Low-complexity intrauterine pressure estimation using the Teager energy operator on electrohysterographic recordings

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Abstract

Monitoring the progression of maternal uterine activity provides important prognostic information during pregnancy and parturition. Currently used methods for intrauterine pressure (IUP) measurement are unsuitable for long-term observation of uterine activity. The abdominally measured electrohysterogram (EHG) provides a non-invasive alternative to the existing methods for long-term ambulatory uterine contraction monitoring. A new low-complexity method for IUP estimation based on the Teager energy (TE) operator is proposed. The TE operator was used as it mimics the physiologic phenomena underlying the generation of the EHG signals. Several EHG signal analysis methods for IUP estimation from the literature are compared with the new TE method. The comparison is based on correlation and root mean square error of the IUP estimate with the gold standard internally measured IUP as well as their respective computational complexity. The proposed method results in a superior IUP estimation accuracy and complexity compared to state-of-the-art methods from the literature, with a complexity as much as 55 times lower. Therefore, the proposed method offers a valuable new option for long-term ambulatory uterine monitoring.