

# 林欽仁 | Chin-Jen Lin

Associate Research Scientist



## Research Interests

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- Seismic instrument
- Rotation seismology
- Infrasound observation

## Education

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- B.S., 2002: Mechanical Engineering, Tamkang University
- M.S., 2004: Mechanical Engineering, National Taipei University of Technology
- Ph.D., 2012: Mechanical Engineering, National Taiwan University

## Work experience

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- 2022/05~now: Associate Research Scientist, Institute of Earth Sciences, Academia Sinica
- 2014/08~2022/05: Assistant Research Scientist, Institute of Earth Sciences, Academia Sinica
- 2015/03~2016/07: Postdoctoral fellows, Ludwig-Maximilians-Universität München, Germany
- 2012/10~2014/07: Postdoctoral fellows, Institute of Earth Sciences, Academia Sinica, Taiwan
- 2004/10~2012/9: Research Assistant, Institute of Earth Sciences, Academia Sinica, Taiwan

## Professional Experience

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- Large ring-laser-gyro (RLG) technology, LMU Munich, Germany, 2015/3~2017/7
- Calibration of rotational sensor, Albuquerque Seismological Laboratory, USGS, 2013
- Calibration of rotational sensor, Albuquerque Seismological Laboratory, USGS, 2008

## Specialty

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- Seismic instrumentation
- Mechatronics
- VSAT (Very Small Aperture Terminal) telemetry technology

## **Major Achievements and Contributions**

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My research interests include observation seismology, rotation seismology, and infrasound. I like to work on anything about seismic instrument, including seismometer installation, seismic station construction, sensor calibration and testing, and data quality analysis.

I study rotation seismology since 2006. A complete calibration/testing facility and method had been established in IES. Recently, a newly developed rotation sensor Blueseis-3A based on Sagnac effect was installed at Nanao array. We did a first measurement, array derived rotation of a seismic event is consistent with point rotation observation along three axis.

I study infrasound measurement since 2011. Beginning from two infrasound sensors, I learned the wind filter design plays important role on the infrasound research. There are two types of wind filter design developed at different time period. In the phase one, studying from CTBTO a down scale pipe array was used as wind filter. After awarding the resonance effect and mechanical sensitivity that caused by pipe and tube could contaminate the infrasound measurement, a PVC tank design was developed in the phase two. In 2010, more than 10 stations of infrasound data is open available from BATS data center.

I lead a team called electrical laboratory with 5 member. The main mission of this team is to maintain Broadband Array in Taiwan for Seismology, BATS. This team also provides technical service to several projects in IES, such as TSMP, SMART 2, Taidon stations, Nanao array, TAIPEI101 monitor, TDCP, TVO, FM Array. I also carry out a MOST project called TEC instrument pool. The contributions of this project are to provide seismic instrument loan service and technique support to geophysical community in Taiwan.

## **Future Research Plan**

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Distributed acoustic sensing (DAS) is a new technology that has been demonstrated its promise for recording earthquake waves and other seismic signals in a wide range of research. Thanks to "Milun fault Drilling and All-inclusive Sensing (MiDAS)" project lead by Prof. Kuo-Fong Ma I have opportunity to work on DAS technique. My ongoing project will to install borehole and surface fiber cable and study ground motion sampled by DAS technique.

With increase of infrasound sensors in IES, a sensor calibration facility and method is planed to be developed. With the collocated pressure and ground motion measurements, I hope the integrated research between atmosphere and solid earth could carry on.

With two portable rotation seismometer Blueseis-3A available in IES, new applications based on 6-DOF measurement such as shallow velocity structure and building state of health will carry on.

## Education

- B.S., 2002: Mechanical Engineering, Tamkang University
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- Ph.D., 2012: Mechanical Engineering, National Taiwan University

## Professional Experience

- Large ring-laser-gyro (RLG) technology, LMU Munich, Germany, 2015/3~2017/7
- Calibration of rotational sensor, Albuquerque Seismological Laboratory, USGS, 2013
- Calibration of rotational sensor, Albuquerque Seismological Laboratory, USGS, 2008

## Public Service

- Take charge of maintaining Broadband Array in Taiwan for Seismology (BATS)
- Execute TEC instrument pool project

### List of Major Collaborators, Post-docs and students in the last 5 years (2016~)

| Name         | Collaborator/Postdoc/Student | Affiliation  | Period    |
|--------------|------------------------------|--|-----------|
| Heiner Igel  | Collaborator                 | Department of<br>Earth and<br>Environmental<br>Sciences<br><br>Geophysics<br><br>Munich University | 2015~ now |
| Adam Ringler | Collaborator                 | USGS ASL   | 2015~ now |

