Dr. Yi-Ren Wang is a professor of Department of Aerospace Engineering at the Tamkang University, Taiwan. His specialties include Aeroelasicity, Structural Dynamics, Nonlinear Vibration and Vibration energy harvesters. He received his Ph.D. in Aerospace Engineering from the Georgia Institute of Technology, U. S. A. He was the chairman of Department of Aerospace Engineering at Tamkang University. He was awarded the best paper of the year 2013 of *JoAAA*, *ICAYS*-2017 and *ICAYS*-2019 conferences and the distinguished oral presentation award of 2021 *ISME-ICMAEE* conference. He also received the golden prize in the years of 2022 and 2023 Green idea invention and design fair (international competition). He was invited to participate in the *International Future Science and Technology Exhibition* 2021 by MOST, Taiwan. He was also awarded the distinguished teacher of the year 2016 and 2023 of Tamkang University. He is an experienced international Journal reviewer and has also published more than 100 journal and conference papers. Dr. Wang has served on the *AASRC* academic committee and has been the Associate Editor for the *Journal of Applied Science and Engineering* (*JASE*) and the Guest Editor of *Sustainability* (SCI). He is a post-reviewer of the ministry of science and technology (MOST), Taiwan. In addition, he also served as councilor in both Association of Helicopter Development and Aeronautical and Astronautical Society, Taiwan, R.O.C.

Refereed journal papers (2013~2023)

1. Yi-Ren Wang, Jin-Wei Chang and Chen-Yu Lin, "Analysis of a wind-driven power generation system with root slapping mechanism," *Appl. Sci.* Vol. 14, 482. 26 pages, 2024. **(SCI)** (NSTC 112-2221-E-032-042) https://doi.org/10.3390/app14020482
2. Yi-Ren Wang, Pin-Tung Chen, "Energy harvesting analysis of the magneto-electric and fluid-structure interaction parametric excited system," *Journal of Sound and Vibration*, Vol. 569, article number 118087, 26 pages, 2024. Available online 10 October 2023. **(SCI)** (MOST 111-2221-E-032-017) ISSN 0022-460X, https://doi.org/10.1016/j.jsv.2023.118087.
3. Yi-Ren Wang, G.-W. Chen, "Predicting Multiple Numerical Solutions to the Duffing Equation Using Machine Learning," *Appl. Sci.* Vol. 13, article number 10359, 32 pages, 2023. **(SCI)** (NSTC 112-2221-E-032-042) https://doi.org/10.3390/app131810359
4. Yi-Ren Wang, Chun-Hsiao Kuo, "Enhancing Electrical Generation Efficiency through Parametrical Excitation and Slapping Force in Nonlinear Elastic Beams for Vibration Energy Harvesting" *Sensors*, *23*, No. 17, article number 7610, 30 pages, 2023. https://doi.org/10.3390/s23177610. https://www.mdpi.com/1424-8220/23/17/7610. **(SCI)** (NSTC 112-2221-E-032-042)
5. Yi-Ren Wang, Pin-Tung Chen, and Yen-Te Hsieh, "Analysis of double inverted flag energy harvesting system in pipe flow," *Sustainability*, Vol.15, No.1, 20 pages, 2023. **(SCI)** (MOST 110-2221-E-032-026) https://doi.org/10.3390/su15010704.
6. Yi-Ren Wang, C.K. Feng , C.H. Cheng, P.T. Chen, "Analysis of a clapping vibration energy harvesting system in a rotating magnetic field," *Sensors*, Vol. 22, No.18, Article number 6916, 20 pages, 2022. **(SCI)** (MOST 111-2221-E-032-017) https://doi.org/10.3390/s22186916.
7. Yi-Ren Wang, Chien-Chun Hung, and Hsin Huang, "Vibration reduction of continuous moving loads on a nonlinear simple beam resting on an elastic foundation," *Journal of Applied Engineering Science*, Vol.20, No.1, article 903, pp53~62, 2022. (MOST 109-2224-E-006-004) http://www.engineeringscience.rs/article/2022/Volume_20_1/30916.

