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Editorial

Smart Sensing Technologies and Their Applications in Civil Infrastructures 2016

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In recent years, numerous civil infrastructures have been built in metropolitan areas all over the world. The performance of these infrastructures during construction, operation, maintenance, and upgrading is a major concern for the society. The use of smart sensing technologies for structural health monitoring, nowadays, has attracted much attention due to their exceptional benefits [1]. These technologies have developed rapidly and some have found widespread applications in civil and geotechnical engineering practices, such as fiber optic sensing (FOS), time domain reflectometry (TDR), microelectromechanical system (MEMS), particle image velocimetry (PIV), acoustic emission (AE), and wireless sensor network (WSN).

This special issue is devoted to the research area of smart sensing technologies and their applications in civil infrastructures. The topics cover various aspects including novel smart sensing mechanisms and devices for civil infrastructures, applications of smart sensors and sensing systems in civil infrastructures, in-field implementation of structural health monitoring and diagnosis systems, supporting technologies and methodologies in monitoring civil infrastructures, and typical case study of sensing applications and civil infrastructures monitoring.

The issue contains two papers dealing with the applications of Fiber Bragg Grating (FBG) to structural health monitoring. Based on this technology, a quasi-distributed fiber optic sensing array can be established to perform accurate strain and temperature measurements [2, 3]. In the research article titled "Fiber Bragg Grating Sensors-Based In Situ Monitoring and Safety Assessment of Loess Tunnel," J. Lai et al. present an investigation of the feasibility of tunnel monitoring using the quasi-distributed FBG sensors. The paper by P. Wang et al. introduces the application of FBG to measure the longitudinal temperature forces of seamless rails. Laboratory tests and field monitoring were conducted to evaluate the measuring accuracy. Besides FBG, another popular FOS technology is the fully distributed Brillouin optical time domain reflectometry (BOTDR), which enables the measurement of strain and temperature profiles along a single-mode optical fiber [4, 5]. Y. Sun et al. successfully utilized the newly developed BOTDR inclinometers to monitor the deformation of Majiagou Landslide. In their paper, the working principle and field performance of this inclinometer are presented.

In recent years, TDR has been used to measure shear deformation in boreholes [6] or moisture content of geomaterials [7]. The paper of D. Ling et al. introduced an experimental study on the relationship between dielectric constant of TDR coaxial cables and water contents of rock-soil mixture.

As a novel visual sensing technology, PIV has great potential in deformation monitoring of physical models [8]. In the paper of G. Chen et al., the acceleration characteristics of a rock slide during laboratory testing are studied by using this technology. The failure mechanism of the rock slope model is analyzed based on the monitoring results of displacement fields. The paper of K.-W. Min et al. introduces a standalone vision sensing system for pseudodynamic testing of tuned liquid column dampers. X. W. Ye et al. present a critical review of the recent development of machine vision-based structural health monitoring. The basic methodologies and practical applications of this technology are discussed in detail.

Nowadays, Fiber Reinforced Polymer (FRP) is a widely used material for structural upgrades and ground improvement [9]. The field performance of this material should be explored carefully. In the paper of R. Krzywon et al., a self-monitoring strengthening system is developed based on carbon fiber laminate. Several trials have been conducted to evaluate the performance of this system.

We hope that this special issue would shed light on development and applications of smart sensing technologies in civil infrastructures and attract attention by the scientific community and civil engineering industry to pursue further investigations leading to the rapid implementation of these sensing technologies.

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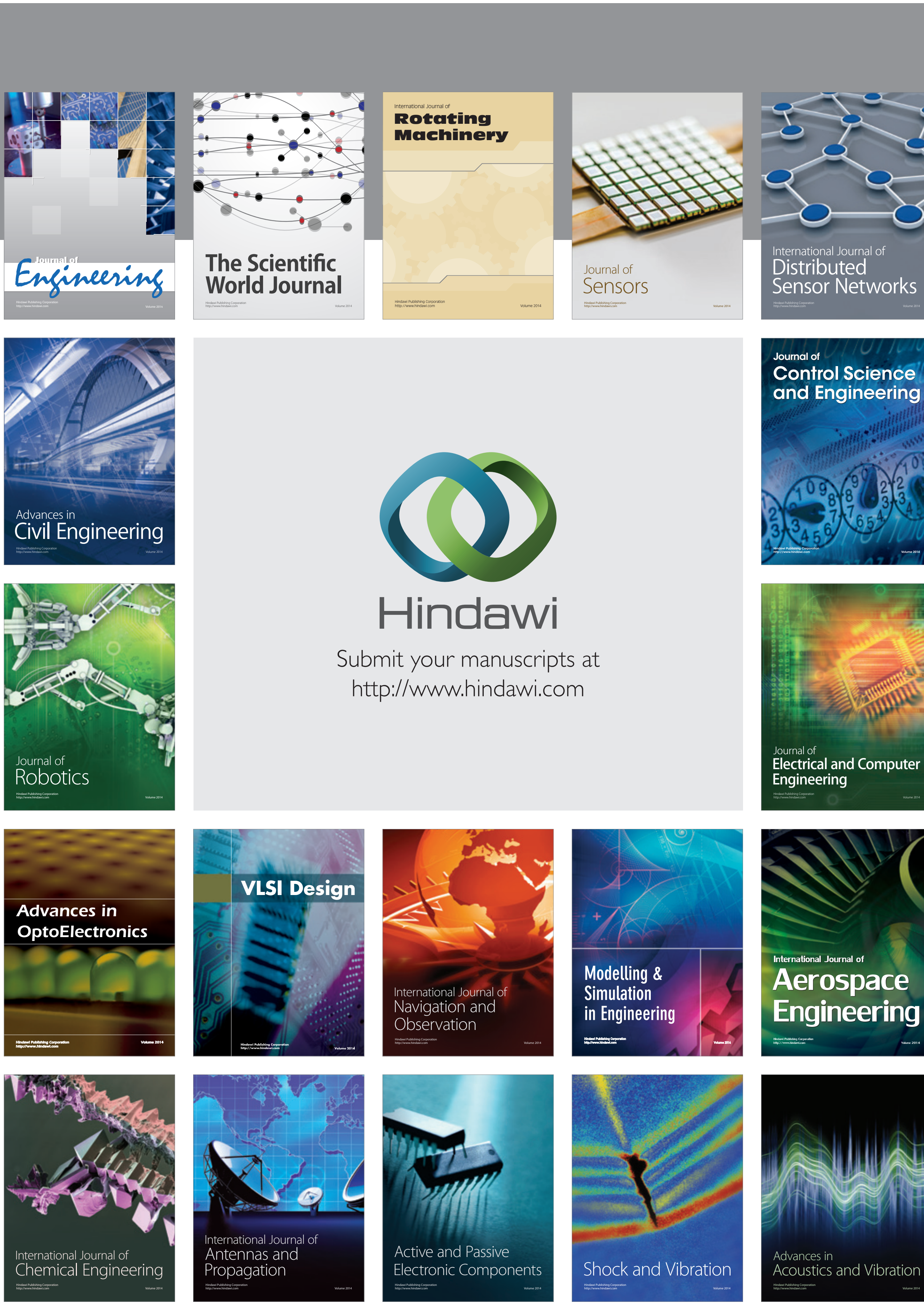
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