

# SOURAV BANERJEE

# CURRICULUM VITAE

Associate Professor (Tenured)  
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## Education

- **Ph.D.**, Department of Engineering Mechanics, **University of Arizona**, Tucson, August 2005.  
Major: **Engineering Mechanics**; Minor: **Applied Mathematics**
- **M.Tech.** Indian Institute of Technology (IIT), Bombay, India, March 2002.  
Institute of Static and Dynamics of Aerospace Structures (ISD), University of Stuttgart, Germany,  
Major: **Structural Engineering**
- **B.E.**, Bachelor of Civil Engineering, Indian Institute of Engineering Science and Technology (IIST), formerly known as Bengal Engineering College (D.U.), West Bengal, India, May 2000.

## Research: Themes

1. **Computational Acoustics and Ultrasonics**: physics based predictive modeling of acoustics & ultrasonic waves in solids, fluids, composites & engineered metamaterials; impact mitigation and wave suppression; computational nondestructive evaluation (NDE) & structural health monitoring (SHM).
2. **Material State Awareness**: composites damage precursors; predictive material degradation; progressive damage assessment at multiple scales; experimental NDE and SHM of materials and structures
3. **System Identification**: Signal Processing; Big-Data analysis; Surrogate modeling of complex systems
4. **Mechatronics and Metamaterials**: smart materials; sensor technology; acoustic/ultrasonic energy harvesting; acoustic/ultrasonic wave guiding, tunneling, lensing, topological manipulation, computing.
5. **AcoustoBiomechanics, Bio-Origami & Programmable Matter**: exploring the physics of acoustics in nature to device new devices / sensors; metamaterial applications; computationally predict the complex dynamics of bioorganisms.

## In-house Research tools

1. Quantitative Acoustic Contrast Tomography (Q-ACT) - Experimental
2. Quantitative Ultrasonic Image Correlation (QUIC) - Experimental
3. Distributed Point Source Method (DPSM-SISMAG) – Computational
4. Peri-elastodynamic Computational Method (PeED) - Computational
5. Finite Spectral Element Method (FSEM) – Computational
6. Inverse Digital and Computational Analysis Terminal (INDICATE) – Big-Data Processing, SIGNAL

## Honors and Awards

- **2019: Breakthrough Star Award**: Prestigious highest research award to a young faculty by USC Office of Vice President of Research
- **2018: Banerjee's student Mr. Sajjan Shrestha, received Outstanding Master Thesis award**, honored by University of South Carolina, Graduate School.

- 2018: **Invited Author**: Advanced Composite Program Handbook on NDE of Composite, NASA
- 2018: **Invited Guest Lecture**: R&D division, TATA Steel, Jamshedpur, India, Jan 9<sup>th</sup> 2018.
- 2017: **Michael J. Mungo Teaching Award**: Prestigious highest teaching award at University of South Carolina, by the Office of Provost, University of South Carolina, May 2017. [An Article on Dr. Banerjee](#)
- 2016: **Editorial Board Member: Scientific Reports** published by Nature Publishing Group. Since 2016
- 2016: **Invited Speaker**: IEEE CMMI conference at Jadavpur University, Kolkata 700047
- 2015: **ASPIRE** Award grant by the Office of Vice President of Research, University of South Carolina
- 2014: **Invited Guest Lecturer**: Industry workshop on SHM of Composites at Skolkovo technological Institute (Skoltech), Moscow, Russia, Dec 8<sup>th</sup> – Dec 12<sup>th</sup>
- 2014: **Invited Speaker**: 29<sup>th</sup> American Society of Composites, Annual Technical Conference, University of California, San Diego, Special Session on NDE and SHM of Composites
- 2013: Who is Who in America
- 2012: **Invited Speaker**: 164<sup>th</sup> ASA Meeting, Kansas City, Missouri, USA, Special Session 2pSA
- 2010: **Achenbach Medal to recognize the outstanding contribution as a young researcher** in the field of structural health monitoring, Sponsored by Embraer, Given in IWSHM 2011
- 2008: **Professional Engineers (PE) License**, Since 2008
- 2007: **Invited speaker** Sponsored by NSF to present contemporary research in “World Forum on Smart Materials and Smart Structures Technology”, Chongqing & Nanjing, China”
- 2007: Invited as a leading author to write a technical article on contemporary research in “Industrial Sensing and Measurement” column of Optical Engineering Magazine, SPIE Newsroom
- 2006: Honored as a **Technical Expert**, by Department of Engineering Mechanics, University of Arizona, Tucson.
- 2004: Visiting research scholar to IIT Bombay, Awarded by University of Arizona, National Science Foundation (NSF)
- 2002: **National Award for one of the best M.Tech Thesis**, Honored by Indian Society of Technical Education (ISTE)
- 2002: **Jaya Seetha Ranjani Harihar Subramani Award**, for being outstanding graduate student. Honored by Indian Institute of Technology (IIT) Bombay
- 2001: **DAAD Scholar**, Honored by German Academic Exchange Program Service, Germany

## Positions and Employments

Year - Year	Institution	Position
2018-present	University of South Carolina	Associate Professor
2012-2017	University of South Carolina	Assistant Professor
2009-2011	Acellent Technologies Inc.	Director of Product Development
2008-2009	Acellent Technologies Inc.	Senior Project Engineer
2008-2008	Arizona State University	Research Assistant Professor
2005-2008	University of Arizona	Technical Expert (Part time)
2006-2007	Consulting Engineers Corporation	Project Engineer, Structure
2005-2006	AMEC, Earth and Environment	Staff Professional, NDE Engineer

