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EDUCATION

National Tsing Hua University (NTHU), HsinChu, Taiwan

Ph.D. in NanoEngineering and MicroSystems (MEMS/NEMS), Sep. 2009 –Jan. 2015 (Defense Date: 6, January, 2015)

- Specification on CMOS-integrated micromechanical resonators and oscillators
- Current research project: Capacitively Driving and Piezoresistively Sensing MEMS Resonators

National Taipei University of Technology (NTUT), Taipei, Taiwan

M.S. in Mechatronic Engineering (ME), ~Jun. 2008

- Specification on CMOS-MEMS Devices, fabrications, sensor readout circuits, soft magnetic materials
- Master Thesis: Design of Driving Circuit and Chip Layout for the CMOS MEMS Fluxgate Magnetometer

Feng Chia University (FCU), TaiChung, Taiwan

B.S. in Automatic Control Engineering (EE), ~Jun. 2006

- Major in **MicroElectroMechanical System (MEMS)**
- Specification on Automatic Control and MicroMechanical Sensors

PROFESSIONAL INTERESTS

- Nano/Microelectromechanical Systems
- Analog and Mixed-signal Circuits
- Semiconductor/MEMS technologies
- Sensors and Interface Circuits

EXPERIENCE

Military Service (Obligation)

Taiwan, Air force, Oct. 2008 –Sep. 2009, Air force, Corporal.

Visiting Scholar (financial support by National Science council, 2013)

Electrical Engineering, Case Western Reserve University, Cleveland, OH, U.S., Aug. 2013-May 2014.

Topic: Parametric amplification on the bulk mode resonator

PROJECT EXPERIENCE

Graduate Research Assistant Fall 2009 –Dec.2014 National Tsing Hua University, HsinChu, Taiwan

Advisor: Prof. Sheng-Shian Li

- **Foundry RF MEMS SOI resonator platform development. (2009-2012)**
 - ▶ Design many kinds of devices and verify the platform.
 - ▶ Silicon based piezoresistive resonator and differential measurement for the first time without the need for the post-data processing.
- **Design of advanced CMOS-MEMS resonator platform (2009-2011)**
 - ▶ Overcome the process issues and demonstrate the devices in 0.18 μm CMOS MEMS platform.
- **Design of capacitively driving and piezoresistively sensing CMOS-MEMS resonator and oscillator(2011-2014)**
 - ▶ Piezoresistive based CMOS MEMS resonator target for timing reference and sensors.
 - ▶ Record High $Q > 15,000$ CMOS MSME bulk mode resonator.
 - ▶ CMOS-MEMS Oscillator with Piezoresistive based resonator.
- **Parametric amplification in MEMS resonator (2013-2014)**
 - ▶ Parametric amplification on the bulk mode CMOS MEMS resonator.
 - ▶ Parametric amplification on the flexure mode CMOS MEMS resonator/oscillator.

Graduate Research Assisant Fall 2006 – Spring 2008 National Taipei University of Technology, Taipei, Taiwan

Advisor: Prof. Jen-Tzong Jeng & Prof. Chih-Cheng Lu

- **Design of driving circuit and chip layout for the CMOS MEMS fluxgate magnetometer**
 - ▶ Fabricate and measure the characteristics of soft magnetic thin films for fluxgate magnetometers
 - ▶ Design the interface circuit and sensing system on the PCB for the magnetometer.
 - ▶ Magnetometer characterization and earth magnetic field measurement
 - ▶ The sensitivity of the magnetometer is about 25.9 V/mT and the linear range is larger than 1 mT with feedback magnetic field. Open loop sensitivity is about 0.47 V/mT with a linear range between ± 0.5 mT.
 - ▶ Chip scale design simulation by Ansoft.

PROFESSIONAL SKILLS and EXPERIENCES

- ▶ **Computer software:** MATLAB, Cadence Virtuoso, ADS, ANSYS, COMSOL, HSPICE, OFFICE...etc.
- ▶ **MEMS and RF Related Experiences:**
 - Network analyzer and spectrum analyzer for MEMS device measurement.
 - Sustaining circuit for MEMS device. (Transimpedance Amplifier, Pierce Oscillator for piezoresistive resonators and Cherry Hooper circuits for the differentially piezoresistive resonator configuration)
 - Earth's magnetic field measurement by using my designed fluxgate magnetometer (Handmade) and circuits. (Master's thesis)
 - Noise of magnetic sensor (fluxgate) measurement by using Lock-in amplifier as a spectrum. (Master's thesis)
- ▶ **MEMS Process Experiences:**
 - Post-CMOS processes: RIE, XeF₂ silicon isotropic etching, Vapor HF, HF for oxide release, Metal wet etching.
 - Soft magnetic material thin film deposition (Lithography and PVD) and measure the characteristics.
 - Troubleshooting of the magnetic thin film deposition problems as well as investigate and optimize the condition of thin film deposition.
 - Assistant for the cleanroom of the school (NTUT) organizing the facilities training and equipment maintenances.
- ▶ **Courses Projects**
 - Hspice, Cadence and matlab simulations for Analog to Digital circuit (ADC), Digital Filter, .etc.
 - Phase Lock Loop (PLL) System simulation by Matlab Simulink

