

A novel approach for the design of fast-settling amplifiers for biosignal detection

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Abstract-

The most common method used to pick up biomedical signals is through metallic electrodes coupled to the input of high-gain, low-noise amplifiers. Unfortunately, electrodes, amongst other effects, introduce an undesired contact resistance and a contact potential. The contact potential needs to be rejected since it would otherwise cause the saturation of the input stage of the amplifiers, and this is almost always obtained by inserting a simple RC high-pass filter in the input signal path. The contact resistance needs to be estimated to ensure that it does not impair correct measurements. Methods exist for estimating the contact resistance by dynamically modifying the input network configuration, but because of the presence of the input RC filter, long transients are induced any time a switch occurs between different input configurations, so that the measurement time may become unacceptably long. In this paper, we propose a new topology for a DC removal network at the input of the differential signal amplifier that results in an AC filter whose time constant can be continuously changed by means of a control voltage. As such, we can speed up the recovery from transients by setting very short time constants (during the input resistance estimation process) while maintaining the ability to obtain very low cut-in frequencies by setting a much larger time constant during actual measurements. A prototype of the system was built and tested in order to demonstrate the advantage of the approach we propose in terms of reduced measurement time.

Index Terms- differential amplifier; DC removal; biological signals; electrode potential

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