Ring-Type Biomedical Eddy Current Sensor for Continuous Blood Pressure Monitoring

Abstract:

Continuous cuffless blood pressure (BP) sensors are evolving for long-term cardiovascular monitoring, especially in diagnostic and prognostic stages. The existing techniques rely on photoplethysmography (PPG) and bioimpedance that have limitations, such as sensitivity to skin tone and high skin-electrode contact impedance that would degrade physiological signal measurement. To this end, this study presents a novel wearable coil-based ring-type sensor utilizing the novel biomedical eddy current technique for continuous BP measurement. The LC-based ring sensor generates the ac magnetic fields along with the finger in parallel with the digital arteries, detecting the resonant frequency variations in response to real-time vessel pulsations. The proposed ring-type sensor is characterized by its compact form with a diameter of 2.42 cm and supporting wireless data transmission. To optimize personalized sensing, various resonant frequencies on vessel pulse measurements were investigated by human trials. The novel ring sensor is employed for the estimation of BP, demonstrating high Pearson's correlations [systolic BP (SBP): 0.88 and diastolic BP (DBP): 0.80] and low mean absolute error (MAE) within 10 subjects (SBP: 3.64 ± 2.71 mmHg and DBP: 3.20 ± 2.66 mmHg), revealing the significant potential use of biomedical eddy current-based ring sensor for continuous, accurate, and comprehensive cardiovascular monitoring.

Reference

S. -H. Ni, Y. -L. Sung, D. -Y. Hsu, C. -Y. Huang, D. -N. Lai and T. -W. Wang, "Ring-Type Biomedical Eddy Current Sensor for Continuous Blood Pressure Monitoring," in IEEE Transactions on Instrumentation and Measurement, vol. 73, pp. 1-14, 2024, Art no. 4010214, doi: 10.1109/TIM.2024.3450913.
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