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ABSTRACT

A method of continuously monitoring of a pulse transit variability time under natural interference

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The purpose of this dissertation was to develop a method of synchronous measurement and processing of biomedical signals such as electrocardiographic (ECG) and photoplethysmographic (PPG) signals which allows the determination of temporary pulse transit time. Based on the obtained temporary values, it is possible to determine the variability of this time. The dissertation presents the method of signal acquisition and filtering as well as the main algorithm that allows to determine in real time the temporary values of pulse transit times. The proposed algorithm consists of two independent parts for determining characteristic points from ECG and PPG signals based on which current values of pulse transit time are calculated. In addition, an important element of the algorithm is a dedicated signal quality evaluation block, which provides real-time information on the signal quality, allowing for possible correction of the position of the measuring sensors.

The dissertation is divided into four parts that correspond to the stages of the research work carried out by the author. The first part presents commonly known methods for measuring pulse transit time. This section focuses on commonly used methods of ECG and PPG signal analysis and processing, based on which temporary pulse transit time values are determined.

In the second and the largest part of the dissertation, data processing blocks that are core part of the proposed method are presented. The main data processing blocks include: a signal filter block, two independently blocks for determining characteristic points, a signal quality evaluation block and a block responsible for calculating target values of the pulse transit time. All processing blocks have been implemented in the MATLAB software.

The third part of the work concerns test research of developed processing blocks. This part also contains the final results of operational tests of the proposed method.

Finally, the presented results are summarized confirming the main thesis of the dissertation which is as follows: **it is possible to determine the variability of a pulse wave propagation time with sufficient accuracy for modern applications in medical diagnostic apparatus, using electrocardiographic and photoplethysmographic signals recorded in typical conditions.**

Keywords: biomedical engineering, pulse transit time, pulse arrival time, pulse wave velocity, electrocardiographic (ECG) signal, photoplethysmographic (PPG) signal.

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