8. Yi-Ren Wang, and Ming-Ching Chu, "Analysis of double elastic steel wind driven magneto-electric vibration energy harvesting system," *Sensors*, Vol. 21, No.21, Article number 07364, 26 pages, 2021. (**SCI**) (MOST 110-2221-E-032-026)
9. Yi-Ren Wang, and Yi-Jyun Wang, "Flutter speed prediction by using deep learning," *Advances in Mechanical Engineering*, Vol.13, No.11, 15 pages, 2021. (**SCI**) (MOST 110-2221-E-032-026)
10. Yi-Ren Wang, Chien-Chun Hung, and Jung-Ting Tseng, "Transverse vibration energy harvesting of double elastic steel," *International Journal of Structural Stability and Dynamics*, Vol. 21, No.8, Article number 2150113, 30 pages, 2021. https://doi.org/10.1142/S0219455421501133 (**SCI**) (MOST 109-2221-E-032-011)
11. Yi-Ren Wang, Yun-Shuo Chang, and Nguyen Cong Ha, "Vibration reduction and stability analysis of damping rings on nonlinear free-free beam," *Advances in Mechanical Engineering*, Vol.12, No.12, 2020, pp.1-21. (**SCI**) (MOST 109-2224-E-006-004).
12. Yi-Ren Wang, and Yun-Shuo Chang, "Study of primary and internal resonance on 3D free-free double-section beam," *Advances in Technology and Innovation*, Vol.5, No.4, 2020, pp.270-291.
13. Yi-Ren Wang, and Y. H. Wei , "Internal resonance analysis of a fluid-conveying tube resting on a nonlinear elastic foundation," *Eur. Phys. J. Plus*, Vol. 135, Article number 364, 2020. https://doi.org/10.1140/epjp/s13360-020-00353-4 (**SCI**)
14. Yi-Ren Wang, Ming-Syun Wong and Bo-Yan Chen, "Analytical and experimental studies of double elastic steel sheet (DESS) vibration energy harvester system," *Energies*, Vol. 13, Article number: 1793, 2020. (**SCI**) (MOST 107-2218-E-006-044)
15. Yi-Ren Wang, and Zi-Wei Hsu, "Effects of nano-particle dampers on multi-walled carbon nanotubes with internal resonance," *Journal of Applied Science and Engineering*, Vol. 22, No.1, 2019, pp.103-117. (**ESCI**)
16. Yi-Ren Wang, and Wan-Chi Hsiao, "Vibration Reduction of Damping Rings on 3D Nonlinear Multi-loaded Slender Beams," *Journal of Chinese Society of Mechanical Engineers*, Vol. 40, No.4, 2019, pp. 327-339. (**SCI**)
17. Yi-Ren Wang, C.K. Feng and S.Y. Chen, "Damping effects of linear and nonlinear tuned mass dampers on nonlinear hinged-hinged beam," *Journal of Sound and Vibration*, Vol. 430, 2018, pp. 150-173. (**SCI**) (MOST 106-2221-E-032-037)
18. Yi-Ren Wang, Chi Tang and Chien-Chih Chiu, "The effects of wake dynamics and trailing edge flap on wind turbine blade," *Journal of Applied Science and Engineering,* Vol. 21, No. 1, 2018. pp.105-115. (**ESCI**)
19. Yi-RenWang, and Hsueh-Ghi Lu, "Damping performance of dynamic vibration absorber in nonlinear simple beam with 1:3 internal resonance," *International Journal of Acoustics and Vibration*, Vol. 22, No.2, 2017, pp.167-185. (**SCI**) (MOST 103-2221-E-032- 047)
20. Yi-Ren Wang and Li-Ping Wu, "Effects of tuned mass damper on fixed-fixed 3d nonlinear string resting on nonlinear elastic foundation," *International Journal of Structural Stability and Dynamics*, Vol.17, No.4, 2017, Article ID 1750047 (33 pages). (**SCI**)
21. Yi-RenWang, and Shu-Chien Tu, "Influence of tuned mass damper on fixed-free 3D nonlinear beam embedded in nonlinear elastic foundation," *Meccanica*, Volume 51, Issue 10, 2016, pp 2377-2416. (**SCI**)
22. Yi-RenWang, and Ting-Hung Kuo, "Effects of a dynamic vibration absorber on nonlinear hinged-free beam," *ASCE Journal of Engineering Mechanics*, Vol. 142, No 4, Article ID 04016003, 25 pages, 2016. (**SCI**)
23. Yi-Ren Wang, and Ting-Yu Lin, "Vibration reduction of a double-layer system sandwiched with elastic medium," *International Journal of Structural Stability and Dynamics* (IJSSD), Vol.16, No.10, 1550065 (14pages), 2016. (**SCI**)
24. Yi-RenWang, and Tzu-Wen Liang, "Application of lumped-mass vibration absorber on the vibration

reduction of a nonlinear beam-spring-mass system with internal resonances," *Journal of Sound and Vibration*, Vol. 350, 2015, pp. 140-170. (**SCI**) (MOST 103-2221-E-032-047)

