Guest Editorial
Unobtrusive Assessment of the Mechanical Aspects of Cardiovascular Function

THERE is a compelling need for unobtrusive cardiovascular monitoring in extra-clinical settings that remains unfulfilled by current technologies. As the population of patients burdened with chronic cardiovascular dysfunction, such as heart failure, continues to grow, we should find solutions 1) to obtain an efficient surveillance of the patient's health status in daily life, 2) to enable physicians to tailor therapy and rehabilitation programs on the basis of the real patient reaction to the everyday challenges, and 3) to expand our understanding of cardiovascular pathophysiology during spontaneous behavior. In clinics some of the most important parameters of cardiovascular performance that physicians consider are related to the mechanical aspects of cardiovascular function. However, current technology, often by ultrasound measures, does not facilitate the unobtrusive assessment of cardiovascular mechanics at home or during outdoor activities.

The aim of this special section is to present advances in the technologies for assessing the mechanical cardiovascular function outside of clinical settings. The articles were selected among the submissions received following an open call for papers.

The papers that were selected include a review of recent progress in ballistocardiography (BCG) and seismocardiography (SCG), methods for improved interpretation of wearable BCG, algorithms for annotating SCG signals, and detecting heartbeats from BCG.

The article, "*Ballistocardiography and Seismocardiography, A Review of Recent Advances,*" by O. T. Inan, P.-F. Migeotte, K.-S. Park, M. Etemadi, K. Tavakolian, R. Casanella, J. Zanetti, J. Tank, I. Funtova, G. K. Prisk, and M. Di Rienzo presents a comprehensive review of BCG and SCG measurement, interpretation, and clinical/physiology studies. The BCG and SCG signals are compared and contrasted, and shown alongside other more traditional physiological signals (such as the electrocardiogram, arterial blood pressure and impedance cardiogram). Challenges and open research topics are also presented and discussed.

The article, "*Towards Continuous, Non-Invasive Assessment of Ventricular Function and Hemodynamics: Wearable Ballistocardiography*," by A. D. Wiens, M. Etemadi, S. Roy, L. Klein, and O. T. Inan investigates wearable BCG signals, and provides guidelines on optimal sensor placement and feature extraction strategies for maximizing clinical relevance. Additionally, the paper presents methods for allowing the same analysis and interpretation techniques that have been developed over the past decade for spot BCG measurements to be applied to wearable BCG signals as well for continuous monitoring.

The article, "*Automatic Annotation of Seismocardiogram with High Frequency Precordial Accelerations*," by F. Khosrow-Khavar, K. Tavakolian, A. P. Blaber, J. M. Zanetti, R. Fazel-Rezai, and C. Menon presents algorithms for automatically annotating SCG signals to denote the isovolumic moment and aortic valve closure points. The authors used several approaches to annotate the waveforms and determined that the cardiac sound characteristic waveform approach yielded the highest accuracy.

The article, "*A Method of Detecting Heartbeat Locations in the Ballistocardiographic Signal from the Fiber-Optic Vital Signs Sensor,*" by M. Krej, L. Dziuda, and F. W. Skibniewski presents a flexible signal processing toolset for robust detection of heartbeat locations for cardiac vibrations signals measured using a fiber Bragg grating (FBG) sensor. The method resulted in high-accuracy heartbeat detection over long-term recordings. Additionally, the use of the FBG sensor could enable BCG measurement in environments such as magnetic resonance imaging scanners.

The guest editorial team greatly appreciates the quality of the papers submitted for consideration in this special section, and thanks the authors and reviewers for their time, hard work, and expert contributions.

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