

# PIERS 2016 Shanghai

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Progress In Electromagnetics Research Symposium

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## Program

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August 8 - 11, 2016

Shanghai, CHINA

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- 09:20 Frequency Selective Surface in Millimeter-wave Automotive Radar Radome Applications  
*Huan Lei Chen (Tongji University); Li Bo Huang (Tongji University); Mei Song Tong (Tongji University);*
- 09:40 A Nystrom Scheme Based on Cuboid Elements for Solving Volume Integral Equations  
*Zhi Guo Zhou (Tongji University); Mei Song Tong (Tongji University);*
- 10:00 **Coffee Break**
- 10:20 Transient Analysis for Electromagnetic Scattering by Dielectric Objects Based on PMCHWT Equations  
*Peng Cheng Wang (Tongji University); Mei Song Tong (Tongji University);*
- 10:40 A Microwave Imaging Chamber Using Bowtie Antennas for Biomedical Applications  
*Muhammad Hassan Khalil (Tsinghua University); Maokun Li (Tsinghua University); Fan Yang (Tsinghua University); Shenheng Xu (Tsinghua University);*
- 11:00 Numerical Modeling of the Interaction of Laser Beams with Plasma at the Entrance Hole of ICF Hohlraum  
*Zhili Lin (Huaqiao University); Jixiong Pu (Huaqiao University);*
- 11:20 Hybrid  $T$ -matrix Modeling of Electromagnetic Scattering from Simplified Leaf Structures  
*Paul Jason Co (Tokyo Institute of Technology); Jun-Ichi Takada (Tokyo Institute of Technology);*
- 11:40 Statistical Moments of Scattered Ordinary and Extraordinary Waves in the Turbulent Plasma  
*George Vakhtang Jandieri (Georgian Technical University); Zh. M. Diasamidze (Batumi Shota Rustaveli State University); M. R. Diasamidze (Batumi State Maritime Academy); Ioseb Aleksandr Nemsadze (Batumi Shota Rustaveli State University);*
- 08:00 A Dual-band Balanced Amplifier with CRLH Transmission Lines Fully Implemented  
*Jongsik Lim (Soonchunhyang University); Qi Wang (Chonbuk National University); Yongchae Jeong (Chonbuk National University);*
- 08:20 Radial Uniform Circular Antenna Array for Dual-mode OAM Communication  
*Zhi-Gui Guo (Fudan University); Guo-Min Yang (Fudan University); Yu Fu (Fudan University);*
- 08:40 RF/Microwave Processing in RF Systems  
*Sang-Min Han (Soonchunhyang University); Seok Jae Lee (Soonchunhyang University); Won-Sang Yoon (Hoseo University);*
- 09:00 A Design of Phase Shifter with Constant Insertion Loss  
*Seungho Jeong (Chonbuk National University); Boram An (Chonbuk National University); Phirun Kim (Chonbuk National University); Yongchae Jeong (Chonbuk National University); Jongsik Lim (Soonchunhyang University);*
- 09:20 **Low Noise Figure CMOS 2-Port Active Inductor Using LC Resonator**  
*Jageon Koo (Chonbuk National University); Seungwook Lee (Chonbuk National University); Junhyung Jeong (Chonbuk National University); Giridhari Chaudhary (Chonbuk National University); Yongchae Jeong (Chonbuk National University);*
- 09:40 A Novel Dual-band Filtering Power Divider with U-section Loaded Resonator  
*Min-Hong Yang (Zhejiang University); Yun Long Lu (Ningbo University); Kai Li (Zhejiang University);*
- 10:00 **Coffee Break**
- 10:20 The Compact Waveguide Filters with Complex Aperture Resonant Diaphragms  
*Viacheslav V. Zemlyakov (Southern Federal University); Sergey V. Krutiev (Southern Federal University); Anatoliy B. Kleshchenkov (Southern Federal University);*
- 10:40 RF Characteristics of SU-8 and Quartz Particle Composite Dielectric for Terahertz Applications  
*Jung-Mu Kim (Chonbuk National University); Ignacio Llamas-Garro (Centre Tecnologic de Telecomunicacions de Catalunya (CTTC)); Moises Espinosa-Espinosa (Centre Tecnologic de Telecomunicacions de Catalunya); Maolong Ke (Dynex Semiconductor Ltd); Michael J. Lancaster (The University of Birmingham); Marcos T. de Melo (Universidade Federal de Pernambuco);*

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**Session 3A8**
**Advanced Antenna and RF Circuits Design 1**


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 Wednesday AM, August 10, 2016

