

Elena Semouchkina

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ACADEMIC DEGREES

Ph. D. in Materials , The Pennsylvania State University, USA	2001
Ph. D. in Physics & Mathematics , Tomsk State University, Russia	1986
M.S. in Electrical Engineering (Honors) , Tomsk State University, Russia	1978

CURRENT RESEARCH FOCUS

- Resonance phenomena in complex media: metasurfaces, metamaterials, photonic crystals
- High-contrast materials integration for electronic and photonic systems • Materials characterization at microwaves

PROFESSIONAL RECORD

Professor <i>Department of Electrical and Computer Engineering, Michigan Technological University</i>	2018-present
Affiliated Professor present <i>Department of Physics, Michigan Technological University</i>	2011-
Associate Professor (with tenure) <i>Department of Electrical and Computer Engineering, Michigan Technological University</i>	2013-2018
Associate Professor (without tenure) <i>Department of Electrical and Computer Engineering, Michigan Technological University</i>	2009-2013
Associate Research Professor 2009 <i>Materials Research Institute and Department of Engineering Science & Mechanics, Penn State University</i>	2006-
Assistant Research Professor 2006 <i>Materials Research Institute, The Pennsylvania State University</i>	2004-
Post-Doctoral Fellow <i>Materials Research Institute, The Pennsylvania State University</i>	2001-2004

AWARDS AND HIGHLIGHTS

- **NSF ADVANCE Fellows Award:** Materials Integration Concepts for Electronic and Photonic Devices, 20042008
- **Best Ph.D. Thesis Award,** Materials Research Institute, Penn State University, 2001

- Featured at the **NSF “Discoveries” website:**
http://www.nsf.gov/discoveries/index.jsp?pims_id=13381&org=NSF
- Featured in **IEEE Women in Engineering eBook:**
<http://www.ieee.org/ns/periodicals/WIE/issue1/index.html>
- Chosen **among 12 women-engineers “Who change the world”** and featured in **IEEE Women in Engineering Poster:** <http://www.ieee.org/documents/wieposter.pdf>
- Profiled in the **IEEE Magazine, Women in Engineering**
- Featured in **NSF “Behind the Scenes”** series on LiveScience.com, a syndicated news website that partners with the NSF and highlights science, health and technology news to create content on cutting-edge research projects and the people behind them: <http://www.livescience.com/12907-invisibility-cloaks-corner-bts-110217.html>
- Featured in the **"First Bell"** ASSE's newsletter under "Higher Education":
<http://mailview.custombriefings.com/mailview.aspx?m=2013032701asee&r=4154459-d0d6>
<http://mailview.custombriefings.com/mailview.aspx?m=2013020501asee&r=2865525-b08b>
- Featured in **CBS Detroit "Top Tech stories"** of the year:
http://detroit.cbslocal.com/2013/12/16/the-top-tech-report-stories-of-2013-first-quarter/?utm_source=DailyContInfoNewsletters&utm_medium=DailyContInfoNewsletters&utm_campaign=TheWWJTechnologyReport
- Featured in the Great Lakes Innovation & Technology report:
<http://detroit.cbslocal.com/2010/10/10/tech-tour-day-two-more-terrific-michigan-tech/>

TEACHING

Courses taught at Michigan Tech University:

- EE5430/MSE5340 Electronic Materials
- EE5460/MSE5460 Solid State Devices
- EE4231 Physical Electronics
- EE4800 Electronic Materials and Devices: Principles and Trends
- EE3140 Electromagnetics
- EE5900 Electromagnetic Material Interactions

- **Courses taught at Penn State University:**
- ESC 400H (Honors) Electromagnetic Fields
- ESC/MATSE 597i Microwave-Materials Interaction
- ESC 596A Electromagnetism for Neural Engineers
- ESC/MATSE 597C Microwave Processing of Materials

PROFESSIONAL ACTIVITIES

- **Associate Editor**, IEEE Antenna and Wireless Propagation Letters, 2008-2014
- **Guest Editor**, Applied Sciences, “Dielectric Metamaterials”, 2018
- **Co-Chair**, IEEE Women in Electromagnetics (WiEM) International Workshop