## Awards and Funding - Present to old

Sponsor	Project Title	Role	Years Funded
	Composite bond line Inspection through Ultrasonics and Bond Quality Index	PI of the Task 7 / Co-PI- TC21	2017-2020
	TOXIMAP: Computational Framework for Prediction of Geographical and Temporal Incidence of Mycotoxins in US Crop Fields	Co-PI	2017-2020
	Demonstration of model using cover crops to improve soil health and reduce crop stress and aflatoxin contamination	Co-PI	2016-2018
	Multiscale Computational Non-destructive Evaluation (NDE) for Composites	PI	2015-2018
	<p>Nondestructive evaluation of Composite</p> <p>Project 1: Energy Harvesting using Acoustoelastic Metamaterials</p> <p>Project 3: Physics based model of wave composite interaction</p> <p>Project 4: Angle beam ultrasonic for wrinkle inspection in composites</p>	<p><i>Bucket Co-director</i></p> <p>PI</p> <p>PI</p> <p>PI</p>	2016-2019
	Explaining to Damage State in Composites at Multiple Length Scale using Quantitative Ultrasonic and SEM	PI	2015-2016
	"Is it possible to Quantify the Growth of Entropy due to Material Damage?"	PI	2015-2016
	"A novel computational method for nondestructive evaluation of space composite" (Palmetto Academy Program)	PI	2015
	Graduate Research: "Autonomous energy scavenging from low frequency ambient noise using Acoustoelastic Metamaterials (AEMM)"	PI	2015-2016
	UG Research: "Development of broad band mechanical energy harvester using cochlea mechanics"	Mentor	2015
	"Center for Colon Cancer Research: Mechanical landscaping of a colon tissue with customized gut microflora (pilot project)"	Co-PI	2014-2015
	"Uncertainty quantification driven multi-scale model development for	Co-PI	2014-2015

	aflatoxin prediction”		
	Advanced Structures, Processes and Engineered Materials (ASPEM), <b>Project 1.2:</b> Predictive Multi-scale Quantification of Precursor to Damage State in Composites	Co-PI  PI for the Project 1.2	2014-2015
	Development of CSLAN for real time monitoring of F-15 aircraft components	PI	2009-2010
AFOSR	Development of CSLAN for real time monitoring of F-15 aircraft components: Phase II	PI	2010-2012
	Development of SMART HULL system for Naval Structures	PI	2011-2011
	Development of on-board SHM system for full-composite Unmanned Air Vehicles	PI	2010-2011
	Development of predictive model to classify disbond and delamination in Composite Structures	Co-PI	2010-2011
	Structural Health Monitoring System for Composite Propellant Tank used in space applications	PI	2010
	Development of SCANSn System for Infrastructure health management. PI: Dr. Shawn Beard	Co-PI	2008-2012

## Professional Services for Broader Scientific Community

### Professional Societies

- Serving as a Secretary, and Executive Committee member of the NDE division of ASME
- Serving as a Chair of the Ultrasonic Technical Committee (TC) of the NDE division of ASME.
- Serving as a member, SHM of Aerospace Structures TC of SMASIS, ASME
- Member, The American Society of Mechanical Engineers (ASME)

### Conferences

- **Symposium Organizer**, Conference wide Symposium on NDE, ASME IMECE **2019**, Salt Lake City, UT
- **Symposium Organizer**, Conference wide Symposium on NDE, ASME IMECE **2018**, Pittsburg, PA
- **Track Organizer**, Track 17- NDE, Diagnosis and Prognosis, ASME IMECE **2017**, Tampa, FL
- **Track Organizer**, Track 17- NDE, Diagnosis and Prognosis, ASME IMECE **2016**, Phoenix, AZ
- **Topic Organizer**, Track 2, Topic 17, Ultrasonic Manufacturing, ASME IMECE, 2015, Huston, TX
- **Committee Member**, Session Chair, SPIE NDE & Smart Structure Conference, **2008-2016**
- **Session Organizer and Chair**, 51<sup>st</sup> Society of Engineering Science (SES) Meeting, Purdue, **2014**
- **Session Organizer and Chair**, Special Session: Precursor to damage quantification, IWASHM **2013**.
- **Session Organizer and Chair**, 50<sup>th</sup> Society of Engineering Science (SES) Meeting, Brown, **2013**
- **Session Chair**, ASME SMASIS, **2011**

### Journals and Publishers

- **Editorial Board Member**, Scientific Reports, Nature Publishing Group, 2016-present
- **Editorial Board Member**, International Aeronautics Journal
- **Editorial Board Member**, International Journal of Aeronautics and Aerospace Engineering
- **Book Reviewer**: Springer, CRC Press, Cambridge University Press,
- **Reviewer** to more than ~52 National and International Journals including Nature publishing Group

### Patents

Approved / Pending / Disclosed

- P1. **Banerjee**, S., Qing, X., Beard, S., Chang, F., "*Method and Apparatus for Estimating Damage in a Structure*", US Patent No. 8521444, Approved on August 2013.
- P2. **Banerjee**, S., Chnada, A., "*Quantitative Acoustic Contrast Tomography (Q-ACT) for studying fungal growth and toxicity*", Patent No. 9670522, Approved on June 6, 2017.
- P3. **Banerjee**, S., Ahmed, R., "*Power Optimization for a Unit Cell Metamaterial Energy Harvester*", Patent Application No. USC# 575 (1281)

### Books / Chapters

Published / In Press / Writing

- B1. **Banerjee**, S., Leckey, C., A Handbook of Computational Nondestructive Evaluation, CRC Press Taylor and Francis Group, Approved, Contract signed.
- B2. **Banerjee**, S., Patra S., Chapter 15 Multiscale Quantification of Damage Precursors, Nonlinear Acoustic Techniques for Nondestructive Evaluation, Acoustical Society of America. ISBN 978-3-319-94474-6, 2018
- B3. **Banerjee**, S., Shrestha, S., "Numerical Modeling of Wave Propagation in Composites", Structural Health Monitoring for Advanced Composite Structures, World Scientific. ISBN 978-1-78634-392-5, 2018
- B4. **Banerjee**, S., Kundu, T., Chapter 4 "Advanced Application of Distributed Point Source Method - Ultrasonic Field Modeling in Solid media". Ed. T. Kundu and D. Placko, *John & Willey Publication*, Hoboken, New Jersey, USA, ISBN: 978-0-471-73314-0 (Lib. CAT# TA347.D57P585), 2007.

### Magazine Articles

Published / In Press / Writing

- M1. **Banerjee**, S., Kundu, T., "Modeling of Ultrasonic Wave-scattering by Internal Anomalies for NDE/SHM Application.", Column - Industrial Sensing and Measurement, SPIE News Room, Optical Engineering Magazine (2007).

