Linqing Luo

Research scientist, Lawrence Berkeley National Laboratory
1 Cyclotron Road, Berkeley, CA 94720

Mobile: +1 (0) 5107668083
Email: linqingluo@lbl.gov

Education

PhD Engineering, *University of Cambridge*, UK, *2013 - 2017*
Develop a complete system for fiber optic sensor with its application in the smart city, including mathematical modeling and simulation, experimental verification and on-site testing in construction sites, data mining, and processing, etc. I contributed from algorithm design to hardware design.

MRes Photonics Systems Development, *University of Cambridge*, UK, *2012-2013*
Research on a portable and wearable near-infrared tomography system for imaging functional activation in the brain.

BEng Electrical Engineering, *University of Liverpool*, UK, 2010-2012, *First class with honor*
Electrical Engineering, *Xi'an Jiao Tong Liverpool University*, China, 2008-2010

PhD Project: Distributed fibre optic sensor and its application on Structure Health Monitoring, under supervision of Prof Kenichi Soga, Cambridge Centre for Smart Infrastructure and Construction

- This project is to develop a low-cost and high-performance Brillouin Scattering fiber optic sensor system mainly developed for civil engineering in Structural Health Monitoring during construction and life-time maintenance. The system can be used for smart infrastructure and smart cities. The system can be used to detect the failure inside the infrastructures. It can detect the strain change continuously in a long-distance (1m spatial resolution, 2cm reading on 2km with 7-10 micro-strain resolution at about 1-50Hz measurement speed), providing a massive amount of strain and temperature data for the early warning system.
- Develop sensors for smart cities and future cities with dynamic sensing, acoustic sensing, and their application in environmental monitoring, smart infrastructure and greenhouse/building design, pavement detection, and human activities tracking for the data analysis for future smart cities development. Hardware design, optical system design, electrical engineering design, signal processing, and data processing. Bench version and prototype is built and under test.

Prizes and scholarships

2013 to 2016 **Cambridge International Scholarship**
2011 to 2012 **Harry Edels Memorial Prize**
2010 to 2011 **Bromley University Undergraduate Scholarship from University of Liverpool**
2010 to 2012 **XJTLU Scholarship from University of Liverpool**

Research activities

2020.7 - **Research Scientist, Lawrence Berkeley National Laboratory**
Distributed fiber optic sensing for strain, temperature, acoustic and pressure monitoring in geophysics applications (natural gas storage, thermal energy well monitoring) and smart city or smart infrastructure applications (smart building monitoring system, offshore wind turbine, pipeline, pavement monitoring, etc.)

2018.5-2020.7 **Postdoctoral in University of California, Berkeley**
Distributed fiber optic sensor development (distributed strain, temperature, pressure and acoustic sensing) and their application in civil engineering, e.g. the pile, levee cut-off wall, vehicle traffic detection, pavement monitoring, pipeline and well for methane hydrate monitoring, etc. Structural health monitoring for the infrastructures and their data mining, interpretation.

2016.10-2018.5 **Visiting Scholar in University of California, Berkeley**
Built a new fiber optic sensing lab in UC Berkeley and develop a distributed fiber optic sensing technique for infrastructure monitoring.

2016.3-2016.8 **Visiting Scholar in the Department of Electronics and Computer Science, University of Southampton**
Develop a distributed strain sensing system alone and research on special optic fibers.

2013.5-2013.9 Project "A wireless, portable system for optical brain imaging", under supervision of Prof. Jem Hebden in *University College London*
This project is to design a portable and wearable near-infrared tomography system for imaging functional activation in the brain.

Research or industrial projects involved:

- Electromagnetic and Optical Sensor Technologies for Natural Gas Storage Safety Monitoring, **CEC**, 2020-2023
- Integrated Distributed Fiber Optic Sensing for Real-time Monitoring of Offshore Wind Turbine Gearbox/Tower Operation and Marine Animal Activities, **CEC**, 2020-2023
- Pipeline monitoring crossing fault zone, **EBMUD**, 2020-2022.
- Baker Innovation Fellow, **University of California, Berkeley**, 2019-2020
- Tsinghua Berkeley Shenzhen Institution Smart infrastructure (smart campus) project, 2019-2020, **TBSI, Shenzhen**.
- National Science Foundation Innovation Corps, **National Science Foundation**, 2019, Co-PI.
- Modeling and Monitoring of Urban Underground Climate Change (MUC2) (Task 1), **National Science Foundation-EPSRC**, 2019-2022.
- Development and miniaturization of distributed fiber optic sensor analyzers, **EPSRC**, 2013-2016
- Deformation induced soil fracturing - multi-scale multi-physics mechanism and early detection, **National Science Foundation**, 2017-2019
- The Eagle Ford Shale Laboratory: A Field study of the Stimulated Reservoir Volume, Detailed Fracture Characteristics, and EOR Potential, **Department of Energy**, 2018-2020
- Deployment of Post Grouting Technique to improve Drilled Shaft End-Bearing Resistance, **Department of Transportation, California**, 2017-2019
- Smart Road Corridors by Meso-Scale In-Pavement Distributed Infrastructure Sensing, **CITRIS**, 2018-2019
- Distributed fiber optics monitoring of Pipeline deformation under large scale fault movement, **IPEX with Cornell University**, 2016-2017
- More confidential projects.