HONORS AND AWARDS

- **2014 FITI Innovation & Startup Competition: First Stage (Team Leader). Project Title:** 2014
CMOS-MEMS timing reference for IoTs. 2013
- **2013 Founding of Study Abroad Program** 2012
- **2012 IEEE Sensors Conference : Best Student Paper Award (Co-recipient)** 2012
- **2012 CIC Outstanding Chip Design Award: Best Design** 2012
- **2012 iNEMS student paper competition: Excellent Research Paper**

Patents

- [1] Sheng-Shian Li, and Cheng-Syun Li, "MEMS resonator, manufacturing method thereof, and signal processing method using MEMS resonator," US Patent Granted, 2014.
- [2] MEMS Oscillator, under review.

PUBLICATION: JOURNAL ARTICLES

- [1] C.-S. Li, M.-H. Li, C.-C. Chen, C.-H. Chin, and S.-S. Li "A Low Voltage CMOS-MEMS Thermal-Piezoresistive Resonator with Q > 10,000," accepted for publication in *IEEE Electron Device Letter*, 2014.
- [2] C.-S. Li, M.-H. Li, and S.-S. Li "Differentially piezoresistive transduction of high-Q encapsulated SOI-MEMS resonators with sub-100nm gaps," *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, vol. 62, no.1, pp. 220–229, Jan. 2015.
- [3] M.-H. Li, C.-Y. Chen, C.-S. Li, C.-H. Chin, and S.-S. Li, "Design and characterization of a dual-mode CMOS-MEMS resonator for TCF manipulation," accepted for publication in *IEEE/ASME J. Microelectromech. Syst. (JMEMS)*
- [4] C.-H. Chin, C.-S. Li, M.-H. Li, Y.-L. Wang, S.-S. Li, "Fabrication and characterization of a charge-biased CMOS-MEMS resonant gate field effect transistor," *J. Micromech. Microeng.* vol.24, no. 9, 09005, 2014.
- [5] M.-H. Li, C.-Y. Chen, C.-S. Li, C.-H. Chin, and S.-S. Li, "A monolithic CMOS-MEMS oscillator based on an ultra-low-power

ovenized micromechanical resonator,” accepted for publication in *IEEE/ASME J. Microelectromech. Syst.* (JMEMS).

- [6] C.-Y. Chen, M.-H. Li, **C.-S. Li**, and S.-S. Li, “Design and characterization of mechanically coupled CMOS-MEMS filters for channel-select applications,” *Sens. Actuators A*, vol. 216, no. 1, pp. 394-404, Sep. 2014.
- [7] **C.-S. Li**, M.-H. Li, C.-H. Chin, and S.-S. Li “Differentially piezoresistive sensing for CMOS-MEMS resonators,” *IEEE/ASME J. Microelectromech. Syst. (JMEMS)*, vol. 22, no. 6, pp. 1361-1372, Dec. 2013.
- [8] V. Pachkawde, M.-H. Li, **C.-S. Li**, and S.-S. Li, “A CMOS-MEMS resonator integrated system for oscillator application,” *IEEE Sensors Journal*, vol. 13, no. 8, pp. 2882-2889, Aug. 2013.
- [9] **C.-S. Li**, L.-J. Hou, and S.-S. Li, “Advanced CMOS-MEMS resonator platform,” *IEEE Electron Device Letter*, vol. 33, no. 2, pp.272-274, Feb. 2012.