- **Co-Chair**, Special Session “Metamaterials/High frequency characterization and simulation”, IMAPS 9th Ceramic Interconnect and Ceramic Microsystems Technology Conference (CICMT), 2013
- **Technical Committee**, IASTED International Conference on Antennas, Radar and Wave Propagation, Boston, MA, 2010
- **Technical Committee**, International Symposium on Smart Processing Technology, Hankyu Expo Park, Osaka, Japan, 2007
- **Expert-Evaluator**, European Commission panels, Directorate-General for Research, (Brussels, Belgium), 2008; 2009
- **Expert-Evaluator**, French National Research Agency, 2010
- **Reviewer**, NSF panels: 2010, 2011, 2013
- **Reviewer**, Oxford University Press, 2012, 2007
- **Reviewer**, Wiley & Sons, 2010
- **Reviewer**, Cambridge University Press, 2009
- **Invited Tutorial**, Applied Computational Electromagnetic Society (ACES) International Symposium, Honolulu, HI, 2016
- **Invited Lecturer**, “Women in Photonics (WiP) School on Photonic Metamaterials,” Paris, France, April 2008

GRANTS

- NSF, ECCS/EPMD: Developing Anisotropic Media for Transformation Optics by Using Dielectric Photonic Crystals, PI, 2017-2022
- NSF, DBI/IDBR: Collaborative Research: Unconventional Antenna Probes for Ultra-High Resolution Magnetic Resonance Imaging, collaborative project with PSU, MTU lead, PI, 2014-2018
- NSF, ECCS/IHCS: Implementation of Dielectric Metamaterials with Integrated Resonance Response, PI, 2009-2013
- NSF, DMR/EPM: ADVANCE Fellows Award: Materials Integration Concepts for Electronic and Photonic Devices, PI, 2004-2008
- ONR SPAWAR: Conformal Broadband Antennas, Co-PI, 2009-2010
- DoE SBIR: Development of Metamaterials for Cherenkov Radiation Based Particle Detectors, Co-PI, 2008-2009
- Grace Woodward Grant: High Permittivity Ceramic Inserts for Submillimeter NMR Imaging of Zebrafish, Co-PI, 2008-2009
- National High Magnetic Field Laboratory: An Integrated in vivo System for 2.1 T: Novel RF Technology for rodent, Co-PI, 2008-2010
- ONR: Antennas for THz Imaging Arrays, Co-PI, 2005
- Vocollect, Inc.: Miniaturized Wearable Transceiver for WLAN Communications, PI, 2005-2006
- Center for Dielectric Studies, PSU: Design and Implementation of Engineered Dielectric Structures in 3D LTCC Microwave Devices, PI, 2003-2005

