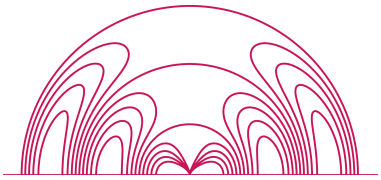
2021 PhotonIcs & Electromagnetics Research Symposium (PIERS)

PIERS 2021 Hangzhou



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Proceedings

21–25 November 2021
Hangzhou, CHINA

IEEE Catalog Number: CFP21C18-ART
ISBN: 978-1-7281-7247-7

2021 Photonics & Electromagnetics Research Symposium (PIERS) | 978-1-7281-7247-7/21/$31.00 ©2021 IEEE | DOI: 10.1109/PIERS53385.2021.9695134

13:00 Artificial Doppler and Micro-Doppler Effect Induced by Time-modulated Metasurface
Ziyang Lai (Nanjing University of Science and Technology); Xinyu Fang (Nanjing University of Science and Technology); Mengmeng Li (Nanjing University of Science and Technology); Da-Zhi Ding (Nanjing University of Science and Technology); Rushan Chen (Nanjing University of Science and Technology);

13:15 A Hybrid Domain Decomposition Method to Accelerate the Scattering Analysis from Multiple Moving Objects
Xiong Yang (University of Electronic Science and Technology of China); Jun Hu (University of Electronic Science and Technology of China);

13:30 An Efficient Hybrid Method for Analysis of Large Antenna Arrays
Haifeng Liang (Ningbo University); Hanru Shao (Ningbo University);

13:45 A Novel Approach to Analyse the Band Gap of Mushroom-like Electromagnetic Band Gap Structure
Guanya Li (University of Electronic Science and Technology of China); Hai-Yan Chen (University of Electronic Science and Technology of China); Qingting He (University of Electronic Science and Technology of China); Yunqiang Huang (University of Electronic Science and Technology of China); Li Zhang (University of Electronic Science and Technology of China); Linbo Zhang (University of Electronic Science and Technology of China); Xiao Long Weng (University of Electronic Science and Technology of China); Jianliang Xie (University of Electronic Science and Technology of China); Difei Liang (University of Electronic Science and Technology of China); Long-Jiang Deng (University of Electronic Science and Technology of China);

14:00 Passive Monopulse Amplitude-comparison Three-dimensional Direction-finding Based on Six-element Antenna Array
Qilun Yang (Science and Technology on Electronic Information Control Laboratory); Longbiao Hu (Science and Technology on Electronic Information Control Laboratory); Xuying Zhang (Science and Technology on Electronic Information Control Laboratory); Yanfei Li (Science and Technology on Electronic Information Control Laboratory);

14:15 Keynote Beyond-5G Wireless Systems: An Opportunity for Applied Electromagnetics and Metamaterials Communities
Filiberto Bilotti ("Roma Tre" University); Mirko Barbuto ("Niccol o Cusano" University); Michela Longhi (Niccol o Cusano University); Angelica Viola Marini ("Roma Tre" University); Alessio Monti (Niccol o Cusano University); Davide Ramaccia ("Roma Tre" University); Luca Stefanini ("Roma Tre" University); Alessandro Toscano ("Roma Tre" University); Stefano Vellucci ("Roma Tre" University);

14:40 Optical Properties of Nanoporous Gold Sponges Using Model Structures Obtained from Three-dimensional Phase-field Simulation
Sebastian Bohm (Technische Universit¨at Ilmenau/Institute of Physics and Institute of Micro- and Nanotechnologies); Malte Grunert (Technische Universität Ilmenau); Hauke Lars Honig (Technische Universit¨at Ilmenau); Dong Wang (Technische Universität Ilmenau); Peter Schaaf (Technische Universität Ilmenau); Erich Runge (Technische Universitat Ilmenau); Jinhui Zhong (University of Oldenburg); Christoph Lienau (Carl von Ossietzky Universitat Oldenburg);

14:50 Realistic 3D Channel Model for Chipless RFID System Considering RFID Tag RCS and Multipath Components
Mohamed El-Hadidy (The University of Duisburg-Essen); T. Ould Mohamed (IMST GmbH);

15:30 Coffee Break

Session 1P16b
SC4: Microwave/Millimeter Wave Circuits and Systems for Emerging Applications

Monday PM, April 25, 2022
Online ROOM 16
Organized by Yongchae Jeong, Girdhari Chaudhary
Chaired by Yongchae Jeong, Girdhari Chaudhary

16:00 Compressive Direction of Arrival Estimation with Wave-chaotic Antennas
Okan Yurduseven (Queen's University Belfast); T. V. Hoang (Queen's University Belfast); M. A. B. Abbasi (Queen's University Belfast); V. Fusco (Queen's University Belfast);

16:10 The Design of Class-F Power Amplifier by Using Asymmetrical Composite Right-/Left-handed Transmission Line
Phanam Pech (Jeonbuk National University); Suyeon Kim (Jeonbuk National University); Daehan Lee (Jeonbuk National University); Muhammad A. Chaudhary (Ajman University); Yongchae Jeong (Jeonbuk National University);

