Hindawi
International Journal of Antennas and Propagation
Volume 2017, Article ID 1425263, 3 pages
https://doi.org/10.1155/2017/1425263

Editorial

Wideband, Multiband, Tunable, and Smart Antenna Systems for Mobile and UWB Wireless Applications 2016

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Received 14 February 2017; Accepted 14 February 2017; Published 5 March 2017

1. Introduction

Due to exceptionally high data rates attainable with modern wireless communication systems and the app-based use paradigm, wireless connectivity through multiple and even diverse air interfaces has become a common requirement in the RF architecture of mobile communication devices. Modern wireless devices frequently incorporate five or more antennas to enable cellular voice, video and data, Wi-Fi, and GPS connectivity, across multiple bands. Multiple antenna systems are frequently designed to implement diversity or spatial multiplexing schemes, as in the case of WCDMA and LTE, to increase resiliency and capacity of wireless links, and to operate multiple voice/data links simultaneously. Carrier aggregation is demanding that multiple cellular bands are to be served simultaneously. Concurrently, ultra-wideband (UWB) systems used in short-range communications, remote sensing, and through-the-wall radar imaging have introduced a new paradigm in the antenna design where the mitigation of pulse distortion is of the essence, thus requiring a shift in antenna design approach and the introduction of novel compact radiating systems. Moreover, vehicular communication systems, in order to provide safety warnings and traffic information, employ dedicated short-range communication devices that are intended to be used in vehicle-to-vehicle and vehicle-to-infrastructure communications, thereby enabling the use of cloud-based applications. Following these trends of the market, the level of complexity in the design and implementation of antenna systems and relevant radio-frequency (RF) front-ends in wireless terminals has grown dramatically, requiring highly innovative solutions.

This special issue is intended to reflect current research trends and novel approaches in the analysis and synthesis of antenna systems and associated RF front-ends for next generations of mobile communication devices, applicable to various device forms such as smartphones, tablets, laptops, and wearable computers, as well as for UWB communication systems and radars, including the ones adopted in the automotive industry. Particular emphasis has been put in the analysis and design of broadband, multiband, and reconfigurable antennas for wireless and UWB applications, as well as in the identification of special materials and antenna integration techniques with the host platforms. Special effort has been devoted to the characterization of the radio channel and to the improvement of the quality of service. The special issue consists of 13 contributions that can be divided into the following 6 topics.

2. Contributions to Broad- and Multibanding Techniques

In "A Compact Novel Three-Port Integrated Wide and Narrow Band Antennas System for Cognitive Radio Applications," by N. A. Kumar and A. S. Gandhi, the authors present the design and realization of a three-port radiating structure, integrating wide- and narrow-band antennas for cognitive radio applications. The radiating system consists of an UWB antenna for spectrum sensing, as well as two narrow-band antennas for wireless communication integrated on the same substrate. In particular, the first narrow-band antenna covers the frequency band between 8.78 GHz and 9.23 GHz, while the second one covers the frequency band between 7.33 GHz and 7.7 GHz and the frequency band between 9.23 GHz and 9.82 GHz, respectively.

In "A Novel Dual-Band Circularly Polarized Rectangular Slot Antenna," by B. Li et al., the authors present a dual-band circularly polarized antenna consisting of a rectangular metal frame, acting as a ground, and an S-shaped monopole working as a radiator. The circular polarization is obtained by means of a suitable design of the S-shaped monopole and of the external metallic frame. The antenna covers the frequency bands 2.39–2.81 GHz and 5.42–5.92 GHz and, therefore, can be conveniently applied in WLAN and WiMAX applications.

In "On-Body Characterization of Planar Differential Antennas for Multiple, Wide, and Narrow Bands" by L. Vallozzi at al., the authors present the results of on-body experimental tests of a set of four planar differential antennas with optimized layout of the radiating arms. It is observed that the performance of the considered antennas is acceptable when they are placed at a distance of 15 mm from the chest area of a human body. Therefore, they can be employed successfully in short-range off-body communications, as well as for the monitoring of vital signs, or body area network applications. Finally, it is observed that the proposed antennas can cover several frequency bands of interests, such as the lower portion of the UWB range from 3 to 5 GHz, the 868 MHz and 2.45 GHz ISM bands, and the 1.2 GHz band (lower L-band) for Global Positioning and Navigation Satellite System (GNSS), as well as the Ultrahigh Frequency (UHF) band at 915 MHz for Radio-Frequency Identification (RFID).

3. Contributions to Antennas for Wideband and UWB Applications

In "Wideband and UWB Antennas for Wireless Applications: A Comprehensive Review," by R. Cicchetti et al., the authors present a comprehensive review concerning the geometry, the manufacturing technologies, the materials, and the numerical techniques, adopted for the analysis and design of wideband and UWB antennas for wireless applications. Planar, printed, dielectric, and wearable antennas, achievable on laminate (rigid and flexible) and textile dielectric substrates, are considered. The performances of small, low-profile, and dielectric resonator antennas are illustrated paying particular attention to the application areas concerning portable devices (mobile phones, tablets, laptops, wearable computers, etc.) and radio base stations. This information provides a guidance to the selection of the different antenna types depending on required bandwidth, gain, field polarization, time-domain response, dimensions, and materials, as well as on the constraints related to the host platform.

