Bing Yu

Research Assistant Professor
Department of Biomedical Engineering, Duke University
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EDUCATION

Ph.D.	Electrical Engineering, Virginia Tech, *Blacksburg, VA,* 2005
M.S.	Optoelectronics Technology, University of Electronic Science and Technology of China (UESTC), *Chengdu, China*, 1994
B.S.	Optoelectronics Technology, UESTC, *Chengdu, China*, 1989

POSITIONS AND EMPLOYMENT

2010 – current	Research Assistant Professor, Dept. of Biomedical Engineering, Duke University
2009 – 2010	Senior Research Scientist, Dept. of Biomedical Engineering, Duke University
2007 – current	Principal Engineer and Co-founder, Zenalux Biomedical (formerly Endls Optics, Inc.), NC
2005 – 2008	Postdoctoral Research Associate, Dept. of Biomedical Engineering, Duke University
2000 – 2005	Research Assistant, Dept. of Electrical and Computer Eng., Virginia Tech, Blacksburg, VA
1999 – 2000	Research Assistant, School of Electrical & Electronic Eng., Nanyang Technological University, Singapore
1997 –1998	Application Engineer, Alcatel (Chengdu) Telecommunication System Co., Ltd., China
1995 – 1996	Telecommunication engineer, Chang Tong Mobile Telecommunication Eng. Co., Ltd., Chengdu, China,
1994 – 1999	Lecturer, University of Electronic Science and Technology of China, Chengdu, China
1989 – 1991	Research Engineer, Chinese Academy of Engineering Physics, Mianyang, China

RESEARCH INTERESTS

- Optical spectroscopy for cancer diagnostics
- Diffuse reflectance imaging for breast tumor margin detection
- Cervical and oral cancer screening in developing countries
- Near infrared spectroscopy for studying tumor hypoxia and angiogenesis
- Specialized fiber optic sensors and photonics devices

RESEARCH GRANTS

Completed Support

1R41CA128160-01, MPI 9/29/07-8/31/09 3.6 calendar
NIH STTR Phase I $195,843, total costs
Title: Optical surveillance of tumor margins in patients undergoing breast conserving surgery
Role: PI

Era of Hope Scholar BC044776, Ramanujam (PI) 09/01/05 - 08/31/11 8.4 calendar
DOD BRCP
Title: Miniature and Molecular Specific Optical Screening Technologies
Role: Investigator

1R01CA100559, Ramanujam (PI) 04/01/04-3/31/10
NIH/NCI
Title: Diagnosis of breast cancer using optical spectroscopy
Role: Investigator

Ongoing Support

1R03EB012210, Yu (PI) 8/1/10-7/31/12 2.4 calendar

NIH/NIBIB $153,954, total costs
Title: A Smart Fiber Optic Sensor for In Vivo Tissue Optical Spectroscopy
Role: PI

1R21CA162747, MPI 7/1/11-6/30/13 2.52 calendar
NIH/NCI Quick Trial $602,297, total costs
Role: PI
Title: Smart Optical Sensor for Detection of Cervical Cancer in the Developing World

1R01EB011574, Ramanujam (PI) 4/1/11-3/31/16 3.48 calendar
NIH BRP $5,268,049, total costs
Title: A Novel Optical Spectral Imaging System for Rapid Imaging of Breast Tumor Margins
Role: Investigator

2 R42 CA128160-02, Ramanujam (PI) 9/30/09-03/29/12 3.6 calendar
NIH STTR Phase II $1,029,260, total costs
Title: Fast Spectral Imaging Device for Tumor Margin Mapping
Role: Investigator

Pending Support

1R41CA156901-01A1, Yu (PI) 5/1/12-4/30/13 3.6 calendar
NIH STTR Phase I $ 228,063, total costs
Title: A Quantitative Optical Sensor to Monitor Pre-Clinical Tumor Vascular Physiology
Role: PI