PRESS RELEASES AND NEWS REPORTS

<https://www.mtu.edu/news/stories/2018/october/updating-highresolution-mri.html>
<http://www.photonics.com/Article.aspx?AID=61257&PID=5&VID=135&IID=911>
<http://iopscience.iop.org/2040-8986/labtalk-article/64842>
<http://abc10up.com/8311649-2/>
<http://phys.org/news/2013-03-invisibility-cloak-mtu.html>
<http://detroit.cbslocal.com/2013/03/26/invisibility-cloak-research-moves-forward-at-michigan-tech/>
http://www.reddit.com/r/science/comments/1b1bj3/michigan_technological_universitys_invisibility/
http://www.mlive.com/news/index.ssf/2013/03/real_life_harry_potter_magic_i.html#incart_river_default_upnorthlive.com
<http://www.physorg.com/news/2011-03-invisibility-cloaks-corner.html>;
<http://www.physorg.com/news/196596396.html>
<http://www.photonicsonline.com/article.mvc/An-Invisibility-Cloak-Made-Of-Glass-0001?VNETCOOKIE=NO>
<http://www.dailymail.co.uk/sciencetech/article-1296769/Scientists-invent-invisibility-cloak-glass.html>
<http://www.metro.co.uk/tech/835922-invisibility-cloak-created-by-us-scientists>
<http://detroit.cbslocal.com/2013/03/26/invisibility-cloak-research-moves-forward-at-michigan-tech/>
<http://www.uppermichiganssource.com/news/story.aspx?id=880467#.UV12tE6U98>
<http://www.upnorthlive.com/news/story.aspx?id=897768#.Ua6dBdjBGCh>
http://article.wn.com/view/2013/03/22/Invisibility_Cloak_Research_Moves_Forward_at_Michigan_Tech_Ml/#/related_news
<http://www.mtu.edu/news/stories/2013/march/story87175.html>
<http://www.noodls.com/view/F30335DAF86C691934F445730AB0F0FE0A0D9BC7?6377xxx1363992305>
http://news.cnet.com/8301-17938_105-20011415-1.html
<http://wwwj.cbslocal.com/2010/10/10/tech-tour-day-two-more-terrific-michigan-tech/>
<http://wwwj.cbslocal.com/2010/07/21/michigan-tech-prof-studies-invisibility-cloak-of-glass>
http://www.stdaily.com/special/content/2010-07/26/content_212875.htm

LIST OF BOOKS AND JOURNAL PUBLICATIONS

- Books and Book Chapters:
 1. Semouchkina, E., Dielectric Metamaterials and Metasurfaces in Transformation Optics and Photonics, ISBN: 9780128205969, ELSEVIER, Woodhead Publishing Series in Electronic and Optical Materials, August 2021.
 2. Semouchkina, E., Formation of Coherent Multi-Element Resonance States in Metamaterials, book Chapter in "Metamaterial", ISBN: 978-953-51-0591-6, INTECH, 2012.
 3. Semouchkina, E., Resonance Field Analysis and Electromagnetic Coupling Effects in Metamaterials Structures, book Chapter in "Metamaterials: Classes, Properties and Applications", ISBN: 978-1-61668-9582, Nova Science Publishers, 2011.
 4. Semouchkina, E., Development of Miniature Microwave Components by Using High Contrast Dielectrics, book Chapter in "Microwave and Millimeter Wave Technologies from Photonic Bandgap Devices to Antenna and Applications", ISBN: 978-953-7619-99-4, INTECH, 2010.
 5. Semouchkina, E., Analysis of Microwave Resonance Structures by Using the FDTD Method: Capacitors, Microstrip Antennas, and Microstrip Resonators, ISBN: 978-3-639-18899-8, VDM Verlag Dr. Muller, 2010.
 6. Randall, C., Yang, G., Dickey, E., Eitel, R., Shrout, Lanagan, M., Kwon, D., Semouchkina, E., Semouchkin, G., Baker, A., Nagata, Wang, A., Trolier-McKinstry, S., Rhee, S., Present and Future Challenges in Multilayer Ceramic Devices, book Chapter in "Global Roadmap for Ceramic and Glass Technology", ISBN-13 9780470-10491-0, ISBN-10 0-470-10491-0, John Wiley & Sons, 2005.
- Journal Publications:

