

In Bed Contactless Cardiorespiratory Signals Monitoring Using Optical Fiber Interferometry

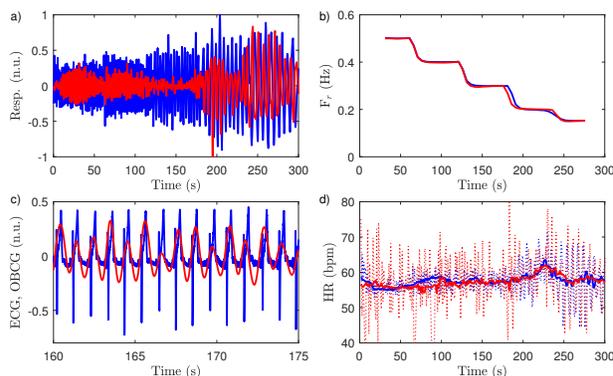
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Motivation and aim: Monitoring of cardiac and respiratory activity in clinical settings requires specific, expensive and usually wired devices, thus resulting in cumbersome configurations. Therefore, there is a large research interest in the development of noninvasive monitoring systems. In this study, we combined fiber-optic speckle interferometry with robust signal processing algorithms for contact-less heart and respiratory rates estimation in bed.

Materials: Four volunteers were recruited. While laying in supine position over a mattress, they were asked to breath at a guided stepwise-decreasing rate. Some of them also underwent a period of breath holding. Electrocardiographic and respiratory effort signals were acquired. Additionally, interferometric signals were recorded using fiber-optic settings placed beneath the mattress.

Methods: The optic interferometric signals were employed for estimating the heart and respiratory rates, which were compared with those obtained from the reference electrocardiographic and respiratory effort signals.

Results and conclusion: Low estimation errors for both heart and respiratory rates (1.63 bpm and 0.03 Hz in basal conditions and 2.09 and 0.03 Hz during the respiration protocol) suggests that the presented fiber-optic system could be suitable for contact-less patient monitoring, specially in overnight recordings or in particular scenarios such as magnetic resonances. System's response to breath holding also suggests that it may be possible to detect apneic events.



Real (blue) and estimated (red) respiratory effort signal (a) and respiratory rate (b). c): ECG (blue) and optic ballistocardiographic signal (red). d): Real (blue) and estimated heart rate (red).