### Journal Publications

Published / In Press / Accepted / Submitted

2019

- J1. Tavaf, V., **Banerjee**, S., Quantification of degraded constitutive coefficients of composites in the presence of distributed defects, *Journal of Composite Materials*, (Accepted)
- J2. Indaleeb, M.M., **Banerjee**, S., Hossain A., Saadatzi, MS., Ahmed, R., Deaf band based engineered Dirac cone in a periodic acoustic metamaterial: A numerical and experimental study, *Physical Review B*, Vol. **99**, 024311; <https://doi.org/10.1103/PhysRevB.99.024311>.
- J3. Patra, S., Hossain A., Saadatzi, MS., **Banerjee**, S., Evidence of dissipative and growing nonlinearity in Lamb waves due to respective stress-relaxation and material degradation in composites, *Ultrasonics*, (Accepted).

## 2018

- J4. Hossain A., Indaleeb M.M., Ahmed, R., **Banerjee**, S., Multifunction acoustic modulation by a multi-mode acoustic metamaterial architecture, *Journal of Physics Communication*, Vol 2 (11), pp. 115001.
- J5. Tavaf, V., Saadatzi, MS, Shrestha, S., **Banerjee**, S., Quantification of Material Degradation and its behavior of Elastodynamic Green's function for Computational Wave Field Modeling in Composites, *Materialstoday Communications*, Vol. 17, pp. 402-412.
- J6. **Habib**, A., Shelke, A., Amjad, U., Pietsch, U., **Banerjee**, S., Nonlocal Damage Mechanics for Quantification of Health for Piezoelectric Sensor, *Applied Sciences*, Vol. 8(9), pp. 1683.
- J7. Saadatzi, MS., Saadatzi, Mir, F., Saadatzi, M. N., **Banerjee**, S., Modeling and Fabrication of a Multi-axial Piezoelectric Energy Harvester based on a Metamaterial-inspired Structure, *IEEE Sensors Journal*, Vol 18, No. 22, pp. 9410-9419.
- J8. Saadatzi, MS., Saadatzi, M. N., Tavaf, V., **Banerjee**, S., A EVE 3D Acousto-Electrodynamics 3Dimensional Vibration Exciter for Engineering Testing, *IEEE/ASME Transactions on Mechatronics*, Vol. 23, No. 4, pp. 1897-1906.
- J9. Mir, F., Saadatzi, MS., Ahmed, R., **Banerjee**, S., (2018) Acoustoelastic Metawall Noise Barriers for Industrial Application with Simultaneous Energy Harvesting Capability, *Applied Acoustics*, Vol 139, pp.282-292.
- J10. Shrestha, S., Ahmed, R., **Banerjee**, S., (2018) Virtual Nondestructive Evaluation of Anisotropic Plates Using Symmetry Informed Sequential Mapping of Anisotropic Green's function (SISMAG), *Ultrasonics*, Vol 88, pp 53-61.
- J11. Ahmed, R., **Banerjee**, S., (2018) An Articulated Predictive Model for Fluid-free Artificial Basilar Membrane as Broadband Frequency Sensor, *Mechanical Systems and Signal Processing*, Vol. 100, pp. 766-781.
- J12. Patra, S., Ahmed, H., **Banerjee**, S., (2018) Peri-Elastodynamic Simulations of Guided Ultrasonic Waves in Plate-Like Structure with Surface Mounted PZT, *Sensors*, Vol. 18, No. 274, pp. 1-16.

## 2017

- J13. Patra, S., **Banerjee**, S., (2017), Material State Awareness for Composites Part II: Precursor Damage Analysis and Quantification of Degraded Material Properties Using Quantitative Ultrasonic Image Correlation (QUIC), *Materials*, Vol. 10(12), pp. 1444
- J14. Patra, S., **Banerjee**, S., (2017), Material State Awareness for Composites Part I: Precursor Damage Analysis Using Ultrasonic Guided Coda Wave Interferometry (CWI), *Materials*, Vol. 10(12), pp. 1436.
- J15. Ahmed, R., Mir, F., **Banerjee**, S., A Review on Energy Harvesting Approaches for Renewable Energies from Ambient Vibrations & Acoustic Waves using Piezoelectricity, *Smart Materials and Structures*, Vol 26, Number 8, (27pp).
- J16. Chijioke, A., Mir, F., **Banerjee**, S., Modified 'Zener' Theory to accurately predict Impact Force History for Soft Impactors employing Spiral Sensing, *Experimental mechanics*, 57:1435-1444.

## 2016

- J17. Ahmed, R., **Banerjee**, S., A Sub-Wavelength Scale Acoustoelastic Sonic Crystal for Harvesting Energies at very Low Frequencies (<~1 KHz) using Controlled Geometric Configurations, *Journal of Intelligent Material Systems and Structures*, Vol. 28(3), pp. 381-391.

- J18. Lin, X., Terejanu, G., Shrestha, S., **Banerjee**, S., Chanda, A., (2016) Bayesian Model Selection Framework for Identifying Growth Patterns in Filamentous Fungi, *Journal of Theoretical Biology*, Vol. 398, pp. 85-95.
- J19. Rima, R., Chijioke, A., Chakraborty, P., **Banerjee**, S., Spiral Sensing & Probability Map of Impact (PMOI) for Impact characterization, *International Journal of Modern Engineering*, Vol. 16 (1), pp. 56-68.

## 2015

- J20. Patra, S., **Banerjee**, S., Terejanu, G., Chanda, A., (2015), Subsurface pressure profiling: a novel mathematical paradigm for computing colony pressures on substrate during fungal infections, *Scientific Reports*, **5**, 12928, (2015).
- J21. Shelke, A., **Banerjee**, S., Zhenhua, T., Yu, L., (2015) "Predictive Design of Spiral Lamb Waveguide for Spatial Filtration of Frequencies in a Confined Space". *Journal of Experimental Mechanics*, Springer, 55:1199-1209.
- J22. Dongyu X, Cheng, X., **Banerjee**, S., Huang, S., (2015), Dielectric and electromechanical properties of modified cement/polymer based 1-3 connectivity piezoelectric composites containing inorganic fillers, *Composites Science and Technology*, Vol. 114, pp. 72-78.
- J23. Habib, A., Vogel, M., Shelke, A., Brand, S., Jiang, X., Kundu, T., Pietsch, U., **Banerjee**, S., (2015) Quantitative Ultrasonic Characterization of c-axis oriented polycrystalline AlN thin film for smart device application, *Acta Austica, European Acoustic Association, Vol 101 (4)*, DOI: 10.3813/AAA.918863.
- J24. Dongyu, X., Cheng, X, **Banerjee**, S, Wang, L, Huang, S, (2015), "Dielectric, piezoelectric and damping properties of novel 2-2 piezoelectric composites", *Smart Materials and Structures*, **24**, 025003 (8pp), 2015, doi: 10.1088/0964-1726/24/2/025003.
- J25. Dongyu, X., **Banerjee**, S, Wang, Y, Huang, S, Cheng, X., (2015), "Temperature and loading effects of embedded smart piezoelectric sensor for health monitoring of concrete structures", *Construction and Building Materials*, **76**, pp. 187-193.