Room 3B

 Organized by Malay Ranjan Tripathy, **Yongchae Jeong**

 Chaired by Jongsik Lim, Malay Ranjan Tripathy
 

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## Session 4P8

## Advanced Antenna and RF Circuits Design 2

Thursday PM, August 11, 2016

## Room 3B

Organized by Malay Ranjan Tripathy, Yongchae Jeong

Chaired by Malay Ranjan Tripathy, Yongchae Jeong

- 13:00 Design of Lange-Ferrite Circulator for X-band Radar  
*Desy Yusianor (Universitas Indonesia); Fitri Yuli Zulkifli (University of Indonesia); Eko Tjipto Rahardjo (Universitas Indonesia);*
- 13:20 Dual Band Frequency Selective Surface for X-band Applications  
*Sarika (Amity University Uttar Pradesh); Malay Ranjan Tripathy (Amity University Uttar Pradesh); Daniel Ronnow (University of Gavle);*
- 13:40 Gap Coupled Half Circular Disk Patch Antenna Using D.G.S for Dual-wideband Application  
*Nagendra Prasad Yadav (Nanjing University of Science and Technology); Xuefeng Liu (Nanjing University of Science and Technology); Malay Ranjan Tripathy (Amity University Uttar Pradesh);*
- 14:00 Design of a High Gain and Low Noise CMOS Folded Mixer for 5 GHz with Low Power Consumption  
*Yi Li (Hunan University); Chunhua Wang (Hunan University);*
- 14:20 Novel Single Layer Proximity Fed Microstrip Patch Array with Gap Coupled Resonators  
*Jacob Abraham (Mahatma Gandhi University Regional Center); Thomaskutty Mathew (Mahatma Gandhi University Regional Center);*
- 14:40 Ultra Wideband Signal Detection with a Schottky Diode Based Envelope Detector  
*Simon Rommel (Technical University of Denmark); Bruno Cimoli (Technical University of Denmark); G. Silva Valdecasa (Technical University of Denmark); Jesper Bevensee Jensen (Technical University of Denmark); Tom Keinicke Johansen (Technical University of Denmark); Juan Jose Vegas Olmos (Technical University of Denmark); Idelfonso Tafur Monroy (Technical University of Denmark);*
- 15:00 Reduction of Mutual Coupling between Closely Spaced Microstrip Antennas with H-shaped Isolation Wall  
*Chan-Hee Park (Chonbuk National University); Eun-Suk Yang (Chonbuk National University); Hae-Won Son (Chonbuk National University);*
- 15:20 Coffee Break
- 15:40 Novel UWB Slotted I-shaped Flexible Microstrip Patch Antenna Design for Satellite Reconnaissance, Amateur Radio, Future Soil Moisture and Sea Surface Salinity Missions  
*Nitika (Punjabi University); Maninder Singh (Punjabi University); Aman Nag (Punjabi University); Ameet Kaur (Punjabi University); Aastha (Punjabi University); Simarjit Singh Saini (Punjabi University); Ekambir Sidhu (Punjabi University);*
- 16:00 A Broadband Reflectarray Antenna Based on Perforated Dielectric Laminates  
*Yingran He (Zhejiang University); Zhiming Gao (The 54th Research Institute of China Electronic Technology Corporation); Biao Du (The 54th Research Institute of China Electronic Technology Corporation);*
- 16:20 Applying X-parameter to the Design and Comparison of 24-GHz Fundamental and Subharmonic Quadrature Passive Mixers  
*Lai He (Fudan University); Wei Li (Fudan University);*
- 16:40 Novel Stacked Patch Array Antenna with Embedded Defective Ground Structure for Wireless Applications  
*S. Sreenath Kashyap (Marwadi Education Foundation); Ved Vyas Dwivedi (Gujarat Technological University); Y. P. Kosta (Marwadi Education Foundation);*
- 17:00 A Dual Polarization Reconfigurable Patch Antenna for Frequency Diversity  
*Xing Yun Zhang (Beijing Institute of Technology); Wu Ren (Beijing Institute of Technology); Wei-Ming Li (Beijing Institute of Technology); Zheng-Hui Xue (Beijing Institute of Technology);*
- 17:20 A Dual Frequency Reconfigurable Patch Antenna for Polarization Diversity  
*Xing Yun Zhang (Beijing Institute of Technology); Wu Ren (Beijing Institute of Technology); Wei-Ming Li (Beijing Institute of Technology); Zheng Hui Xue (Beijing Institute of Technology);*
- 17:40 A Mathematical Model for Energy Efficient SDN/NFV Using Autonomic Network Intelligence  
*Huned Materwala (Amity University); Varsha Jain (IIT Mandi); Priya Ranjan (Amity University Uttar Pradesh);*
- 18:00 Elliptic Function Based Band Pass mm Wave Filter for Wireless Communication  
*Manish Sharma (Amity University Uttar Pradesh); Malay Ranjan Tripathy (Amity University Uttar Pradesh); Priya Ranjan (Amity University Uttar Pradesh); Yongchae Jeong (Chonbuk National University);*