AWARDS AND HONORS

- **Best Poster Award**, ECI conference on the Advances in Optics for Biotechnology, Medicine and Surgery XI, Burlington, Vermont, USA, 2009.
- **Postdoctoral Award for Research Excellence**, Duke University Postdoctoral Association, 2008
- **Two-times recipient**, Travel Grant award by the Graduate Student Association of Virginia Tech, 2003 – 2004.
- **Excellent Young Researcher Award**, Chinese Academy of Engineering Physics, China, 1991.
- Recommended to enter the graduate program at UESTC, waived of the National Graduate Admission Examination, 1989.
- Three-times recipient, **Outstanding Undergraduate Student award**, UESTC, 1987-89

PUBLICATIONS

Theses and Book Chapters

[1] "Development of Tunable Optical Filters for Demodulation of White-Light Interferometric Sensors," Ph.D. dissertation, Virginia Tech, May 2005, (Advisor: Professor Anbo Wang).

[2] "Servo System of a Magneto-Optical Disk Driver," Chapter 2 of Part II in Magneto-Optical Recording Technology, UESTC Publisher, pp146-176, 1994 (in Chinese).

[3] "Study of Optical Fiber Line Support System," M.S. thesis, UESTC, April 1994, (Advisor: Associate Professor Congjie Lin, in Chinese).

Journal Publications

[1] **B. Yu**, J.Q. Brown, T.M. Bydlon, S.A. Kennedy, M. Junker, J. Geradts, L.G. Wilke, and N. Ramanujam, "A 49-channel Diffuse Reflectance Imaging System for Intraoperative Detection of Breast Tumor Margins," under preparation.

[2] **B. Yu**, G.M. Palmer, B. Wang, A. Shah and N. Ramanujam, "Measuring Tumor Cycling Hypoxia and Angiogenesis using a Side-firing Fiber Optic Probe," to be submitted.

[3] Vivide Tuan-Chyan Chang, Delson Merisier, **Bing Yu**, David K. Walmer, and Nirmala Ramanujam, "Towards a field-compatible optical Spectroscopic device for cervical cancer screening in resource-limited settings: effects of calibration and pressure," Optics Express, Vol. 19, Iss. 19, pp. 17908–17924 (2011).

[4] **B. Yu**, H.L. Fu and N. Ramanujam, "Instrument-Independent Diffuse Reflectance Spectroscopy," Journal of Biomedical Optics, vol. 16(1): p. 011010 (2011).

[5] H.L. Fu, **B. Yu**, J.Y. Lo, G.M. Palmer, T.F. Keuch, and N. Ramanujam, "A low-cost, portable, and quantitative spectral imaging system for application to biological tissues," Optics Express, Vol. 18, Issue 12, pp. 12630-12645 (2010).

[6] J.Q. Brown, T.M. Bydlon, L.M. Richards, **B. Yu**, S.A. Kennedy, J. Geradts, L.G. Wilke, M. Junker, J. Gallagher, W. Barry, and N. Ramanujam, "Optical assessment of tumor resection margins in the breast," Journal of Selected Topics in Quantum Electronics, vol. 16(3), pp. 530-544, 2010.

[7] T.M. Bydlon, S.A. Kennedy, L.M. Richards, J.Q. Brown, **B. Yu**, M.S. Junker, J. Gallagher, J. Geradts, L.G. Wilke, and N. Ramanujam, "Performance metrics of an optical spectral imaging system for intra-operative assessment of breast tumor margins". Optics Express, Vol. 18, Issue 8, pp. 8058-8076 (2010).

[8] J.E. Bender, A.B. Shang, E.W. Moretti, **B. Yu**, L.M. Richards and N. Ramanujam, "Noninvasive monitoring of tissue hemoglobin using UV-VIS diffuse reflectance spectroscopy: a pilot study," Optics Express, Vol. 17, Issue 26, pp. 23396-23409 (2009).

[9] C. Zhu, E.S. Burnside, G.A. Sisney, L.R. Salkowski, J.M. Harter, **B. Yu** and N. Ramanujam, "Fluorescence spectroscopy: an adjunct diagnostic tool to image-guided core needle biopsy of the breast," IEEE Trans Biomed Eng. 2009 Oct;56(10):2518-28.

[10] J.Y. Lo, **B. Yu**, H.L. Fu, J.E. Bender, G.M. Palmer, T.F. Kuech and N. Ramanujam, "A strategy for quantitative spectral imaging of tissue absorption and scattering using light emitting diodes and photodiodes," *Optics Express*. 17 (3):1372-1384, 2009.