CONFERENCE PROCEEDINGS

- [1] C.-H. Chin, **C.-S. Li**, M.-H. Li, and S.-S. Li, “A CMOS-MEMS arrayed RGFET oscillator using a band-to-band tunneling bias scheme,” to be presented in the 28th IEEE Int. Micro Electro Mechanical Systems Conf. (MEMS’15), Estoril, Portugal, Jan. 18-22, 2015.
- [2] M.-H. Li, **C.-S. Li**, and S.-S. Li, “Exploring the Q -factor limit of temperature compensated CMOS-MEMS resonators,” to be presented in the 28th IEEE Int. Micro Electro Mechanical Systems Conf. (MEMS’15), Estoril, Portugal, Jan. 18-22, 2015.
- [3] M.-H. Li, C.-Y. Chen, C.-H. Chin, **C.-S. Li**, and S.-S. Li, “Optimizing the close-to-carrier phase noise of monolithic CMOS-MEMS oscillators using bias-dependent nonlinearity,” to be presented in the, 2014 IEEE International Electron Devices Meeting (IEDM’14), San Francisco, CA, Dec. 15-17, 2014.
- [4] **C.-S. Li***, J. Lee*, Z. Wang, M.-H. Li, C.-H. Chin, S.-S. Li, and P. X.-L. Feng “High-Frequency Parametric Bulk Mode Resonators in CMOS-MEMS Technology,” *Proceedings*, 2014 Joint Conf. of the IEEE Int. Frequency Control Symp. Taipei, Taiwan, May 19-22, 2014, pp. 329-331. (*Co-first authors)
- [5] **C.-S. Li***, J. Lee*, M.-H. Li, C.-H. Chin, S.-S. Li, and P. X.-L. Feng “Multimode Characteristics of High-Frequency CMOS-MEMS Bulk-Mode Resonators,” *Proceedings*, 2014 Joint Conf. of the IEEE Int. Frequency Control Symp. Taipei, Taiwan, May 19-22, 2014, pp. 478-480. (*Co-first authors)
- [6] C.-Y. Chen, M.-H. Li, C.-H. Chin, **C.-S. Li**, and S.-S. Li, “Combined electrical and mechanical coupling for mode-reconfigurable CMOS-MEMS filters,” *Proceedings*, 27th IEEE Int. Micro Electro Mechanical Systems Conf. (MEMS’14), San Francisco, CA, Jan. 26-30, 2014, 1249-1252.
- [7] M.-H. Li, C.-Y. Chen, **C.-S. Li**, C.-H. Chin, C.-C. Chen, and S.-S. Li, “Foundry-CMOS integrated oscillator circuits based on ultra-low power ovenized CMOS-MEMS resonators,” 2013 IEEE International Electron Devices Meeting (IEDM’13), Washington, DC, Dec. 9-11, 2013.
- [8] **C.-S. Li**, M.-H. Li, C.-H. Chin, C.-Y. Chen, P. X.-L. Feng, and S.-S. Li “A Piezoresistive CMOS-MEMS Resonator with High Q and Low TC_f ,” *Proceedings*, 2013 IEEE UFFC Joint Symposia, Prague, Czech Republic, July 21-25, 2013, pp. 425-428.
- [9] M.-H. Li, C.-Y. Chen, **C.-S. Li**, C.-H. Chin and S.-S. Li, “Enhanced temperature sensitivity of a single CMOS-MEMS resonator via resonant modes in orthogonal axes,” *Proceedings*, 2013 IEEE UFFC Joint Symposia, Prague, Czech Republic, July 21-25, 2013.
- [10] C.-H. Chin, **C.-S. Li**, M.-H. Li, and S.-S. Li, “A CMOS-MEMS resonant-gate transistor,” *Dig. of Tech. Papers*, the 17th Int. Conf. on Solid-State Sensors & Actuators (Transducers’13), Barcelona. Spain, June 16-20, 2013, pp. 2284-2287.
- [11] C.-Y. Chen, M.-H. Li, **C.-S. Li**, and S.-S. Li, “Design and characterization of mechanically-coupled CMOS-MEMS filters,” *Dig. of Tech. Papers*, the 17th Int. Conf. on Solid-State Sensors & Actuators (Transducers’13), Barcelona. Spain, June 16-20, 2013, pp. 2288-2291.
- [12] H. Zhu, C.-H. Chuang, **C.-S. Li**, M.-H. Li, J. E.-Y. Lee, and S.-S. Li, “The effects of tight capacitive coupling on phase noise performance: A LAMÉ-mode MEMS oscillator study,” *Dig. of Tech. Papers*, the 17th Int. Conf. on Solid-State Sensors & Actuators (Transducers’13), Barcelona. Spain, June 16-20, 2013, pp. 2304-2307.
- [13] T.-T. Chen, J.-C. Huang, Y.-C. Peng, C.H. Chu, C.-H. Lin, C.-W. Cheng, **C.-S. Li**, S.-S. Li, “A 17.6-MHz 2.5V ultra-low polarization voltage MEMS oscillator using an innovative high gain-bandwidth fully differential transimpedance voltage amplifier,” *Proceedings*, 26th IEEE Int. Micro Electro Mechanical Systems Conf. (MEMS’13), Taipei, Taiwan, Jan. 20-24, 2013.
- [14] M.-H. Li, **C.-S. Li**, C.-H. Chin, C.-Y. Chen, and S.-S. Li, “An ultra-low power ovenized CMOS-MEMS resonator monolithically integrated with interface circuits,” *Proceedings*, 26th IEEE Int. Micro Electro Mechanical Systems Conf. (MEMS’13), Taipei,

Taiwan, Jan. 20-24, 2013.