## 2014

- J26. Dongyu, X., Cheng, X, **Banerjee**, Huang, S, (2014), "Design fabrication and properties of 2-2 connectivity cement/polymer based piezoelectric composites with varied piezoelectric phase distribution", *AIP Journal of Applied Physics*, **116**, 244103.1-7.
- J27. Ahmed, R., **Banerjee**, S., (2014), "Low Frequency Energy scavenging using sub-wave length scale acousto-elastic metamaterial", *AIP Advances* **4**, 117114 (2014).
- J28. **Banerjee**, S., Gummadidala, P. M., Rima R. A., Ahmed, R. U., Kenne, G. J., Mitra, C., Gomaa, O. M., Hill, J., McFadden, S., Banaszek, N., Fayad, R., Terejanu, G., Chanda, A., (2014), "Quantitative acoustic contrast tomography reveals unique multiscale physical fluctuations during aflatoxin synthesis in *Aspergillus parasiticus*", *Fungal Genetics and Biology*, Oct 10. pii: S1087-1845(14)00189-3. doi: 10.1016/j.fgb.2014.10.006.
- J29. Ahmed, R., **Banerjee**, S, (2014), "Predictive Electromechanical Model for Energy Scavengers using Patterned Piezoelectric Layers", *ASCE Journal of Engineering Mechanics*, 10.1061/(ASCE) EM.1943-7889.0000829, 04014113.
- J30. **Banerjee**, S., Terejanu, G., Chanda, A, (2014), 'Uncertainty Quantification driven Predictive multi-scale model for synthesis of mycotoxin ', *Computational Biology and Bioinformatics*, Vol. 2,1, pp. 7-12, doi: 110.11648/j.cbb.20140201.12.

- J31. **Banerjee**, S., Ahmed, R., (2014), 'Phonon Confinement using Spirally Designed Elastic Resonators in Discrete Continuum', *International Journal of Material Science and Application*, ISSN: 2327-2635, Vol. 3,1, pp. 6-13, doi: 10.11648/j.ijmsa.20140301.12

## 2013

- J32. Yadav, S., **Banerjee**, S., Kundu, T., (2013) "On sequencing feature extraction tools for online damage characterization", *Journal of Intelligent Materials Systems and Structures*, Vol. 24 (4), pp. 473-483.
- J33. **Banerjee**, S., Ahmed, R., (2013),"Precursor/Incubation of Multi-scale Damage State Quantification in Engineered Materials: Using Hybrid Microcontinuum Field Theory and High Frequency Ultrasonic", *IEEE Transaction of Ultrasonics, Ferroelectrics and Frequency Control*, Vol. 60. No. 6, pp. 1141-1151.
- J34. Ahmed, R., **Banerjee**, S., (2013) 'Wave Propagation in Metamaterials using Multi-scale Resonators by creating Local Anisotropy', *International Journal of Modern Engineering*, Vol. 13, No. 2, pp. 51-59.
- J35. Shelke, A., **Banerjee**, S., Habib, A., Rahani, E. K., Ahmed, R., Kundu, T., (2013), 'Wave Guiding and Wave Modulation using Phononic Crystal Defects' *Journal of Intelligent Materials Systems and Structures*, 2014, Vol. 25 (13), pp. 1541-1552. DOI: 10.1177/1045389X13507344.

## 2011

- J36. Shelke, A., **Banerjee**, S., Kundu, T., Amjad, U., Grill, W., (2011) 'Multi Scale Damage State Estimation in Composites Using Nonlocal Kernel: An Experimental Validation', *International Journal of Solids and Structures*, Volume 48, Issues 7-8, April 2011, Pages 1219-1228
- J37. **Banerjee**, S (2011), "Electromechanical Model for a plate type energy harvester using coupled strain rate damping mechanism", *JP Journal of Solids and Structures*, Volume 5, Issue 2, Pages 75-105.

## 2009

- J38. **Banerjee**, S., Qing, X. P., Beard, S., Chang, F. K., (2009) "Prediction of Progressive Damage States at the Hot Spots using Statistical Estimation", *Journal of Intelligent Materials Systems and Structures*, Vol 21 (6), pp.595-605
- J39. **Banerjee**, S., (2009) "Estimation of Damage State in Materials using Nonlocal Perturbation: Application to Active Health Monitoring", *Journal of Intelligent Materials Systems and Structures*, Vol. 20, No. 10, pp. 1221-1232.
- J40. **Banerjee**, S., (2009) "Effect of intrinsic length scale and multi-scale information migration for calculating elastodynamic Green's function using nonlocal theory", *JP Journal of Solids and Structures*, Vol. 3 (1), pp. 43-69.
- J41. Qing, X.P., Beard, S., Shen S.B., **Banerjee**, S., Bradley, I., Salama, M.M., Chang, F.K., (2009) Development of Real-Time Active Pipeline Integrity Detection System, *Smart Materials and Structures*, Vol. 18, 115010 (10pp).
- J42. Dao, C. M., Das, S., **Banerjee**, S., Kundu. T. (2009),"Wave Propagation in a fluid wedge over a solid half space – Mesh free analysis with experimental verification" *International Journal of Solids and Structures*, Vol. 46, Issue 11-12., pp. 2486-2492.
- J43. **Banerjee**, S., Das, S., Kundu, T., Placko, D., (2009) "Controlled Space Radiation Concept for Mesh-Free Semi-Analytical Technique to Model Wave Fields in Complex Geometries", *Ultrasonics*, Vol. 49(8), pp. 615-622, 2009.
- J44. Ahmad, R., **Banerjee**, S., Kundu, T., (2009) "Pipe Wall Damage Detection in Buried Pips Using Guided Waves" *ASME Journal of Pressure Vessel Technology*, Vol. 131, No. 1 / 011501-1-011501-10.