[11] **B. Yu**, J.Y. Lo, T.F. Kuech, G.M. Palmer, J.E. Bender, N. Ramanujam, "A Cost-Effective Diffuse Reflectance Spectroscopy Device for Quantifying Tissue Absorption and Scattering In Vivo," Journal of Biomedical Optics, Vol. 13, No. 6, 2008.

[12] **B. Yu**, H.L. Fu, T.M. Bydlon, J.E. Bender and N. Ramanujam, "Diffuse reflectance spectroscopy with a self-calibrating fiber optic probe*,"* Optics Letters, Vol. 33, Issue 16, pp. 1783-1785 (2008).

[13] **B. Yu**, E.S. Burnside, G.A. Sisney, J.M. Harter, C. Zhu, A.H. Dhalla and N Ramanujam, "Feasibility of near-infrared diffuse optical spectroscopy on patients undergoing image-guided core-needle biopsy," Optics Express **15**, pp. 7335-50 (2007).

[14] **B. Yu**, A. Wang, and G.R. Pickrell, "Analysis of Fiber Fabry-Perot Interferometric Sensors Using Low-Coherence Light Sources," Journal of Lightwave Technology, vol. **24**, no. **4**. pp. 1758-67 (2006).

[15] **B. Yu**, A. Wang, G.R. Pickrell, and J. Xu, "Tunable Optical Filter Based White Light Interferometry for Sensing," Optics Letters, vol. **30**, no. **12**, pp.1452-54 (2005).

[16] **B. Yu**, G.R. Pickrell, and A. Wang, "Thermally Tunable Extrinsic Fabry-Perot Filter," IEEE Photonics Technology Letters, vol. 16, no. 10, pp. 2296-98 (2004).

[17] **B. Yu** and A. Wang, "Grating-assisted Demodulation of Interferometric Optical Sensors", Applied Optics, vol. 42, no. 34, pp. 6824-29 (2003).

[18] **B. Yu**, D.-W. Kim, J. Deng, H. Xiao, and A. Wang, "Fiber Fabry-Perot sensors for detection of partial discharges in power transformers ", Applied Optics, Vol.42, No.16, pp. 3241-50 (2003).

[19] **B. Yu** and B. Cai, "The Application Techniques of WDM in Optical SDH Communication Systems," Optical Communication Technology, vol. **24**, no. **86**, pp.13-18, (2000) (in Chinese).

Conference Proceedings and Presentations

[1] Justin Y. Lo, Sulochana Dhar, **Bing Yu**, Martin Brooke, Thomas F. Kuech, Nan M. Jokerst, Nimmi Ramanujam, "Design, validation, and implementation of a diffuse reflectance spectroscopic imaging system for tissue absorption and scattering," Proceedings of SPIE (2012), accepted.

[2] Sulochana Dhar, Justin Y. Lo, **Bing Yu**, Talmage Tyler, Martin A. Brooke, Thomas F. Kuech, Nimmi Ramanujam, Nan M. Jokerst, "A custom wide-field spectral imager for breast cancer margin assessment," Proceedings of IEEE Photonics Society Annual Meeting, accepted 2011.

[3] Sulochana Dhar, JustinY. Lo, **Bing Yu**, Martin A. Brooke, Nimmi Ramanujam and Nan M. Jokerst, "Custom Annular Photodetector Arrays for Breast Cancer Margin Assessment Using Diffuse Reflectance Spectroscopy," 2011 IEEE Biomedical Circuits & Systems Conference, San Diego, California, November 10-12, 2011

[4] **B. Yu**, V. Chang, A. Shah, D. Merisier, D. Walmer and N. Ramanujam, *"A smart fiber optic sensor for detection of oral and cervical cancer in developing world," NIH/NCI Cancer Detection and Diagnostics Technologies for Global Health Conference,* August 22-23, 2011 at the NIH Campus. (poster and invited technology demo)