25. Yi-Ren Wang, and Ko-En Hung, "Damping effect of pendulum tuned mass damper on vibration of two-dimensional rigid body," *International Journal of Structural Stability and Dynamics* (IJSSD), Vol.15, No.2, 2015, DOI: 10.1142/S0219455414500412, Article ID 1450041, 37 pages. (**SCI**)
26. Yi-Ren Wang, and Chi-Wei Fang, "Study on vibration in elastic beam with nonlinear supports at both ends," *Journal of Applied Mechanics and Technical Physics*, Vol. 56, No.2, 2015, pp. 337-346. (**SCI**)
27. Yi-Ren Wang, and C.-Y. Lo, "Design of hybrid dynamic balancer and vibration absorber," *Shock and Vibration*, Vol. 2014, DOI:10.1155/2014/397584, Article ID 397584, 18 pages. (**SCI**)
28. Yi-Ren Wang, and Chia-Man Chang, "Elastic beam with nonlinear suspension and a dynamic vibration absorber at the free end," *Transactions of the Canadian Society for Mechanical Engineering* (TCSME), Vol. 38, No. 1, 2014, pp.107-137. (**SCI**)
29. Yi-Ren Wang, and Han-Shiang Lin, "Stability analysis and vibration reduction for a two-dimensional nonlinear system," *International Journal of Structural Stability and Dynamics* (IJSSD), Vol.13, No.5, 2013, DOI: 10.1142/S0219455413500314, Article ID 1350031, 30 pages. (**SCI**)
30. Yi-Ren Wang, and Shu-Wei Chen, "Study of the positions of multiple dampers in a dual-plate mechanism for vibration reduction," *Journal of Aeronautics, Astronautics and Aviation,* Series A, Vol.45, No.2, 2013, pp.121-134. (**ESCI**) **Best paper award.**

Conference papers (2013~2023)

1. 王怡仁、龔敏瑄，"多節橫樑之內共振分析", 中華民國力學學會第四十七屆全國力學會議 (CTAM 2023)， 結構振動論壇， 論文編號: S020 ，中華民國一一二年十一月十七~十八日。(in Chinese)
2. 王怡仁、張晉維 、林宸宇、許阡妤、黃柏詮、馬育瀚， "應用於無人機的風力-磁力-壓電振動獵能裝置"， 2023 中華民國航太學會學術研討會，論文編號:1081，台中，逢甲大學，中華民國 112 年 11 月 25 日。(in Chinese)
3. 王怡仁、黃柏詮， "流體-磁-電能量擷取裝置：提升振動能發電效率的設計"， 中國機械工程學會第四十屆全國學術研討會論文集，論文編號: C5-003，台中，彰化市，國立彰化師範大學 彰化市，中華民國112年12月1~2日。(in Chinese)
4. 王怡仁、馬育瀚， "以機器學習方法預估小流片振顫速度"， 中國機械工程學會第四十屆全國學術研討會論文集，論文編號: C5-004，台中，彰化市，國立彰化師範大學 彰化市，中華民國112年12月1~2日。(in Chinese)
5. Hsin-Cheng Ni and Yi-Ren Wang, "Progress in small sounding rocket development: accomplishments and future initiatives", 2023 Taiwan International Assembly of Space Science, Technology, and Industry (TASTI), Session: Space Transportation, PO084, Taipei Nangang Exhibition Center Hall 2, Oct. 30~Nov.3, 2023.
6. Yi-Ren Wang, Pin-Tung Chen and Yen-Te Hsieh, "Experimental analysis of double inverted flag vibration energy harvester in pipe flow," *Proceedings of the 3rd International Conference on*

Advances in Energy Research and Applications (ICAERA'22), paper number: ICAERA 105, Seoul, South Korea-Virtual Conference, October 27 - 29, 2022. (MOST 111-2221-E-032-017).