In "Dielectric Resonator Antennas: Basic Concepts, Design Guidelines, and Recent Developments at Millimeter-Wave Frequencies," by S. Keyrouz and D. Caratelli, the authors present an up-to-date literature overview of the most effective design approaches for controlling circuital characteristics and radiation properties of dielectric resonator antennas (DRAs). The main advantages of DRAs are discussed in detail, with special emphasis put on the most advanced techniques for antenna feeding, size reduction, and gain enhancement. In this way, guidance is given to RF front-end designers in the selection of different DRA topologies useful for achieving desired performance in terms of bandwidth, radiation pattern, polarization, and ease of integration with the host platform. In particular, advances in the application of DRA technology at mm-wave frequencies have been presented, and the most recent implementation of on-chip and off-chip DRAs has been reviewed. It has been shown that silicon-based DRAs realized with standard CMOS process are characterized by good efficiency and gain, thus proving the good potential of DRAs for upcoming 5G communications, as well as high-resolution radar applications.

4. Contributions to Smart Antennas

In "Smart Cylindrical Dome Antenna Based on Active Frequency Selective Surface," by T. Ding et al., the authors present a highly agile, electronically steerable active smart dome antenna. The radiating structure is composed of an active dipole antenna surrounded by 16 strips with active frequency selective surfaces forming a dome. The response of the frequency selective surfaces is continuously tuned by varying the bias voltages of suitable varactors. In this way, some strips integrated in the dome can be biased in order to become reflective, while other strips are tuned so as to focus the electromagnetic energy at the boresight, thus enabling the coverage of the complete angular range.

In "Band-Notched UWB Antenna with Switchable and Tunable Performance," by W. Wu et al., the authors present a novel UWB antenna with switchable and tunable notch bands. The antenna consists of a circular UWB monopole printed on a trapezoidal ground plane. The radiating structure is integrated with two filters whose frequency behavior is electronically controlled by PIN and varactor diodes. The PIN diodes are used to control the switch between the lower (centered at about 4.5 GHz) and upper (centered at about 6 GHz) notch frequency bands, while the varactors are used to tune the filters in the individual bands.

5. Contributions to Antennas for Mobile Phones

In "A Small Planar Antenna for 4G Mobile Phone Application" by H. Jian-rong et al., the authors present the analysis and design of a small planar multiband antenna operating in the 4G frequency bands. The antenna consists of two horizontal-U rings, a shorting line, and a ground plane printed on a commercial FR4 substrate. The antenna satisfies the requirement of 6 dB return loss across the LTE700/LTE2300/LTE2500 and WiMAX 3500 bands.

In "A Wideband Antenna with Circular and Rectangular Shaped Slots for Mobile Phone Applications," by W.-H. Zong et al., the authors present a wideband slot antenna for mobile phone applications. The antenna is composed of two slots. The main slot, whose shape is a combination of a rectangle and a circle, presents small size, while an additional slot having rectangular shape is employed to excite a resonance at higher frequencies. The two slots are fed with a bent shape structure to obtain wideband impedance matching characteristics. The measurements performed on an antenna prototype confirm that the proposed antenna solution covers the LTE700/2300/2500, GSM850/900/1800/1900, and UMTS bands with nearly omnidirectional radiation patterns.

6. Contributions to Substrates, Special Materials, and Fabrication Techniques

In "Wideband, Low-Profile, Dual-Polarized Slot Antenna with an AMC Surface for Wireless Communications," by W. Hu et al., the authors present a wideband dual-polarized slot antenna loaded with an artificial magnetic conductor (AMC) for WLAN/WiMAX and LTE applications. The antenna structure consists of two pairs of arrow-shaped slots realized along the diagonals of a square patch. Two orthogonal stepped microstrip feedlines are used to excite horizontal and vertical field polarization, independently, while an AMC surface composed of 7×7 unit cells is employed to achieve unidirectional radiation patterns.

In "A Multiband Proximity-Coupled-Fed Flexible Microstrip Antenna for Wireless Systems," by G. A. Casula et al., the authors present a multiband printed microstrip antenna for wireless communications. The antenna, which consists of proximity-coupled annular rings printed on a flexible substrate, can cover both the WLAN frequencies (both S-band at 2.45 GHz and C-band at 5.2 GHz) and WiMAX frequency at 3.5 GHz. The considered antenna can be also employed for vehicle-to-vehicle (V2V) and Vehicle-to-Roadside (V2R) communications, relying on Wireless Access in Vehicular Environments (WAVE)/Dedicated Short-Range Communication (DSRC) based on Intelligent Transportation System (ITS).