- [15] V. Pachkawde, **C.-S. Li**, S.-S. Li, “A fully-differential CMOS-MEMS resonator integrated with an On-chip Amplifier”, *IEEE SENSORS 2012 October 28-31, 2012 – Taiwan. (Best Student Paper Award)*
- [16] **C.-S. Li**, M.-H. Li, and S.-S. Li “Differential measurement of piezoresistive transduction for silicon-based MEMS resonators”, *Proceedings, 2012 Joint Conf. of the IEEE Int. Frequency Control Symp. Baltimore, Maryland, USA, May 21-24, 2012,*
- [17] M.-H. Li, **C.-S. Li**, L.-J. Hou, Y.-C. Liu and S.-S. Li, “A 1.57mW 99dBOhm CMOS transimpedance amplifier for VHF micromechanical reference oscillators,” *Proceedings, the 2012 IEEE Int. Symp. on Circuits and Systems (ISCAS’12), Seoul, Korea, May 20-23, 2012*
- [18] **C.-S. Li**, C.-H. Chin, Y.-C. Liu, and S.-S. Li, “Capacitively-driven and piezoresistively-sensed CMOS-MEMS resonators”, *Proceedings, 25rd Int. IEEE Micro Electro Mechanical Systems Conf. (MEMS’12), Paris, France, Jan. 29-Feb. 2, 2012, pp. 539-542.*
- [19] L.-J. Hou, **C.-S. Li** and S.-S. Li, “High-stiffness-driven micromechanical resonator oscillator with enhanced phase noise performance”, *Proceedings, 25rd Int. IEEE Micro Electro Mechanical Systems Conf. (MEMS’12), Paris, France, Jan. 29-Feb. 2, 2012, pp. 700-703.*
- [20] **C.-S. Li** and S.-S. Li, “Capacitive gap-aspect-ratio enhancement using advanced CMOS process for CMOS-MEMS resonators,” *Proceedings, 9th International Workshop on High Aspect Ratio Micro Structure Technology (HARMST’11), Hsinchu, Taiwan, June 12-18, 2011, pp. 47-48.*

DOMESTIC PUBLICATIONS

- [1] 陳昭瑜、李銘晃、李承勳、李昇憲, “機械耦合式 CMOS-MEMS 濾波器之設計與特性探討,” 第 17 屆奈米工程暨微系統技術研討會, 台中, Aug. 22-23, 2013. (Oral Presentation)
- [2] 莊捷旭、李承勳、李銘晃、李昇憲, “高 Q 值微機械震盪器研製與探討差動機制對微機械震盪器的影響,” 第 17 屆奈米工程暨微系統技術研討會, 台中, Aug. 22-23, 2013. (Oral Presentation)
- [3] **C.-S. Li**, C.-C. Lu, J.-T. Jeng, “Characteristics of soft magnetic thin films for integrated fluxgate magnetometers”, Annual Meeting of the physical Society of Republic of China, Hsinchu, PC-21, Jan. 2008.
- [4] **C.-S. Li**, C. C. Lu, and J. T. Jeng, “Designs of Driving Circuit and Chip Layout for the CMOS-MEMS Fluxgate Magnetometer” 97 年台灣磁性技術協會年會暨第二十屆磁學與磁性技術研討會, 2008.7.1.
- [5] 李承勳、陳亭宏、鄭振宗、呂志誠, “繞線式磁通開磁量計之製作與特性測定”, 第 25 屆中國機械工程學會學術研討會, 台灣彰化, 十一月, (2008), 編號 0953。

Teaching Assistant	Fall 2010– Spring 2012	National Tsing Hua University, HsinChu, Taiwan
▶ Undergraduate-level course: PME 3202 – <i>Electronics II</i>		2012 Fall
▶ Graduate-level course: NEMS5110 – <i>Measurements of nano and micro devices</i>		2012 Spring
▶ Undergraduate-level course: PME 3202 – <i>Electronics II</i>		2011 Fall
▶ Graduate-level course: PME 5101 – <i>Microsensor and Microinstrument System</i>		2011 Spring
▶ Graduate-level course: NEMS5800 – <i>RF MEMS Theory and Applications</i>		2010 Fall
Teaching Assistant	2007	National Taipei University of Technology, Taipei, Taiwan
▶ <i>Micro- and Nano System Lab of NTUT (Common Lab Assistant)</i>		2007

LANGUAGES

English – Listening/ Reading/ Speaking/ Writing

Mandarin – Listening/ Reading/ Speaking/ Writing (**Native speaker**)

PROFESSIONAL AFFILIATIONS

IEEE, Student member

2011-Present

REFERENCE

Dr. Sheng-Shian Li (Ph.D thesis Advisor)

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Dr. Jen-Tzong Jeng (Master thesis Advisor)

Email : jtjeng@cc.kuas.edu.tw

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