7. 王怡仁、陳品彤，“磁電及流固耦合參數激擾之能量擷取系統分析，”2022 中華民國航太學會學術研討會，台中，朝陽科大，中華民國 111 年 11 月 5 日，**論文競賽第三名 (Third place in the Best Paper Competition)**。(MOST 110-2221-E-032-026). (in Chinese)
8. 王怡仁、郭俊孝，“軸向參數激擾之能量擷取系統，”2022 中華民國航太學會學術研討會，台中，朝陽科大，中華民國 111 年 11 月 5 日。(in Chinese)
9. 王怡仁、鮑光晟，“小型探空火箭研發 – 固態推進劑製作，”2022 中華民國力學學會(STAM)，【科研火箭研製】技術論壇，台中，逢甲大學，中華民國 111 年 11 月 7 日。(NSPO-P-111021). (in Chinese)
10. 王怡仁、朱銘敬、陳品彤，“風力及磁力驅動之壓電能量擷取系統研究，” 中國機械工程學會第三十八屆全國學術研討會，國立成功大學 台南市，中華民國 110 年 12 月 3~4 日。(MOST 110-2221-E-032-026). (in Chinese)
11. 王怡仁、朱銘敬，“風力及磁力驅動之壓電獵能系統研究，”2021 未來科技獎入圍參展，台灣創新技術博覽會-未來科技館，網路參展，中華民國 110 年 10 月 14~24 日。(MOST 110-2221-E-032-026). (in Chinese)
12. 王怡仁、陳品彤、郭俊孝、陳冠維、許榮楊、張晉維， “遙控直升機動態響應及分析，”2021 中華民國航太學會學術研討會，雲林，中華民國 110 年 10 月 30 日。(MOST 110-2622-E-032-001). (in Chinese)
13. 王怡仁，王義竣，陳冠維，“以深度學習方式預測振顫速度之生成，”2021 中華民國航太學會學術研討會，雲林，中華民國 110 年 10 月 30 日。(in Chinese)
14. Yi-Ren Wang, Chin-Han Cheng and Pin-Tung Chen, “Analysis of energy harvester system with piezo-patch in magnetic field”, *2021 International Conference on Mechatronic, Automobile, and Environmental Engineering*, 22-24 October, 2021, Hualien, Taiwan.
15. Yi-Ren Wang and Yun-Shuo Chang, "Internal Resonance Analysis of 3D Free-Free Double-Section Beam," *International Conference on Advanced Technology Innovation 2020*, Okinawa, Japan, Nov. 28-Dec. 01, 2020. (MOST 109-2224-E-006-004).
16. 王義竣、王怡仁，“以深度學習方式預測振顫速度之生成，” 中國機械工程學會第三十七屆全國學術研討會 國立虎尾科技大學，中華民國 109 年 11 月 21 日。(in Chinese)
17. 謝彥德、王怡仁，“流場激擾之壓電片分析，” 中國機械工程學會第三十七屆全國學術研討會 國立虎尾科技大學，中華民國 109 年 11 月 20 日. (in Chinese)
18. 朱銘敬、王怡仁，“風力驅動之磁電獵能系統研究，” 中國機械工程學會第三十七屆全國學術研討會 國立虎尾科技大學，中華民國 109 年 11 月 20 日. (in Chinese)
19. 王怡仁、鄭勤瀚，“旋轉磁場之壓電獵能系統分析，”2020 中華民國航太學會學術研討會 新竹，中華民國 109 年 11 月 14 日. (in Chinese)
20. 王怡仁、龔敏瑄，“三節探空火箭結構振動之內共振，” 2020 中華民國航太學會學術研討會 新竹，中華民國 109 年 11 月 14 日. (MOST 109-2224-E-006-004). (in Chinese)
21. Yun-Shuo Chang and Yi-Ren Wang, "Aeroelastic analysis of rocket structural vibrations," *The 4*th

International Conference in Aerospace for Young Scientists (2019), Beihang University, Beijing, P.R.China, Oct. 12-13, 2019. **Best paper award**. (MOST 107-2218-E-006-044)

