

ESTIMATION OF TRANSIENT SIGNALS: APPLICATION TO HIGH RESOLUTION ECG BEAT-TO-BEAT ESTIMATION

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Signal averaging is a well known widely used technique to recover very low-level periodic signals from noisy records. The results obtained by signal averaging have been of unvaluable interest in high resolution ECG (HRECG) for estimating ECG micropotentials such as the His-Purkinje, sinus activity and late potentials. The main features associated with the signal averaging technique are that it shows objectively the time constancy of the desired micropotential and it allows to link this micropotential with a given high level classical wave used for time synchronisation (e.g. QRS complex). These two features facilitate the interpretation and the understanding of the medical meaning of the phenomenon related with the estimated micropotential. However, when the relevant feature of a given micropotential is its random repeatability, signal averaging is of poor utility and beat-to-beat estimation can be advantageously used. In that context this study presents and compares both in simulated and real HRECG data a number of signal processing estimation techniques aiming to extract very low-level deterministic signals from noisy records in a beat-to-beat basis. Comparison is made between fast low computation on-line processing techniques such as modified least squares and more robust and heavy calculation techniques such as smoothing Kalman based techniques. AR time dependent modelling has been used as the key innovator step to best approach the transient character of HRECG micropotentials. Real data results are shown for the S-T and P-R intervals obtained both with normal and abnormal subjects. The results showed the robustness of the techniques against noise contamination and the well founded of the time dependent models used. From these results it is concluded that beat-to-beat estimation may be an helpfull tool for obtaining complementary information for interpreting signal averaging results.