[5] **B. Yu**, J.Q. Brown, J.Y. Lo, T.M. Bydlon, H.L. Fu, S.A. Kennedy, M. Junker, T.F. Kuech, J. Geradts, L.G. Wilke and N. Ramanujam, "Quantitative Spectral Imaging for Intraoperative Breast Tumor Margin Assessment," European Conference on Biomedical Optics 2011, 22 - 26 May 2011, Munich, Germany. (invited talk)

[6] **B. Yu**, G.M. Palmer, B. Wang, A. Shah, K. Vishwanath and N. Ramanujam, “Monitoring of Head and Neck Tumor Physiology in Response to Hyperoxia using a Side-firing Fiber Optic Probe,” European Conference on Biomedical Optics 2011, 22 - 26 May 2011, Munich, Germany. (poster presentation)

[7] V. Chang, D. Merisier, **B. Yu**, D.K. Walmer and N. Ramanujam, “Calibration schemes of a field-compatible optical spectroscopic system to quantify neovascular changes in the dysplastic cervix,” accepted for oral presentation by Photonics West 2011 (BiOS), 22-27 Jan. 2011, San Francisco, CA.

[8] J.Y. Lo, **B. Yu**, H. Fu, T.F. Kuech and N. Ramanujam, “A compact, cost-effective diffuse reflectance spectroscopic imaging system for quantitative tissue absorption and scattering,” Proceedings of SPIE Vol. 7890, 78900B (2011).

[9] J.Q. Brown, **B. Yu**, N. Ramanujam, "Tissue-mimicking phantoms for system calibration and validation in Quantitative Diffuse Reflectance Spectroscopy (Q-DRS)," Design and Performance Validation of Phantoms used in Conjunction with Optical Measurement of Tissue III, SPIE Photonics West - BIOS, San Francisco, CA. 2010.

[10] **B. Yu**, H. Fu and N. Ramanujam, “UV-visible Diffuse Reflectance Spectroscopy with a Self-calibrating Fiber Optic Probe,” *ECI Conference on Advances in Optics for Biotechnology, Medicine and Surgery XI Clinical Challenges and Research Solutions,* June 28 - July 2, 2009, Burlington, Vermont, USA. (Best Poster Award)

[11] J.E. Bender, **B. Yu**, A.B. Shang, E.W. Moretti, L.M. Richards and N. Ramanujam “Noninvasive Monitoring of Blood Loss Using Diffuse Reflectance Spectroscopy: A Preliminary Patient Study,**”** *ECI Conference on Advances in Optics for Biotechnology, Medicine and Surgery XI Clinical Challenges and Research Solutions,* June 28 - July 2, 2009, Burlington, Vermont, USA.

[12] H.L. Fu, **B. Yu**, J.Y. Lo, T.F. Kuech, and N. Ramanujam, “A Low Cost System for Quantitative Spectral Imaging of Tissue Absorption and Scattering,” ECI Conference on Advances in Optics for Biotechnology, Medicine and Surgery XI *Clinical Challenges and Research Solutions,* June 28 - July 2, 2009, Burlington, Vermont, USA.

[13] **B. Yu**, H.L. Fu, T.M. Bydlon, J.E. Bender, and N. Ramanujam, “A Self-Calibrating Fiber Optic Probe for Tissue Optical Spectroscopy,” *CLEO 2008*, May 6-8, 2008, San Jose, CA.

[14] J.Y. Lo, **B. Yu**, G.M. Palmer, T.F. Kuech and N. Ramanujam, “A Miniature Optical Device for Noninvasive, Fast Characterization of Tumor Pathology,” *2008 OSA Topic Meeting in Biomedical Optics*, March 16-19, 2008**,** St. Petersburg, Florida.

[15] **B. Yu**, C. Lubawy, C. Zhu, E.S. Burnside, G.A. Sisney and N. Ramanujam, “Fiber Optic Probe Based-on Near Infrared Spectroscopy for Improving the Accuracy of Breast Core Needle Biopsy,” invited poster presentation at the *Annual NIH/NIBIB Grantee Meeting*, August 8-9, 2005, Washington, DC.

[16] X. Wang, J. Xu, Y. Zhu, **B. Yu,** M. Han, K.L. Cooper, G.R. Pickrell, and A. Wang, “An optical fiber tip pressure sensor for medical applications,**”** *Quantum Electronics and Laser Science Conference* 2005**,** vol. 2, pp. 916- 918, May 2005.