## 2008

- J45. Das, S., **Banerjee**, S., Kundu, T., (2008) "Elastic Wave Scattering in Solid Half Space with a Circular Cylindrical Hole Using Distributed Point Source Method" *International Journal of Solids and Structures*, Vol. 45, pp. 4498-4508.
- J46. **Banerjee**, S., Kundu, T., (2008). "Elastic Wave Field Computation in Multilayered Non-Planar Solid Structures: A Mesh-free Semi-Analytical Approach", *Journal of Acoustical Society of America*, Vol. 123 (3), pp. 1371-1382.
- J47. **Banerjee**, S., Kundu, T., (2008). "Semi-Analytical Modeling of Ultrasonic Fields in Solids with Internal Anomalies Immersed in a Fluid", *Wave Motion* Vol. 45, Issue 5, April 2008, Pages 581-595.

## 2007

- J48. Das, S., Dao, C.M., **Banerjee**, S., Kundu, T., (2007) "Interaction between Bounded Acoustic Beams and Corrugated Plates", *IEEE Transaction of Ultrasonics, Ferroelectrics and Frequency Control*, Vol. 54, Number 9, pp. 1860-1872.
- J49. **Banerjee**, S., Kundu, T., (2007). "DPSM Technique for Ultrasonic Field Modelling Near Fluid-Solid Interface", *Ultrasonics*, Vol. 46 (3), pp. 235-250.
- J50. **Banerjee**, S., Kundu, T., (2007). "Ultrasonic Field Modeling in Plates Immersed in Fluids", *International Journal of Solids and Structures*. Vol. 44, Issues 18-19, September 2007, Pages 6013-6029.
- J51. **Banerjee**, S., Kundu, T., (2007). "Scattering of Ultrasonic Waves by Internal Anomalies in Plates", *Optical Engineering Journal*. Vol. 46(5), pp. 053601-1 to 053601-9.

## 2006

- J52. **Banerjee**, S., Kundu, T., Placko, D., (2006). "Ultrasonic Field Modeling in Multilayered Fluid Structures Using DPSM Technique", *ASME Journal of Applied Mechanics*, Vol. 73 (4), pp. 598-609.
- J53. **Banerjee**, S., Kundu, T., (2006). "Elastic Wave Propagation in Sinusoidally Corrugated Wave Guides", *Journal of Acoustical Society of America*, Vol. 119 (4), pp. 2006-2017.
- J54. **Banerjee**, S., Kundu, T., (2006). "Symmetric and Anti-symmetric Rayleigh-Lamb modes in Sinusoidally corrugated waveguides: An Analytical approach", *International Journal of Solids and Structures*, Vol. 43. pp. 6551-6567.
- J55. Kundu, T., **Banerjee**, S., Kumar, V.J., (2006). "An Experimental Investigation of Guided Wave Propagation in Corrugated Plates Showing Stop Bands and Pass Bands", *Journal of Acoustical Society of America*, Vol. 120 (3), 1217-1226.

## Conference Proceedings

## Full Articles

- C1. Tavaf, V., Shrestha, S., Saadatzi, Md. S., **Banerjee**, S., Effect of multiscale precursor damage on wave propagation through modulated constitutive properties of composite materials, Health Monitoring of Structural and Biological Systems XII, SPIE 2018, Colorado
- C2. Patra, S., **Banerjee**, S., Effect of bond stiffness degradation on sensor signals under dynamic loading, Health Monitoring of Structural and Biological Systems XII, SPIE 2018, Colorado.
- C3. Ahmed, H., Ahmed, R., **Banerjee**, S., Butterfly metamaterial for acoustic holographic imaging through super lensing capability, Health Monitoring of Structural and Biological Systems XII, SPIE 2018, Colorado.

- C4. Mir, F., Saadatzi., S., **Banerjee**, S., The possibility of harvesting electrical energy from industrial noise barriers using meta-wall bricks, *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, SPIE 2018, Colorado.
- C5. Indaleeb, M., Ahmed, H., **Banerjee**, S., Investigation on multi-occurrence of Dirac cone and exceptional ring, *Health Monitoring of Structural and Biological Systems XII, Special Session on Metamaterials*, SPIE 2018, Colorado.
- C6. Ahmed, R., **Banerjee**, S., An approach to manipulate frequency selectivity in Basilar metamembrane based broadband frequency sensors, *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, SPIE 2018, Colorado.
- C7. Saadatzi, Md. S., **Banerjee**, S., Direct measurement of modal fluctuations in PVDF based artificial Basilar membrane using a high-resolution data acquisition board, *Bioinspiration, Biomimetics, and Bioreplication VIII*, SPIE 2018, Colorado.
- C8. Saadatzi, Md. S., Nasser, M. S., Tavaf, V., **Banerjee**, S., Multi-frequency three-directional energy harvesting from a unit-cell acoustic metamaterial, *Active and Passive Smart Structures and Integrated Systems XII*, SPIE 2018, Colorado.
- C9. Shrestha, S., Banerjee, S., (2018), Computational wave modeling of anisotropic plates with implementation of Symmetry Informed Sequential Mapping of Anisotropic Green's function (SISMAG), *Health Monitoring of Structural and Biological Systems XII*, SPIE 2018, Colorado
- C10. Shrestha, S., **Banerjee**, S. (2017), Comparison of Elastodynamic Green's function formulations for wave modeling in composite materials, *International Conference on Mechanical Engineering*, Jadavpur University, Kolkata, India ([Invited paper](#)).
- C11. Shrestha, S., **Banerjee**, S., (2017), Computational Wave Field Modeling in Anisotropic Plate, *Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems Proceedings of SPIE 2017*.
- C12. Patra, S., Banerjee, S., (2016), Precursor damage inception quantification in composites using coda wave interferometry based on Taylor series expansion technique, *Proceeding of American Society of Composite*, 31<sup>st</sup> technical Meeting, Williamsburg, VA. ([Invited paper](#)).
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- C58. Kundu, T., **Banerjee**, S., (2006) "Theoretical and Experimental investigations in Ultrasonic Guided waves for Structural Health Monitoring Application.", Key Note Lecture, 1st International Conference at Bengal Engineering College and University on recent development in Civil Engineering, 150th Year Celebration.
- C59. Kundu, T., **Banerjee**, S., Kumar, V.J., (2006)"An experimental investigation of guided wave propagation in corrugated plates with series of parabolic gratings", Third European Workshop on Structural Health Monitoring , Granada , Spain , July 5-7 , Ed. A. Guemes, Pub. DEStech Publications, Inc., Lancaster, PA pp. 1037-1044.
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- C61. **Banerjee**, S., Kundu, T., (2006), "Scattering of ultrasonic waves by internal anomalies in plates immersed in a fluid", Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems , Ed. T. Kundu, SPIE's 11<sup>th</sup> Annual International Symposium on NDE for Health Monitoring and Diagnostics, San Diego, California, Feb. 26 - March 2, Vol. 6177, pp.617709-1 to 617709-11.