1. Jamilan, S., Danyal, M., and Semouchkina, E., "Collimation Effects Controlled by Near-Zero Refractive Indices in Highly Anisotropic Dielectric Photonic Crystals: Simulation and Experiment," *Applied Physics Letters*, v. 119, no. 25, 251901, 2021.
2. Jamilan, S., Kumar, V., Danyal, M., and Semouchkina, E., "Extra high-Q resonances and extraordinary transparency in finite fragments of dielectric metasurfaces: Prospects for 5G applications," *Applied Physics Letters*, v. 119, no. 2, 021103, 2021.
3. Jamilan, S., Semouchkin, G., and Semouchkina, E., "Analogue of Electromagnetically Induced Transparency in Metasurfaces Composed of Identical Dielectric Disks," *Journal of Applied Physics*, v. 129, no. 6, 063101, 2021.
4. Jamilan, S., Gandji, N. P., Semouchkin, G., Safari, F., and Semouchkina, E., "Scattering from Dielectric Metasurfaces in Optical and Microwave Ranges," *IEEE Photonics Journal*, v. 11, no. 2, 2200407, 2019.
5. Jamilan, S., Semouchkin, G., Gandji, N. P., and Semouchkina, E., "Specifics of scattering and radiation from sparse and dense dielectric meta-surfaces," *J. Appl. Phys.*, v. 125, no. 16, 163106, pp. 1-12, 2019.
6. Gandji, N., Lee, G., Semouchkin, G., Semouchkina, E., Neuberger, T. and Lanagan, M., "Development and Experimental Testing of Microstrip Patch Antenna-Inspired RF Probes for 14T MRI Scanners", *IEEE Transactions on Microwave Theory and Techniques*, v. 67, no. 1, Jan. 2019.
7. Gandji, N., Semouchkin, G., and Semouchkina, E., "Antenna-Based Solutions for RF Probes in Ultra High Field Magnetic Resonance Imaging Scanners", *Microwave and Optical Technology Letters*, v. 60, no. 12, 2018.
8. Jamilan, S., Semouchkin, G., Gandji, N., and Semouchkina, E., "Spatial dispersion of index components required for building invisibility cloak medium from photonic crystals", *Journal of Optics*, v. 20, 045102 (9pp), March 2018.
9. Gandji, N., Semouchkin, G., and Semouchkina, E., "All-dielectric metamaterials: irrelevance of negative refraction to overlapped Mie resonances", *Journal of Physics D: Applied Physics*, v. 50, no. 45, 2017.
10. Seifi, B., Semouchkina, E., Lanagan, M., and Neuberger, T., "Approaches to designing micro-solenoidal RF probes for 14 T MRI studies of millimeter-range sized objects", *Concepts in Magnetic Resonance Part B: Magnetic Resonance Engineering*, v. 46B, no. 4, pp. 178-185, 2017.
11. Gandji, N., Palle, A., Semouchkin, G., and Semouchkina, E., "Field-Simulation Based Engineering of RF Antenna Probes with Nonuniform Substrates for High-Field Magnetic Resonance Imaging Systems", *ACES Journal*, v. 31, no. 5, pp. 492-497, 2016.
12. Semouchkina, E., Duan, R., Gandji, N., Jamilan, S., Semouchkin, G., and Pandey, R., "Superluminal Media Formed by Photonic Crystals for Transformation Optics-Based Invisibility Cloaks", *Special Issue of Journal of Optics on Transformation Optics*, v. 22, 044007, 2016.
13. Semouchkina, E., Duan, R., Semouchkin, G., and Pandey, R., "Sensing Based on Fano-Type Resonance Response of All-Dielectric Metamaterials", *Sensors, Special Issue "Metamaterial-Inspired Sensors"*, v. 15, no. 4, p. 9344-9359, 2015.
14. Duan, R., Semouchkina, E., and Pandey, R., "Geometric Optics-Based Multiband Cloaking of Large Objects with the Wave Phase and Amplitude Preservation", *Optics Express*, v. 22, no. 22, p. 27193-27202, 2014.
15. Chen, F., Wang, X., Semouchkin, G., and Semouchkina, E., "Effects of Inductive Waves on Multi-Band Below-Cut-off Transmission in Waveguides Loaded with Dielectric Metamaterials", *American Institute of Physics (AIP) Advances*, v. 4, no. 10, p. 107129-1-107129-15, 2014.
16. Rybin M., Sinev I., Samusev K., Hosseinzadeh A., Semouchkin G., Semouchkina, E., and Limonov, M., "Photonic properties of two-dimensional high-contrast periodic structures: Numerical calculations", *Phys. Solid State*, v. 56, p. 588-93, 2014.
17. Wang, X. and Semouchkina, E., "A Route for Efficient Non-Resonance Cloaking by Using Multilayer Dielectric Coating", *Applied Physics Letters*, v. 102, p. 113506, 2013.
18. Wang, X., F. Chen (grad student), and Semouchkina, E., "Spherical Cloaking Using Multilayer Shells of Ordinary Dielectrics", *American Institute of Physics (AIP) Advances*, v. 3, p. 112111-1-112111-7, 2013.
19. Wang, X., Chen, F., and Semouchkina, E., "Implementation of Low Scattering Microwave Cloaking by AllDielectric Metamaterials", *IEEE Microwave and Wireless Components Letters*, v. 23, no. 2, p. 63-65, 2013.
20. Rybin, M. V., Samusev, K. B., Sinev, I. S., Semouchkin, G., Semouchkina, E., Kivshar, Y. S., and Limonov,