22. Yi-Ren Wang, " Vibration reduction for nonlinear beam systems – internal resonance," *The 4th International Conference in Aerospace for Young Scientists* (2019), Beihang University, Beijing, P.R.China, Oct. 12-13, 2019. **Invited Speaker**.
23. 王怡仁 、張耘碩，“三維雙節自由邊界樑之內共振分析，”2019 中華民國航空太空學術研討會，淡水 淡江大學，中華民國一 O 八年十一月十六日。(MOST 107-2218-E-006-044) (in Chinese). (in Chinese)
24. 顏志仲、王怡仁，“雙層停車設備之改良設計與實作，”2019 中華民國航空太空學術研討會，淡水 淡江大學，中華民國一 O 八年十一月十六日。(in Chinese). (in Chinese)
25. 鍾竹軒、王怡仁，“大型遙控直升機主旋翼主軸承螺栓受力分析，”2019 中華民國航空太空學術研討會，淡水 淡江大學，中華民國一 O 八年十一月十六日。(in Chinese).
26. 趙 鉞、王怡仁，“台灣 ＡＨ-６４Ｅ 守衛者直升機接裝之挑戰 - 論先進直升機訓練人員身心理狀況，” 2019 中華民國航空太空學術研討會，淡水 淡江大學，中華民國一 O 八年十一月十六日 。(in Chinese).
27. 楊儒健 、王怡仁，“以空勤總隊海豚直升機失事事件論直升機飛安改進策略，”2019 中華民國航空太空學術研討會，淡水 淡江大學，中華民國一 O 八年十一月十六日。(in Chinese).
28. 王怡仁、陳柏諺、翁銘壎,“長條形彈性鋼片獵能系統效益分析,” 第十二屆海峽兩岸航空航天學術研討會，淡水，淡江大學，中華民國 108 年 4 月 23~24 日。(in Chinese).
29. Y. A. Wan, Y. R. Wang and Y. T. Liu, “Axial controlled nonlinear simple beam vibration energy harvester system,” *The 9th International Conference & Workshop, REMOO-Energy reliability*, 16–18 April, 2019, Hong Kong. (MOST 107-2218-E-006-044).
30. Y.R Wang, B.Y. Chen, and M.S. Wong, “Effects of long elastic steel sheet vibration energy harvester,” *2018 AASRC Conference*, NCKU, Tainan, December 8, 2018.
31. J. T. Tseng, Y. R. Wang, “Effects of double-steel-sheet vibration energy harvester system,” *2018 AASRC Conference*, NCKU, Tainan, December 8, 2018.
32. Y.R Wang, C.K. Feng, Y.H. Wei and S.Y. Chen, “Effects of tuned mass dampers (TMDs) on nonlinear beam systems - case studies,” *The Taiwan-Japan Workshop on Mechanical and Aerospace Engineering 2018*, Oct. 5-7, 2018, Hsinchu, Taiwan.
33. Y.H. Wei and Y.R. Wang, "Flow-induced vibration of a fluid-conveying tube resting on nonlinear elastic foundation," *The 3rd International Conference in Aerospace for Young Scientists* (*2018*), Beihang University, Beijing, P.R.China, Sep. 15-16, 2018.
34. M.S. Wong, Y.R. Wang, and J.T. Tseng, " Application of vibration energy harvester on the double-long-slender-membrane system," *The 3rd International Conference in Aerospace for Young Scientists* (*2018*), Beihang University, Beijing, P.R.China, Sep. 15-16, 2018. **Best paper award.**
35. Y.A. Wan and Y.R. Wang, "Vibration control of axial actuator on the transverse vibration stability of nonlinear hinged-hinged beam," *The 3rd International Conference in Aerospace for Young Scientists* (*2018*), Beihang University, Beijing, P.R.China, Sep. 15-16, 2018. **Best paper award.**
36. 王怡仁，馮朝剛，陳思遠， “非線性減振器之於非線性簡支樑之減振研究，”2017 中華民國

航空太空學術研討會，台中 逢甲大學，中華民國一 O 六年十二月九日。(in Chinese).