### List of funding in the last 5 years (2016~)

| Funding Agency | Project Title  | Total Budget<br>(NTD)                    | Period                    |
|----------------|--|--|---------------------------|
| MOST           | Scientific purpose for preventing possible disasters in the Taipei metropolis: Identifying magma chamber beneath Tatun volcano group | 50,000,000/year<br>(total in four years) | 2017/05/01<br>~2021/12/31 |
| MOST           | Toward a 6-DOF ground measurements for earthquake location   | 465,000                                  | 2017/08/01~<br>2018/07/31 |
| MOST           | 2017 Taiwan Earthquake Research Center Instrument Service Program  | 6,305,000                                | 2017/08/01~<br>2018/07/31 |
| MOST           | Infrasound Observations- Wind Filter Design  | 805,000                                  | 2018/08/01~<br>2019/10/31 |
| MOST           | 2018 Taiwan Earthquake Research Center Instrument Service Program  | 7,823,000                                | 2018/08/01~<br>2019/07/31 |
| MOST           | Investigations of Tilt Measurement Using Fiber Optic Gyroscope   | 1,334,000                                | 2019/08/01~<br>2020/10/31 |
| MOST           | 2019 Taiwan Earthquake Research Center Instrument Service Program  | 7,700,000                                | 2019/08/01~<br>2020/07/31 |
| MOST           | Study on microbarom and microseism during typhoon  | 1,505,000                                | 2020/08/01~<br>2021/07/31 |

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| MOST | 2020 Taiwan Earthquake Research Center Instrument Service Program | 7,200,000 | 2020/08/01 ~<br>2021/07/31 |
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## Publication list

1. Yen Yu Lin; Da Yi Chen; Chun Hsiang Kuo; **Chin Jen Lin**; Wen Yu Chen; Yi Ying Wen (2022, Feb). Orientation Corrections of a Borehole Seismometer Network in Taiwan Using Teleseismic Earthquakes. *Seismological Research Letters*.
2. Chen, Kate Huihsuan Yeh, Ting-Chen Chen, Yaochieh Johnson, Christopher W. Lin, Cheng-Hong Lai, Ya-Chuan Shih, Min-Hung Guéguen, Philippe Huang, Win-Gee Huang, Bor-Shouh Chen, Kou-Cheng **Lin**, **Chin-Jen** Ku, Chin-Shang (2022, Jan). Characteristics and impact of environmental shaking in the Taipei metropolitan area. *Scientific Reports*.
3. **Chin-Jen Lin**, Chin-Shang Ku, Tsung-Chih Chi, Bor-Shouh Huang, Hsin-Hua Huang, Chun-Chi Liu (2022). Correcting the background tilt signal of the horizontal seismometer by using a rotation sensor. *Seismological Research Letters*. (Accepted).
4. Igel, H., K. U. Schreiber, A. Gebauer, F. Bernauer, S. Egdorf, A. Simonelli, **C.-J. Lin**, J. Wassermann, S. Donner, C. Hadziioannou, S. Yuan, A. Brotzer, J. Kodet, T. Tanimoto, U. Hugentobler and J.-P. R. Wells (2021, Jan). ROMY: a multicomponent ring laser for geodesy and geophysics. *Geophysical Journal International*.
5. André Gebauer, Monika Tercjak, Karl Ulrich Schreiber, Heiner Igel, Jan Kodet, Urs Hugentobler, Joachim Wassermann, Felix Bernauer, **Chin-Jen Lin**, Stefanie Donner, Sven Egdorf, Andrea Simonelli, and Jon-Paul R. Wells (2020, Jul). Reconstruction of the Instantaneous Earth Rotation Vector with Sub-Arcsecond Resolution Using a Large Scale Ring Laser Array. *PHYSICAL REVIEW LETTERS*, 125, 033605 (2020).
6. Shihao Yuan; Andreino Simonelli; **Chin-Jen Lin**; Felix Bernauer; Stefanie Donner; Thomas Braun; Joachim Wassermann; Heiner Igel (2020, Jun). Six Degree-of-Freedom Broadband Ground-Motion Observations with Portable Sensors: Validation, Local Earthquakes, and Signal Processing. *Bulletin of the Seismological Society of America*, 110 (3): 953–969..
7. Lin, C. H., Lai, Y. C., Shih, M. H., **Lin, C. J.**, Ku, J. S., , Huang, Y. C. (2019, Dec). A Major Hydrothermal Reservoir Underneath the Tatun Volcano Group of Taiwan: Clues from a Dense Linear Geophone Array. *Pure and Applied Geophysics*.
8. A. T. Ringler, R. E. Anthony, A. A. Holland,\* D. C. Wilson, and **C.-J. Lin** (2018, Dec). Observations of Rotational Motions from Local Earthquakes Using Two Temporary Portable Sensors in Waynoka, Oklahoma. *BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA*, Vol. 108, No. 6, pp. 3562–3575.
9. C. H. Lin, Y. C. Lai, M. H. Shih, **C. J. Lin**, J. S. Ku, H. C. Pu (2018, Nov). Extremely Similar Volcano Sounds from Two Separated Fumaroles at the Tatun Volcano Group in Taiwan. *Seismological Research Letters*.
10. Stefanie Donner, **Chin-Jen Lin**, Céline Hadziioannou, André Gebauer, Frank Vernon, Duncan Carr Agnew, Heiner Igel, Ulrich Schreiber, Joachim Wassermann (2017, May). Comparing Direct Observation of Strain, Rotation, and Displacement with Array Estimates at Piñon Flat Observatory, California. *Seismological Research Letters*, September 2017 88 (5).
11. Toshiro Tanimoto, **Chin-Jen Lin**, Céline Hadziioannou, Heiner Igel, Frank Vernon (2016, Nov). Estimate of Rayleigh-to-Love wave ratio in the secondary microseism by a small array at Piñon Flat observatory, California. *Geophysical Research Letters*.
12. Chi, Wu-Cheng, W. H. K. Lee, **C.J. Lin**, and C.C. Liu (2013, Apr). Inverting Ground Motion from a Seismometer Array to obtain the Vertical Component of Rotation: A Test Using Data from Explosions. *JOURNAL OF ASIAN EARTH SCIENCES*, 55-62.