Academic activities

Reviewer: Optics Communications, AGU Books, etc.

Invited talk

December 2018, Seminar, Tsinghua University, China
January 2019, Seminar, Wuhan University, China
January 2019, Seminar, China University of Geosciences, China
June 2019, Seminar, Lawrence Berkeley National Laboratory

Publication

L.Luo, Y.Mei, K. Soga, "Precision error analysis of the distributed fiber optic strain monitoring", *Structural Control and Health Monitoring*, (under review)

P. Hubbard, J. Xu, S. Zhang, M. Dejong, **L. Luo**, K. Soga, C. Papa, C. Zulberti, D. Malara, F. Fugazzotto, F. Garcia Lopez, C. Minto, "Dynamic Structural Behavior Monitoring and Damage Detection of a Model Wind Turbine Tower using Rayleigh-Based Distributed Fiber-Optic Strain Sensing", *Journal of Civil Structural Health Monitoring,* (under review).

1. Y. Mei, X. Xu, **L. Luo*** and K. Soga (2020), "Reconstruction of distributed strain profile using a weighted spectrum decomposition algorithm for Brillouin scattering based fiber optic sensor," in *Journal of Lightwave Technology*, 38 (22), pp.6385-6392, doi: 10.1109/JLT.2020.3011686. (Corresponding author)

2. US Patent (US10677616B2): "Distributed dynamic strain fiber optics measurement by Brillouin optical time-domain Reflectometry".

3. **LINQING LUO**, HIDEHIKO SEKIYA, KENICHI SOGA (2019), "Dynamic distributed fiber optic strain sensing on movement detection", *IEEE Sensors Journal*, 19(14), pp.5639-5644.

4. KENICHI SOGA, **LINQING LUO**, "Distributed Fiber Optics Sensors for Civil Engineering Infrastructure Sensing", *Journal of Structural Integrity and Maintenance*, 3(1), 1-12.

5. LINQING LUO, FRANCESCA PARMIGIANI, YIFEI YU, BO LI, KENICHI SOGA, JIZE YAN, "Frequency uncertainty improvement in STFT-BOTDR using highly nonlinear optical fibres", *Optics Express*, 26(4), 3870-3881.

6. YIFEI YU[1], **LINQING LUO**[1], BO LI, KENICHI SOGA, JIZE YAN, "Quadratic Time-Frequency Transforms based Brillouin Optical Time Domain Reflectometry", *IEEE Sensors Journal*, 17(20), 6220-6626.

7. TSU-HSUAN LIN, YAN WU, KENICHI SOGA, **LINQING LUO**, XINNAN GAO, MICHAEL RIEMER, HONGWEI HUANG, "Experimental and Simulation Study of Underground Wireless Sensor Networks", IWSHM 2017, Stanford, CA.

8. BO LI, **LINQING LUO**, YIFEI YU, KENICHI SOGA, JIZE YAN, (2017), "Dynamic Strain Measurement Using

Small Gain Stimulated Brillouin Scattering in STFT-BOTDR". IEEE Sensors Journal, 17(9), 2718-2724. DOI:10.1109/JSEN.2017.2657119
9. YIFEI YU, **LINQING LUO**, BO Li, KENICHI SOGA, JIZE YAN, (2016), "Frequency Resolution Quantification of Brillouin Distributed Optical Fibre Sensors," in IEEE Photonics Technology Letters, no.99, pp.1-1. doi: 10.1109/LPT.2016.2594084
10. LINQING LUO, BO LI, YIFEI YU, XIAOMIN XU, JIZE YAN and KENICHI SOGA, (2016), "Iterative filtering for Time-Frequency Localised Pulse Optimisation in STFT-BOTDR", *Proceedings of the International Conference on Smart Infrastructure and Construction*, Cambridge, 2016
11. YIFEI YU, **LINQING LUO**, BO LI, JIZE YAN AND KENICHI SOGA, (2016), "Multiple windows algorithm for event detection in STFT-BOTDR", Proceedings of the International Conference on Smart Infrastructure and Construction, Cambridge, 2016
12. LINQING LUO, BO LI, YIFEI YU, XIAOMIN XU, KENICHI SOGA, AND JIZE YAN, (2016), "Time and Frequency Localized Pulse Shape for Resolution Enhancement in STFT-BOTDR", *Journal of Sensors*, vol. 2016
13. YIFEI YU, **LINQING LUO**, BO LI, LINFENG GUO, JIZE YAN, AND KENICHI SOGA, (2015), "Double peak-induced distance error in short-time-Fourier-transform-Brillouin optical time domain reflectometers event detection and the recovery method", *Applied optics*, *54*(28), E196-E202.