## Low Noise Figure CMOS 2-Port Active Inductor Using LC Resonator

Jageon Koo, Seungwook Lee, Junhyung Jeong, Girdhari Chaudhary, and Yongchae Jeong  
Chonbuk National University, Republic of Korea

**Abstract**— One important issue related to the standard CMOS technology is a low-resistivity silicon substrate that results in low Q-factor for the passive spiral inductor. Therefore, active inductors have widely studied and applied to different range of RF circuit applications due to high-Q, low insertion loss, small size, and inductance tenability [1]. However, the conventional active inductors have also some drawbacks such as high noise figure, poor linearity, and high power consumption [2]. Moreover, most of the previously studied active inductors were basically grounded-type 1-port network. In this paper, a design of novel active 2-port inductor using LC parallel resonator is presented. The parasitic capacitances are decreased by adding parallel  $L_f$  and  $C_f$  to gates of  $M_1$  and  $M_2$ , as a result the Q-factor of overall circuit can be improved. The simulation was performed in Cadence Spectre by using SP simulation. The overall circuit size of the proposed active inductor is  $0.45 \text{ mm} \times 0.5 \text{ mm}$  including the pads, where the active area occupies only  $0.2 \text{ mm} \times 0.15 \text{ mm}$ . The proposed circuit consumed  $3.6 \text{ mW}$  DC power at  $1.8 \text{ V}$  supply voltage. On wafer probing was used to characterize 2-port S-parameters of the proposed circuit and also a pad de-embedding method was used for accurate measurements. Figs. 1 and 2 show the simulated and measured inductances and Q-factors of the fabricated circuit. From an experiment, it is found that the inductance and Q-factor are higher than  $2 \text{ nH}$  and 50, respectively, in the frequency range of 1–6 GHz. The simulated and measured noise figure of the fabricated circuit is shown in Fig. 3. The measured noise figure is less than  $12 \text{ dB}$  in constant inductance range. The proposed circuit provides high inductance, Q-factor, low DC power consumption, and low noise figure over wide frequency range. The proposed 2-port active inductor is applicable in various RF circuits and systems such as coupler, RFIC filters, power dividers, and LC-VCO.

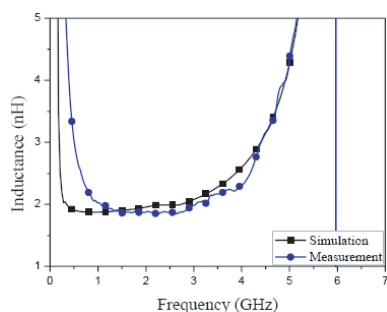


Figure 1.

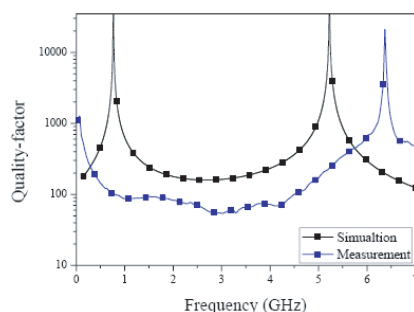


Figure 2.

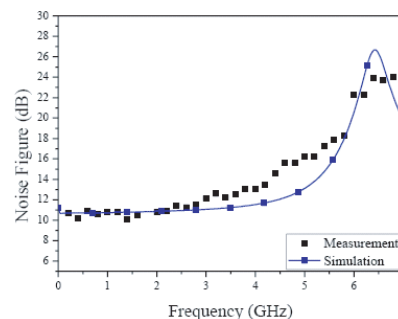


Figure 3.

### REFERENCES

1. Seo, S., N. Ryu, H. Choi, and Y. Jeong, "Novel high-Q inductor using active inductor structure and feedback resonance circuit," *Proceedings of IEEE Radio Frequency Integrated Circuits Symposium*, 467–470, June 2007.
2. Hwang, K., C. Cho, J. Lee, and J. Kim, "High quality-factor and inductance of symmetric differential-pair structure active inductor using a feedback resistance design," *IEEE International Microwave Symposium Digest*, 1059–1062, 2008.