[17] X. Wang, J. Xu, **B. Yu**, K.L. Cooper, A. Wang, “Implementation of nondestructive Young's modulus measurement by miniature optical sensors,” *Proceedings of SPIE* Vol. 5998, 23-26 Oct. 2005.

[18] J. Xu, G.R. Pickrell, X. Wang, **B. Yu**, K.L. Cooper, A. Wang, “Vacuum-sealed high temperature high bandwidth fiber optic pressure and acoustic sensors,” *Proceedings of SPIE* Vol. 5998, 23-26 Oct. 2005.

[19] X. Wang, J. Xu, Y. Zhu, **B. Yu**, M. Han, K.L. Cooper, G.R. Pickrell, A. Wang, A. Ringshia, W. Ng, “Verifying an all fused silica miniature optical fiber tip pressure sensor performance with turbine engine field test,” *Proceedings of SPIE* Vol. 5998, 23-26 Oct. 2005.

[20] **B. Yu** and A. Wang, “Tunable Extrinsic Fabry-Perot Filter for Sensing Applications”, *2004 Optics in the Southeast*, SE04-A2, November 4 - 5, 2004, Charlotte, North Carolina.

[21] B. Yu, G.R. Pickrell, D.-W. Kim, and A. Wang, "Thermally tunable extrinsic Fabry-Perot filter for white-light interferometry," in *Frontiers in Optics*, OSA Technical Digest Series (Optical Society of America, 2004), paper FWH23.

[22] **B. Yu**, A. Wang, and G.R. Pickrell, “Analysis of White-light Fiber Fabry-Perot Interferometric Sensors”, *Proc. of SPIE, Fiber Optic Sensor Technology and Applications III*, Edited by Michael A. Marcus, Brian Culshaw, John P. Dakin, Vol. 5589, 2004.

[23] J. Xu, G.R. Pickrell, **B. Yu**, M. Han, Y. Zhu, X. Wang, K.L. Cooper, and A. Wang, “Epoxy-free high temperature fiber optic pressure sensors for gas turbine engine applications,” *Proc. of SPIE, Sensors for Harsh Environments*, Edited by Anbo Wang, Vol. 5590, 2004.

[24] Y. Zhu, G.R. Pickrell, X. Wang, J. Xu, **B. Yu**, M. Han, K.L. Cooper, A. Wang, A. Ringshia, and W. Ng, “Miniature fiber-optic pressure sensor for turbine engine,” *Proc. of SPIE, Sensors for Harsh Environments*, Edited by Anbo Wang, Vol. 5590, 2004.

[25] X. Chen, **B. Yu**, Y. Zhu and A. Wang, "Deep wet etching of fused silica material for fiber optic sensor fabrication," *Proc. of the SPIE*, vol. 5342, pp. 128-136, 2004.

[26] **B. Yu**, G.R.. Pickrell and A. Wang, "Grating-assisted Operation-Point Tuning for Fiber-Optic Fabry-Perot Interferometric Sensors," *Proc. of the SPIE, vol. 5272, pp. 41-48,* 2004.

[27] (Presentation Author) – G.R. Pickrell, R. Stolen, and D. Kominsky, "Random hole optical fibers," Proc. of *SPIE, vol. 5272, pp. 207-215,* 2004.

[28] D.-W. Kim, **B. Yu**, Y. Song, A. Wang, Y. Liu, A. Shahsiah, R. Degeneff, B. Ward, "Discharge and Thermal Gassing Monitoring using Fiber Acoustic Sensors," *EPRI Substation Equipment Diagnostics Conference XII*, February 15-18, 2004, New Orleans, Louisiana.

[29] **B. Yu**, D.-W. Kim, J. Deng, B. Ward, W. Cockey, Y. Liu and A. Wang, "Fiber Optic Sensors for Partial Discharge Monitoring in Power Transformers", *2003 EPRI Substation Equipment Diagnostics Conference*, Feb. 23-26, 2003, New Orleans, Louisiana.