16:20 Design of Matching Networks with Bandpass Filtering Response Using Stepped Impedance Resonator
Jaehun Lee (Jeonbuk National University); Phanam Pech (Jeonbuk National University); Girdhari Chaudhary (Jeonbuk National University); Jongsik Lim (Sooncheonhyang University); Yongchae Jeong (Jeonbuk National University);

16:30 Low Profile Patch Antenna Surrounded by Mushroom-type Resonators for Highly Integrated Wireless Devices at 60 GHz
I. Kaid Omar (Université Paris-Saclay); Frederic Aniel (Univ. Paris-Sud); Nicolas Zerounian (Univ. Paris 11); Badreddine Ratni (Univ. Paris 11);

Design of Matching Networks with Bandpass Filtering Response Using Stepped Impedance Resonator

J. Lee[1], **P. Pech**[1], **G. Chaudhary**[1], **J. Lim**[2], **and Y. Jeong**[1]

[1]Division of Electronic and Information Engineering, Jeonbuk National University, South Korea
[2]Department of Electric Engineering, Sooncheonhyang University, South Korea

Abstract— The matching networks (MN) with bandpass filtering responses are the important circuits in modern wireless communication systems in order to reduce circuit size and insertion loss, and enhance out-of-band signal suppressions. An impedance transformer (IT) is one of the arbitrary termination impedance circuits. Quarter-wavelength ($\lambda/4$) ITs are widely used, but the out-of-band suppression is poor. Recently, the real-to-real ITs with bandpass filtering response have been proposed using the parallel-coupled line with the shunt-couple line or transmission line (TL) [1, 2]. However, the unequal real-to-real termination impedances with bandpass filtering responses are not suitable to apply directly as the MNs of the power or low noise amplifiers which real-to-complex or complex-to-complex impedance matching is required.

In this paper, the design of MN with bandpass filtering response is proposed by using the stepped impedance resonator (SIR). The proposed MN can be designed with predefined fractional bandwidth (FBW), Chebyshev response, and arbitrary real and/or complex termination impedances. The proposed MN consists of open-ended parallel-coupled lines and T-type networks, which are implemented from J- and K-inverters, respectively. Since J- and K-inverters cannot directly match the complex termination impedances, the complex impedance must be transformed into a real impedance. In order to cancel the imaginary part of complex termination impedance, the series TLs must be added to the input and output ports of the conventional $\lambda/4$ SIR. The addition of series TLs is more beneficial than the addition of shunt TLs for capacitive or inductive effects in terms of bandwidth and simplicity. Fig. 1 shows the structure of proposed MN. The proposed MNs are designed with even-order, $n = 4$. In order to prove the validity, the MNs are designed with the termination impedances of $15 - j25\,\Omega$ to $50\,\Omega$, $10 + j40\,\Omega$ to $50\,\Omega$, and $20\,\Omega$ to $50\,\Omega$. The proposed MNs are designed with the center frequency (f_0) and FBW of 2.4 GHz and 3.5%, respectively. The bandpass filtering responses are obtained with high out-of-band signal attenuation

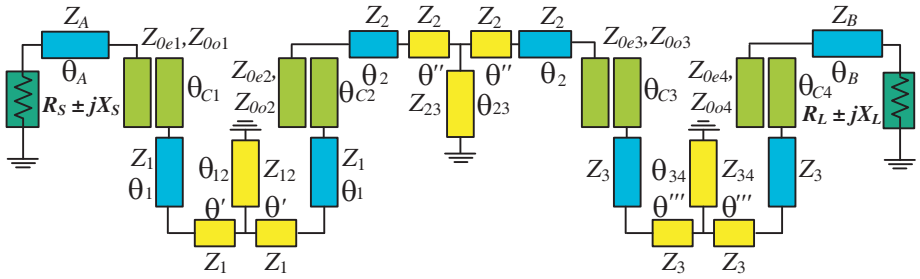

Figure 1: Structure of proposed MN with bandpass filtering response.

ACKNOWLEDGMENT

This work was supported in part by the National Research Foundation of Korea (NRF) grant funded by the Korean Government (MSIT) under Grant 2020R1A2C2012057 and in part by the Basic Research Program through the NRF funded by the Ministry of Education under Grant 2019R1A6A1A09031717.

REFERENCES

1. Kim, P., G. Chaudhary, and Y. Jeong, "Enhancement impedance transforming ratios of couple line impedance transformer with out-of-band supprssion characteristics," *Microw. Opt, Technol. Lett.*, Vol. 57, No. 7, 1600–1603, Jul. 2015.

2. Kim, P., J. Park, J. Jeong, S. Jeong, G. Chaudhary, and Y. Jeong, "High selectivity coupled line impedance transformer with second harmonic suppression," *J. Electromagn. Eng. Sci.*, Vol. 16, No. 1, 13–18, Jan. 2016.