- C62. Ahmed, R., **Banerjee**, S., Kundu, T., (2006), "Cylindrical guided waves for damage detection in underground pipes using wavelet transforms", Smart Structures and NDE Joint Conference: Sensors and Smart Structures Technologies for Civil, Mechanical and Aerospace Systems, Ed. M. Tomizuka, SPIE Symposium on Smart Structures and Materials and NDE for Health Monitoring and Diagnostics, San Diego, California, Feb. 26 - March 2, Vol. 6174.
- C63. Ahmad, R., **Banerjee**, S., and T. Kundu, (2005) "Influence of Water Flow on Pipe Inspection", Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems, Ed. T. Kundu, SPIE's 10th Annual International Symposium on NDE for Health Monitoring and Diagnostics, March 6-10, 2005, San Diego, California, Vol. 5768, pp. 285-294.
- C64. **Banerjee**, S., Kundu, T., (2005), "Elastic wave propagation in corrugated plate", Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems, Proc. of SPIE, Vol. 5768, pp.323-333.
- C65. Kundu, T., Ahmad, R., **Banerjee**, S., Na, W. B., (2004) "Guided Waves for Health Monitoring of Civil Infrastructure: Pipes and Reinforced Concrete Structures", Joint US-India Workshop on Advanced Sensing Systems and Smart Structures Technologies, in cooperation with IIT Bombay, Mumbai, India, December 20-21.
- C66. **Banerjee**, S., Kundu, T., (2004). "Analysis of wave propagation in symmetrically periodic sinusoidal wave guide", Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems, Proc. of SPIE, Vol. 5394, pp.89-98.
- C67. **Banerjee**, S., Banerji, P., Berning, F., Eberle, K., (2003). "Lamb wave propagation and scattering in laminated composite plates", Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems, Proc. of SPIE, Vol. 5047, pp.13-24.

## Conference Presentations / Posters

- CP1. Chanda, A., **Banerjee**, S., Terejanu, S., (2016) Multiscale mapping of morphomechanical properties of fungi with ultrasound, Biology and Biochemistry of Fungi, Gordon Research Conference, New Hampshire.
- CP2. **Banerjee**, S., (2014) "Precursor to damage quantification in composites under fatigue: A method for real time implementation", A19: NDE and SHM for Composites, 2014 ASC 29 / US-Japan 16 / ASTM D30 Conference, University of California, San Diego.
- CP3. Terejanu, S., **Banerjee**, S., Chanda, A., (2014) Multiscale Modeling of Fungi, Multiscale Modeling in Biology, organized by IMAG, NIH, NIH Campus, Bethesda, MD.
- CP4. **Banerjee**, S., Ahmed, R., (2013) "Guided Wave Propagation Showing Frequency Trapping in Periodic Structure", Society of Engineering Science, 50 the Annual Technical Meeting and ASME-AMD Annual Summer Meeting (July 28-31 2013).
- CP5. Ahmed, R., **Banerjee**, S., (2013) "Introduction of Novel Split Ring Metamaterial for Acoustic Wave Control", Society of Engineering Science, 50 the Annual Technical Meeting and ASME-AMD Annual Summer Meeting (July 28-31 2013).
- CP6. **Banerjee**, S., (2013), Incubation of Damage State Quantification in Laminated Composites and Metallic Alloys", Session 3aSAb, San Francisco, CA December 2013, Acoustical Society of America. 2013 Nov; 134(5):4105. doi: 10.1121/1.4831066.

- CP7. **Banerjee, S.**, (2012), Hybrid Microcontinuum Field Approach for Intrinsic Damage State Quantification", Session 2pSA, 164th Meeting, Acoustical Society of America, Kansas City, MO, 2012
- CP8. Beard, S., **Banerjee, S.**, Zhang, D., Kumar, A., Chang, F., (2011), "Networked Elements for Resin Visualization and Evaluation (NERVE) System", DARPA Conference, March 2011.
- CP9. Qing, X., **Banerjee, S.**, Beard, S., (2010) "Maturation of Active Smart patch System for monitoring the integrity of aircraft structures", Aircrafts Airworthiness and Sustainability Conference (AASC), Austin, Texas, 2010.

### Presentations in Professional Technical Meeting

- PM1. Chanda, A., **Banerjee, S.**, Mechanical Landscaping if Gut Microbiome using Quantitative Acoustic Contrast Tomography (Q-ACT), Invited seminar in COBRE Retreat to demonstrate the technologies applied for colon cancer research, January 2016, River Center at Saluda Shoals Park.
- PM2. **Banerjee, S.**, Terejanu, G., Chanda, A., Hazardous Aflatoxin Map for South Carolina farmers using trans disciplinary UQ driven multi-scale modeling frame work. Invited as Guest Presented at the USDA State Technical Committee Meeting organized by NRCS, South Carolina in Forestry Department, Columbia, SC on 3<sup>rd</sup> March 2015.
- PM3. Chanda, A., **Banerjee, S.**, Mechanical Landscaping if Gut Microbiome using Quantitative Acoustic Contrast Tomography (Q-ACT), Invited seminar in COBRE Retreat to demonstrate possible new technologies, January 2015, River Center at Saluda Shoals Park.
- PM4. Chanda, A., **Banerjee, S.**, Quantitative Acoustic Contrast Tomography (Q-ACT): A possible diagnostic tool for studying invasive cellular colonies, Invited seminar in COBRE Retreat to demonstrate possible new technologies, January 2014, River Center at Saluda Shoals Park.

