamics and Thermodynamic

## **Award**

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**Columbia University, New York, NY** 12/2004  
*Extraordinary Teaching Assistant award for thermodynamics course*

## **Leadership Experience, Columbia University, New York, NY**

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**Athletic Department** 08/2007-present  
*Tutoring Coordinator*

- Introduced tutoring evaluation which improved reappointment of tutors
- Reduced tutoring expenses without compromising tutoring quality
- Developed procedure for scheduling group tutoring

**Mechanical Engineering Graduate Student Association** 12/2008-04/2009  
*President*

**Mechanical Engineering Department Graduate Student Seminar Series** 01/2008 – 05/2008  
*Coordinator*

**North American Manufacturing Research Conference (NAMRC 33)** 05/2005  
*Member – Graduate Student Organization Committee*

## **NSF Panelist and Reviewer of Technical Papers**

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NSF panel in Fall 2009, 2013; ASME Journal of Manufacturing Science and Engineering, SME Journal of Manufacturing Processes, LIA Journal of Laser Applications, Experimental Mechanics, Journal of Physics D – Applied Physics, International Congress of Lasers and Electro-Optics (ICALEO), North American Manufacturing Research Conference (NAMRC), ASME International Conference of Manufacturing Science and Engineering (MSEC), Biomedical Circuits and Systems Conference (BIOCAS)

## **Professional Affiliations**

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American Society of Mechanical Engineers (ASME); Materials Research Society (MRS)