13. **Lin, C.-J.**, Huang, W.-G., Huang, H.-P., Huang, B.-S., Ku, C.-S., & Liu, C.-C. (2012, Oct). Investigation of array-derived rotation in TAIPEI 101. *JOURNAL OF SEISMOLOGY*, 16(4),709-720.
14. Chiu, H.-C., Wu, F.-J., **Lin, C.-J.**, Huang, H.-C., & Liu, C.-C. (2012, Aug). Effects of rotation motions on strong-motion data. *JOURNAL OF SEISMOLOGY*, 16,829-838.
15. Lauren M. Kendall, Charles A. Langston, W. H. K. Lee, **C. J. Lin**, C. C. Liu (2012, Apr). Comparison of point and array-computed rotations for the TAIGER explosions of 4 March 2008. *JOURNAL OF SEISMOLOGY*, 16(4),733-743.
16. Nguyen Dinh Pham, Bor-Shouh Huang, **Chin-Jen Lin**, Tuan-Minh Vu, Ngoc-Anh Tran (2012, Apr). Investigation of ground rotational motions caused by direct and scattered P-waves from the 4 March 2008 TAIGER explosion experiment. *JOURNAL OF SEISMOLOGY*, 16(4),709-720.
17. Chi, W.-C., Lee, W. H. K., Aston, J. A. D., **Lin, C. J.**, & Liu, C. C. (2011, Dec). Inversion of Ground-Motion Data from a Seismometer Array for Rotation Using a Modification of Jaeger's Method. *BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA*, 101(6), 3105-3109.
18. **Lin, C.-J.**, Huang, H.-P., Pham, N. D., Liu, C.-C., Chi, W.-C., & Lee, W. H. K (2011, Aug). Rotational motions for teleseismic surface waves. *GEOPHYSICAL RESEARCH LETTERS*, 38(15).
19. **Lin, C.-J.**, Huang, H.-P., Liu, C.-C., & Chiu, H.-C. (2010, Apr). Application of Rotational Sensors to Correcting Rotation-Induced Effects on Accelerometers. *BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA*, 100(2), 585-597.
20. Lee, W. H. K., Huang, B.-S., Langston, C. A., **Lin, C.-J.**, Liu, C.-C., Shin, T.-C., et al. (2009, May). Review: Progress in Rotational Ground-Motion Observations from Explosions and Local Earthquakes in Taiwan. *Bulletin of the Seismological Society of America*, 99(2B), 958-967.
21. **Lin, C.-J.**, Liu, C.-C., & Lee, W. H. K. (2009, May). Recording Rotational and Translational Ground Motions of Two TAIGER Explosions in Northeastern Taiwan on 4 March 2008. *BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA*, 99(2B), 1237-1250.
22. Liu, C.-C., Huang, B.-S., Lee, W. H. K., & **Lin, C.-J.** (2009, May). Observing Rotational and Translational Ground Motions at the HGSD Station in Taiwan from 2007 to 2008. *Bulletin of the Seismological Society of America*, 99(2B), 1228-1236.
23. Langston, C. A., Lee, W. H. K., **Lin, C. J.**, & Liu, C. C. (2008, Dec). SeismicWave Strain, Rotation, and Gradiometry for the 4 March 2008 TAIGER Explosions. *Bulletin of the Seismological Society of America*, 99(2B), 1287- 1301.