### Workshop / Lectures

- PM5. **Banerjee, S.**, Acoustoultrasonics: New directions and visions – A pathway to the new Future of Engineering, Department of Mechanical Engineering, Michigan Tech., Hancock, Michigan (April 2017).
- PM6. **Banerjee, S.**, Research to Product: The fundamentals of Online NDE and SHM of Composite, December 2014, Skolkovo Institute of Science and Technology, Moscow, Russia. (65 Professional Registered)

### Teaching

Course	Title	Institution	Enrollment	Max. Rating
EMCH 220	Mechanical Engineering: Fundamental of Fluid Mechanics	<i>University of South Carolina</i>	35	4.7/5.0
EMCH 201 PHYS 311	Introduction to the Application of Numerical Methods for Engineers	<i>University of South Carolina</i>	130-165 / yr.	4.2/5.0
ENCP 201	Numerical Methods for Engineers	<i>University of South Carolina</i>	30 / yr.	4.4/5.0

<b>EMCH 501</b>	Engineering Analysis I (Advanced Mathematical Methods for Engineers)	<i>University of South Carolina</i>	12-25 /yr.	4.8/5.0
<b>EMCH 561</b>	Advanced Numerical Methods	<i>University of South Carolina</i>	20	4.2/5.0
<b>EMCH 260</b>	Mechanics of Solids	<i>University of South Carolina</i>	90 /yr.	TBD
<b>EMCH 764</b>	Mechanical Engineering Projects	<i>University of South Carolina</i>		5.0/5.0
<b>EMCH 792</b>	Selected Topics in Mechanics Systems	<i>University of South Carolina</i>		5.0/5.0
<b>EMCH 799</b>	Thesis preparation	<i>University of South Carolina</i>		NA
<b>EMCH 899</b>	Dissertation preparation	<i>University of South Carolina</i>		NA

## PhD Graduated

No.	Name	Year	Dissertation
1.	Dr. Riaz U. Ahmed	2012-2015	Bio-inspired Design of Mechanical Band Pass Filter with the Ability of Scavenging Energy
2.	Dr. Subir Patra	2014-2018	Ultrasonic Analysis Methods and Tools for Quantitative Material State Awareness of Engineered and Biological Materials

## MS Graduated

No.	Name	Year	Thesis
1.	Ms. Rowshan R. Rima	2012-2014	Modeling of Ultrasonic Wave Field Emanating from Scanning Acoustic Microscope for Reliable Characterization of Pathogens
2.	Mr. Agbasi Chijioke	2013-2014	Classification of Material Properties of the Foreign Impactors using Acoustoultrasonic Spiral Sensing
3.	Mr. Sajan Shrestha	2015-2017	Computational Wave-field Modeling using Sequential Mapping of Poly-Crepitus Green's Function in Anisotropic Media
4.	Ms. Fariha Mir	2016-2018	Acoustoelastic Metamaterial with Simultaneous Noise Filtering and Energy Harvesting Capability from Ambient Vibration
5	Mr. Indaleeb M. Mustahseen	2016-2018	Topological Conduction and Investigation on Multi-occurrence of Dirac-Cone

## Professional Services

Conference | Journal | Grant Reviewer

### Grants Reviewed

- NEUP, DoE, 2017
- NSF CMMI: Mechanics of Materials, 2017
- NSF CMMI : Dynamics Systems and Control, 2015
- NSF CMMI : Sensors, Dynamics Systems and Controls, 2016
- USC ASPIRE I Grants to Aspiring Young Faculties, 2016
- USC Magellan Scholar Grants for Under Graduate Research, 2016

### Conference Committee

- ASME Pressure Vessel Technology Conference
- ASME IMECE Conference
- SPIE Smart Structures and NDE Conference
- IEEE Conference

## Journal Reviews

- Reviewer to more than **~97** National and International Journals including Nature publishing Group

## Others

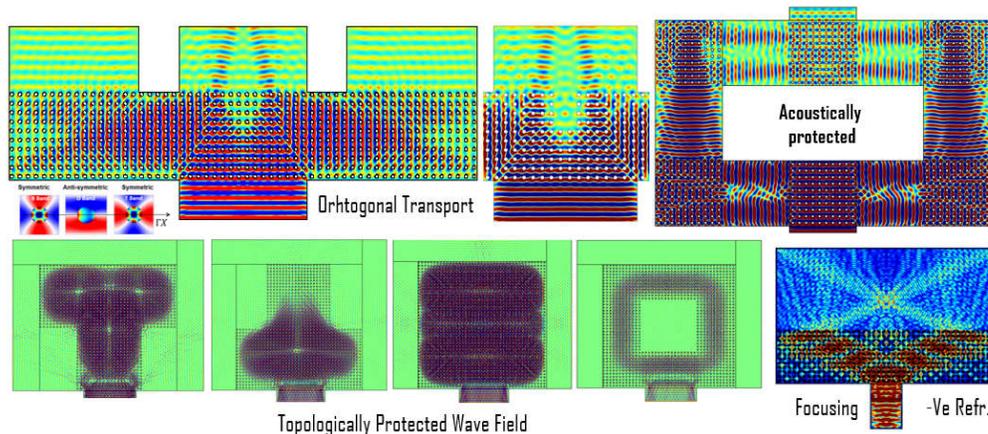
## Mentee

Dates	Relevance	Name
2012-present	Technical, Non-technical, Teaching, Research	Prof. Victor Giurgiutiu
2013-present	Proposal Mentee	Prof. Mike Sutton
2013-present	Materials and Multidisciplinary Research Mentee	Prof. Ken Reifsnider
2014-present	NIH Proposal Mentee	Prof. Swapan K Ray
2014-present	Cancer Biology Mentee	Prof. Frank Berger
2015-present	NIH Proposal Mentee	Prof. Jim Carson

## | Contribution to Science and Engineering |

## MetaMaterials

**M**y laboratory has found new ways of manipulating wave to guide and channel the waves in solids and fluids using the physics of Dirac cone phenomena in acoustics which is a counterpart of quantum Hall effect in electromagnetic waves. We developed predictive geometric tuning based on deaf band that will generate the required Dirac-like cones where orthogonal wave transport, negative refraction, and wave tunneling, even topologically protected wave fields are achieved. Few images are shown below followed by few publications.



Additionally phononic metamaterials are the emerging field of study in engineering. In this field I have contributed significantly to fundamentally develop new metamaterials that can guide and tunnel the waves in specified designed direction and also harvest the trapped wave to generate electricity simultaneously, that we call energy harvesting by metamaterials. We applied the concept of phononic metamaterial or acoustoelastic metamaterials in various fields of engineering from mechanical, aerospace to civil applications. I have integrated piezoelectric sensing method with metamaterials that is unique in its own and a part is proposed in this project. My expertise helped me to exploit the metamaterial recently for ultrasonic beam focusing.