[30] Steven Tsai, **Bing Yu**, Ling Chen, Anbo Wang, Yilu Liu, Barry Ward, "Analysis of on-site transformer partial discharge measurement from fiber optic acoustic sensors", *2003 EPRI Substation Equipment Diagnostics Conference*, Feb. 23-26, 2003, New Orleans, Louisiana.

[31] Ling Chen, Steven Tsai, Yilu Liu*, **Bing Yu**, Anbo Wang, Barry Ward, "Finite Element Simulation and Theoretical Analysis of the Partial Discharge Acoustic Wave Propagation inside Power Transformers", *2003 EPRI Substation Equipment Diagnostics Conference*, Feb. 23-26, 2003, New Orleans, Louisiana.

PATENTS AND PATENT APPLICATIONS

[1] **Bing Yu** and Nirmala Ramanujam, "Smart fiber optic sensor system for quantitative tissue optical spectroscopy," US patent application No. PCT/US2010/059140.

[2] **Bing Yu** and Nirmala Ramanujam, "Systems and methods for performing optical spectroscopy using a self-calibrating fiber optic probe," International Application No. PCT/US2009/041857. (Licensed to Zenalux Biomedical, Inc.)

[3] **Bing Yu**, Nirmala Ramanujam, and Justin Y. Lo, "A diffuse reflectance spectroscopy device for quantifying tissue absorption and scattering," International Application No. PCT/US2009/041732.

[4] Nirmala Ramanujam, **Bing Yu**, J. Quincy Brown and Allan Shang, "System and methods for spectral analysis of a tissue mass using an instrument, an optical probe and a Monte carlo or Diffusion algorithm," International Application No. PCT/US2008/078186. (Licensed to Zenalux Biomedical, Inc.)

[5] Nirmala Ramanujam, **Bing Yu** and J. Quincy Brown, "Optical spectral imaging for intra-operative margin assessment," International Application No.: PCT/US2008/078194. (Licensed to Zenalux Biomedical, Inc.)

[6] **Bing Yu** and Anbo Wang, "Q-point Stabilization for Linear Interferometric Sensors Using Tunable Diffraction Grating," US patent application No. **20050231728**. (Exclusively licensed to Prime Photonics, L.C., Blacksburg, VA)

[7] **Bing Yu** and Anbo Wang, "Thermally Tunable Fiber Fabry-Perot Filters", Virginia Tech Intellectual Properties, Inc., VTIP No. **03-098**, July 2003. (Exclusively licensed to Prime Photonics, L.C.)

[8] **Bing Yu** and Anbo Wang, "Diaphragm-based Fabry-Perot Tunable Filter", Virginia Tech Intellectual Properties, Inc., VTIP No. **02-127**, Dec. 2002. (Exclusively Licensed to Prime Photonics, L.C.)

TEACHING EXPERIENCE AND TRAINING

- Guest Instructor, *Advances in Photonics* (BME 335, Duke University), Spring 2008
- Guest Instructor, *Biomedical Optical Diagnostics* (BME 265, Duke University), Fall 2007
- Volunteer Instructor, *Design in Power Engineering* (ECE 4304, Virginia Tech), 2003
- Introduction to College Teaching (GS 302), Duke University Graduate School, Fall 2007. (Training)
- Teaching Idea Workshop, Duke University Center for Instructional Technology (CIT) and Graduate School, 2006 - 2007. (Training)

PROFESSIONAL ACTIVITIES

- Ad-hoc Grant Reviewer:
    - US Department of State for the Science Centers, 2004

  - NSF Industry/University Cooperative Research Center (I/UCRC), 2008
- Manuscript reviewer:
  - Journal of Biomedical Optics Express
  - Optics Letters
  - Optics Express
  - Applied Optics
  - Optical Engineering
  - Journal Sensors
  - Journal of Lightwave Technology
  - BioMedical Engineering OnLine
  - The International Journal of Functional Informatics and Personalised Medicine" (IJFIPM)
  - 2007 ASME International Mechanical Engineering Congress and Exposition
- Conference Services:
  - Session Chair and Program Committee, 2011 European Conference on Biomedical Optics, Munich, Germany, May 21-26, 2011.
- Memberships:
  - SPIE - The international society for optics and photonics
  - ASLMS - American Society for Laser Medicine and Surgery