- M. F., "Mie Scattering as a Cascade of Fano Resonances", *Optics Express*, v. 21, no. 24, p. 30107-30113, 2013.
21. Hosseinzadeh, A., and Semouchkina, E., "Effect of Permittivity on Energy Band Diagrams of Dielectric Metamaterial Arrays", *Microwave and Optical Technology Letter*, v.55, no. 1, p. 134-137, Jan. 2013.
 22. Semouchkina, E., "All-Dielectric Metamaterials for New Areas of Applications", Invited paper, *Journal of Microelectronics and Electronic Packaging*, no. 4, Dec. 2012.
 23. Chen, F., Wang, X., and Semouchkina, E., "Formation of Resonance States due to Interaction between Resonators in Arrays Used in Dielectric Metamaterials", *Microwave and Optical Technology Letters*, v.54, no. 3, p. 555-560, March 2012.
 24. Chen, F., Mao, S, Wang, X., Semouchkina, E., and Lanagan, M., "Effect of Cavity Dimensions on TE_{01δ} Mode Resonance in Split-Post Dielectric Resonator Techniques", *Journal of Electromagnetic Analysis and Applications (JEMAA)*, published online Sept. 2012.
 25. Semouchkina, E., Scholz, J., Perini, S., Semouchkin, G. B., Lanagan, M., Haupt, R., Simonds, H. "Metamaterials-Inspired Miniaturization of UHF Patch Antennas with Circular Polarization", *Microwave and Optical Technology Letters*, v.53, no. 8, p. 1938-1943, August 2011.
 26. F. Namin, T. G. Spence, D. H. Werner, and E. Semouchkina, "Broadband, Miniaturized Stacked-Patch Antennas for L-Band Operation Based on Magneto-Dielectric Substrates", *IEEE Transactions on Antennas and Propagation*, vol. 58, no.9, September 2010.
 27. Semouchkina, E., Werner, D., Semouchkin, G. B., Pantano, C., "An Infrared Invisibility Cloak Composed of Glass", *Applied Physics Letters*. Vol. 96, no. 23, June 2010.
 28. K. Haines, T. Neuberger, M. Lanagan, E. Semouchkina, and A. G. Webb, "High Q Calcium Titanate Cylindrical Dielectric Resonators for Magnetic Resonance Microimaging," *Journal of Magnetic Resonance*, vol. 200, Issue 2, 349-353, October 2009.
 29. Tyagi, V. and Semouchkina, E., "Sensitivity Analysis of the Effective Parameter Extraction Procedure for Metamaterial Applications", *Microwave Optical Tech. Lett.*, April, 2009.
 30. T. Neuberger, T., Tyagi, V., Semouchkina, E., Lanagan, M., Baker, A., Haines, K., and Webb, A., "Design of a Ceramic Dielectric Resonator for NMR Microimaging at 14.1 Tesla", *Concepts in Magnetic Resonance Part B: Magnetic Resonance Engineering*, vol. 33B, Issue 2, 109-114, April 2008.
 31. Semouchkina, E., Miyamoto, Y., Kiriara, S., Semouchkin, G., and Lanagan, M., "Analysis of Electromagnetic Response of 3D Dielectric Fractals of Menger Sponge Type," *IEEE Transactions on Microwave Theory Techn.*, vol. 55, No. 6, 1305-1313, June 2007.
 32. Semouchkina, E., "Double Negative Materials: Hypothesis, Realization, and New Developments", invited paper in *Smart Processing Technology*, High Temperature Society of Japan, Japan, 79-87, 2006.
 33. Hennings, A., Semouchkina, E., Baker, A., and Semouchkin, G., "Design Optimization and Implementation of Band-Pass Filters with Normally Fed Microstrip Resonators Loaded by High-Permittivity Dielectric," *IEEE Transactions on Microwave Theory Techn.*, vol. 54, No. 3, 1253-1261, March 2006.
 34. Iwasaki, M., Semouchkina, E., Semouchkin, G., Rajab, K., Randall, C., and Lanagan, M., "Symmetry Matching of Hybrid Modes for Dielectric Metamaterials", *Japanese Journal of Applied Physics*, vol. 45, No. 4A, 2835-2841, 2006.
 35. A. Baker, M. Lanagan, C. Randall, E. Semouchkina, G. Semouchkin, K. Rajab, R. Mittra, R. Eitel, S. Rhee, P. Geggier, C. Duschl, G. Fuhr, "Integration Concepts for the Fabrication of LTCC Structures," *The International Journal of Applied Ceramic Technology*, 2[6] 514-520 (2005).
 36. Semouchkina, E., Semouchkin, G., Lanagan, M., and Randall, C., "FDTD Study of Resonance Processes in Metamaterials," *IEEE Transactions on Microwave Theory Techn.*, vol. 53, No. 4, 1477-1487, April 2005.
 37. Semouchkina, E., Baker, A., Semouchkin, G., Lanagan, M., and Mittra, R., "New Approaches for Designing Microstrip Filters Utilizing Mixed Dielectrics," *IEEE Transactions on Microwave Theory Techn.*, vol. 53, No. 2, 644-652, February 2005.
 38. Semouchkina, E., Semouchkin, G., Mittra, R. and Cao, W., "Finite Difference Time Domain Simulation of Resonant Modes of Rectangular Dielectric Resonators", *Microwave Optical Tech. Lett.*, vol. 36, 160-164, 2003.