Indaleeb, M., Ahmed, H., **Banerjee**, S., Investigation on multi-occurrence of Dirac cone and exceptional ring, Health Monitoring of Structural and Biological Systems XII, Special Session on Metamaterials, SPIE 2018, Colorado.

Hossain A., Indaleeb M.M., Ahmed, R., **Banerjee**, S., Multifunction acoustic modulation by a multi-mode acoustic metamaterial architecture, **Journal of Physics Communication**, Vol 2 (11), pp. 115001.

Shelke, A., **Banerjee**, S., Zhenhua, T., Yu, L., (2015) "Predictive Design of Spiral Lamb Waveguide for Spatial Filtration of Frequencies in a Confined Space". **Journal of Experimental Mechanics**, Springer, 55:1199-1209.

**Banerjee**, S., Ahmed, R., (2014), 'Phonon Confinement using Spirally Designed Elastic Resonators in Discrete Continuum', **International Journal of Material Science and Application**, ISSN: 2327-2635, Vol. 3,1, pp. 6-13, doi: 10.11648/j.ijmsa.20140301.12

Ahmed, R., **Banerjee**, S., (2013) 'Wave Propagation in Metamaterials using Multi-scale Resonators by creating Local Anisotropy', **International Journal of Modern Engineering**, Vol. 13, No. 2, pp. 51-59.

Shelke, A., **Banerjee**, S., Habib, A., Rahani, E. K., Ahmed, R., Kundu, T., (2013), 'Wave Guiding and Wave Modulation using Phononic Crystal Defects' **Journal of Intelligent Materials Systems and Structures**, 2014, Vol. 25 (13), pp. 1541-1552. DOI: 10.1177/1045389X13507344.

### Experimental NDE/SHM: Composite Damage Precursor

**M**y laboratory has developed a new comprehensive early detection nondestructive method based on ultrasonic that will provide the early material state awareness of a material of interest during operation and will quantify the precursor to damage state in the material. The fundamental philosophy can be applied to both engineered materials and biomaterials. Here are the following publications that was applied to engineered composite materials. The result shows that the coupling of multi-scale bottom-up understanding of materials, with top-down ultrasonic nondestructive evaluation opens new door to not only understand the early state of anomalies in materials but also quantify the state with fair accuracy.

- a. Patra, S., **Banerjee**, S., (2017), Material State Awareness for Composites Part II: Precursor Damage Analysis and Quantification of Degraded Material Properties Using Quantitative Ultrasonic Image Correlation (QUIC), *Materials*, Vol. 10(12), pp. 1444
- b. Patra, S., **Banerjee**, S., (2017), Material State Awareness for Composites Part I: Precursor Damage Analysis Using Ultrasonic Guided Coda Wave Interferometry (CWI), *Materials*, Vol. 10(12), pp. 1436.
- c. **Banerjee**, S., Ahmed, R., (2013), "Precursor/Incubation of Multi-scale Damage State Quantification in Engineered Materials: Using Hybrid Microcontinuum Field Theory and High Frequency Ultrasonic", *IEEE Transaction of Ultrasonics, Ferroelectrics and Frequency Control*, Vol. 60. No. 6, pp. 1141-1151.

### Computational NDE/SHM

**C**omputational NDE and SHM is recently getting popular for offline understanding of NDE data and to aid the concept of Virtual Flight Leader (VFL) or the Digital Twin concepts conceptualized by NASA and Air Force, respectively. My laboratory has developed virtual ultrasonic wave propagation tool that will simulate the ultrasonic waves in any complex 3D isotropic or anisotropic material to understand how ultrasonic wave interacts with the materials and its internal architectures. A virtual wave simulation tool will be immensely valuable in the near future in the engineering and biological fields for designing and developing an ultrasonic scanning systems/experiments with a prior understanding of the data to be obtained from the scanning experiments. This is also valuable to understand the ultrasonic signal better to extract the right feature that are related to the material properties of the material of interest. Following publication shows its application to engineered materials. Our method used

Distributed Point Source Method (DPSM), Peri-Elastodynamic (PED) simulation method and Finite Spectral Element Method (FSEM).

Shrestha, S., Ahmed, R., **Banerjee**, S., (2018) Virtual Nondestructive Evaluation of Anisotropic Plates Using Symmetry Informed Sequential Mapping of Anisotropic Green's function (SISMAG), *Ultrasonics*, Vol 88, pp 53-61.

Yadav, S., **Banerjee**, S., Kundu, T., (2013) "On sequencing feature extraction tools for online damage characterization", *Journal of Intelligent Materials Systems and Structures*, Vol. 24 (4), pp. 473-483.

**Banerjee**, S., Kundu, T., (2008). "Elastic Wave Field Computation in Multilayered Non-Planar Solid Structures: A Mesh-free Semi-Analytical Approach", *Journal of Acoustical Society of America*, Vol. 123 (3), pp. 1371-1382.

**Banerjee**, S., Kundu, T., (2008). "Semi-Analytical Modeling of Ultrasonic Fields in Solids with Internal Anomalies Immersed in a Fluid", *Wave Motion* Vol. 45, Issue 5, April 2008, Pages 581-595.

**Banerjee**, S., Kundu, T., (2007). "Ultrasonic Field Modeling in Plates Immersed in Fluids", *International Journal of Solids and Structures*. Vol. 44, Issues 18-19, September 2007, Pages 6013-6029.

### Ultrasonics for Biology / Biomedical / Biomechanics

**W**ith the collaborators from biological sciences and computer science, my laboratory has developed Quantitative Acoustic Contrast Tomography (Q-ACT) that will understand the mechanical behavior of live pathogens in real-time by extracting the biophysical parameters from ultrasonic signals. This technology is patented by the University of South Carolina. Q-ACT is valuable for almost all biological materials. Following publications demonstrate the method with added statistical analysis of the data.

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### Energy Harvesting

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## Biomimetics

Ahmed, R., **Banerjee**, S., (2018) An Articulated Predictive Model for Fluid-free Artificial Basilar Membrane as Broadband Frequency Sensor, **Mechanical Systems and Signal Processing**, Vol. 100, pp. 766-781.