7. Contributions to Channel Modeling and System Design

In "Impact on Antijamming Performance of Channel Mismatch in GNSS Antenna Arrays Receivers" by Z. Lu et al., the authors analyze the impact on antijamming performance of channel mismatch in GNSS antenna arrays receivers. The characteristics of channel mismatch and impact of mismatch level are studied through theoretical analysis and simulation experiments. To determine the antijamming performance of an antenna array the concept of channel mismatch impact factor is introduced.

In "Design and Performance Analysis of MISO-ORM-DCSK System over Rayleigh Fading Channels," by G. Zhang et al., the authors present a novel chaotic communication system, named Orthogonality-Based Reference Modulated-Differential Chaos Shift Keying (ORMDCSK), to enhance the performance of RM-DCSK. It is demonstrated that by using an orthogonal chaotic generator the intrasignal interference components existing in RM-DCSK are eliminated. Moreover, it is shown that the proposed system shows excellent agreement between theoretical expressions and Monte Carlo simulations, while exhibiting a significant BER improvement.

Acknowledgments

The editors would like to express their gratitude to the authors and the anonymous reviewers for their efforts and contributions to this special issue. As a final word to our readers, after compiling this set of papers, we believe that it gives a good and current overview of the selected topics. We hope you will enjoy reading this year's special issue as much as we have enjoyed putting it together.

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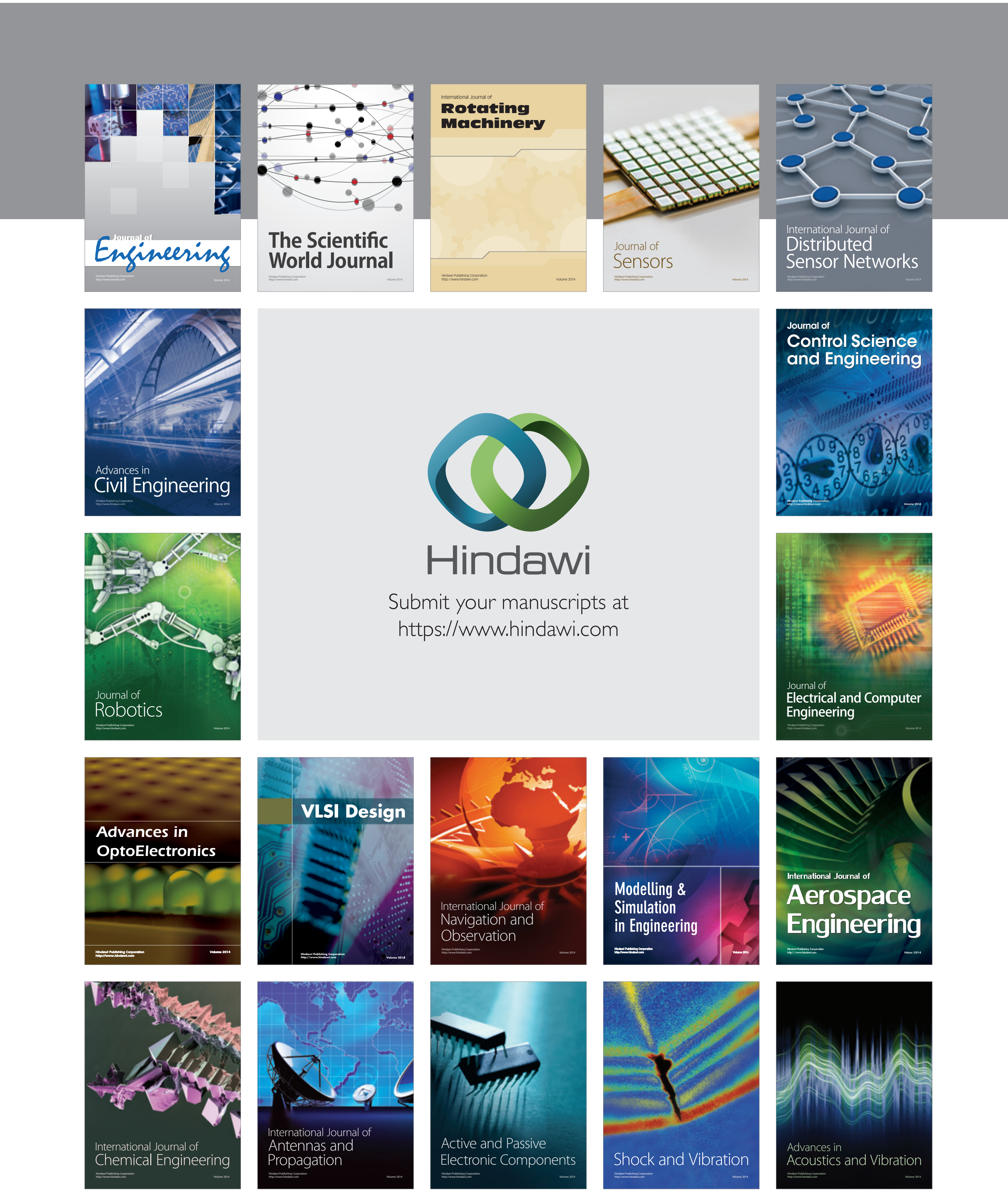
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