37. Yi-Ren Wang, Bo-Ruei Lai, and Shin-Ting Huang, "Nonlinear effects on moving string rested on nonlinear elastic foundation," *2017 International Conference in Aerospace for Young Scientists*, Beihang University, Beijing, P.R.China, Sep. 07-08, 2017. **Best paper award.**
38. Yi-Ren Wang , Chi Tang, and Chien-Chih Chiu, "Application of Finite State Wake Dynamics on Wind Turbine Blade," *2017 International Conference in Aerospace for Young Scientists*, Beihang University, Beijing, P.R.China, Sep. 07-08, 2017.
39. 王怡仁，邱建智，唐其，“考慮尾流及後緣襟翼之風機葉片效能研究”，2016 中華民國航空太空學術研討會，高雄 空軍航空技術學院，中華民國一 O 五年十一月五日。(in Chinese).
40. 陳聿翎，蕭宛琪，王怡仁，“減振器參數激擾之分析”，2014 中華民國航空太空學術研討會，台南 成功大學，中華民國一 O 三年十一月十五日。(in Chinese).
41. Wang, Yi-Ren and Chiu, Chien-Chih “The Effects of Wake Dynamics and Trailing Edge Flap on Wind Turbine Blade,” *The Seventh Across-Strait Workshop on Shock/Vortex Interaction (SVIAW)*, Tamsui, June 23~28, 2014.
42. 王怡仁，張家嫚，“非線性懸吊彈性樑及端點減振器之研究，”2013 中華民國航空太空學術研討會，淡水 淡江大學，中華民國一 O 二年十一月三十日。(in Chinese).

Projects (2018~2023)

Project title	Grant or commission	Start and end date	Progress of the project	Position held in the project	Funding (NTD)
Theoretical and experimental analysis of clapping energy harvesting system with axial excitation (NSTC 112-2221-E-032-042)	National Science and Technology Council (NSTC)	2023/08/01~ 2024/07/31	in progress	principal investigator	953,000
Analysis of energy harvesting for Magneto-electric and fluid structure coupling parametric excitation system (111-2221-E-032-017-)	Ministry of Science and Technology (Taiwan)	2022/08/01~ 2023/07/31	closed	principal investigator	893,000
Development of small sounding rocket (A) (NSPO-P-111021)	Taiwan Space Agency (TASA)	2022/01/12~ 2025/01/11	in progress	principal investigator	8,991,000
Analytic and experimental study of wind driven magnetic piezoelectric vibration energy harvesting system (110-2221-E-032-026-)	Ministry of Science and Technology (Taiwan)	2021/08/01~ 2022/07/31	closed	principal investigator	996,000
Verification of unmanned helicopter main rotor frequency and dynamic	Ministry of Science and Technology	2021/01/01~ 2021/12/31	closed	principal investigator	449,000

response (110-2622-E-032-001-)	(Taiwan)				
Industry-University Cooperation Program - Verification of unmanned helicopter main rotor frequency and dynamic response	Sovereign Technology CO.	2021/01/01~ 2021/12/31	closed	principal investigator	202,680
Effects of fixed-fixed double-steel-sheet vibration energy harvesting system (109-2221-E-032-011-)	Ministry of Science and Technology (Taiwan)	2020/08/01~ 2021/07/31	closed	principal investigator	866,000
Afterburner hybrid sounding rocket test and verification platform rocket development (3/3) (109-2224-E-006- 004-)	Ministry of Science and Technology (Taiwan)	2020/08/01~ 2022/07/31	closed	co- principal investigator	21,400,000
Afterburner hybrid sounding rocket test and verification platform rocket development (2/3) (108-2218-E-006- 021-)	Ministry of Science and Technology (Taiwan)	2019/08/01~ 2021/07/30	closed	co- principal investigator	21,349,000
Remote control helicopter rotor blade design principles and experimental verification (107-2622-E-032-008-CC3)	Ministry of Science and Technology (Taiwan)	2018/11/01~ 2019/10/31	closed	principal investigator	700,000
Industry-University Cooperation Program – Remote control helicopter rotor blade design principles and experimental verification	Sovereign Technology CO.	2018/11/01~ 2019/10/31	closed	principal investigator	297,320
Afterburner hybrid sounding rocket test and verification platform rocket development (1/3) (107-2218-E-006- 044-)	Ministry of Science and Technology (Taiwan)	2018/08/01~ 2019/10/31	closed	co- principal investigator	21,400,000
Vibration and stability analysis of the nonlinear vibration aborber (nonlinear energy sink) on a nonlinear beam (106-2221-E-032-037-)	Ministry of Science and Technology (Taiwan)	2017/08/01~ 2018/07/31	closed	principal investigator	548,000