39. Semouchkina, E., Cao, W., Lanagan, M., Mitra, R., and Yu, W., "Combining FDTD Simulations with Measurements of Microstrip Ring Resonators for Characterization of Low- and High-K Dielectrics at Microwaves", *Microwave Optical Tech. Lett.*, Vol.29, 21-24, 2001.
40. Semouchkina, E., Cao, W., Mitra, R., and Lanagan, M., "Numerical Modeling and Experimental Investigation of Resonance Properties of Microwave Capacitors", *Microwave Optical Tech. Lett.*, Vol. 29, 54-60, 2001.
41. Semouchkina, E., Cao, W., Mitra, R., and Yu, W., "Efficient Determination of Resonance Frequencies in Resonant Structures using the FDTD Method", *Microwave Optical Tech. Lett.*, Vol. 28, 244-247, 2001.
42. Semouchkina, E., Cao, W., Mitra, R., and Yu, W., "Analysis of Resonance Processes in Microstrip Ring Resonators by the FDTD Method", *Microwave Optical Tech. Lett.*, Vol. 28, 312-321, 2001.
43. Semouchkina, E., Cao, W., and Mitra, R., "Modeling of Microwave Ring Resonators Using the FiniteDifference Time-Domain Method (FDTD)", *Microwave Optical Tech. Lett.*, Vol. 24, 392-396, 2000.
44. Semouchkina, E., Cao, W., and Lanagan, M., "High Frequency Permittivity Determination by Spectra Simulation and Measurement of Microstrip Ring Resonators", *Electronics Lett.*, Vol. 36, 956-958, 2000.
45. Semouchkina, E., Cao, W., and Mitra, R., "Source Excitation Methods for the Finite Difference Time Domain Modeling of Circuits and Devices", *Microwave Optical Tech. Lett.*, Vol. 21, 93-100, 1999.