別紙様式３

学位論文の要旨

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専　　攻 入学年度	宮崎大学大学院農学工学総合研究科博士後期課程 物質・情報工学専攻　専攻 （西暦）２０１３年度（　４月）入学
学位論文 題　　目	Study on Battery-less Signal Conditioner for a Biological Signal Measurement System Using Smartphone （スマートフォンを用いた生体信号計測システムのための バッテリレスシグナルコンディショナに関する研究）

In recent years, improving the quality of life and increasing healthspan are becoming global concern and challenges. For this reason, management of health on a daily basis, and measuring the own vital data, such as heartbeats, pulses etc., using various equipment are essential. Wearable devices are well known one of the equipment for biological signal measurement system. However, the cost of these devices is often expensive, because these consist many functions that are realized by the display, storage, analog front-end, cell battery and so on. The cell battery is one of the hardware, which prevents reducing the cost. On the other hands, energy harvesters often have a voltage rectifier circuit, which consists of active diodes with bulk regulation transistors and generates DC voltages from AC voltages. However, these diodes have the dead region, which does not ensure the stable operation of diodes (around -0.6V to +0.7V). For this reason, the conventional voltage rectifier circuit cannot generate expected DC voltage.

In order to overcome these problems, I propose battery-less signal conditioner and a new active diode with bulk regulation transistor and its application to the voltage rectifier circuit. Firstly with the proposed signal conditioner consists of an instrumentation amplifier, a filter, and a voltage rectifier circuit. The proposed signal conditioner positively uses some functions of a smartphone. The biological signal, sensed by using a sensor, is converted to the digital data through the microphone terminal with A/D converter in the smartphone. And, the proposed signal conditioner is supplied the power through the earphone terminal of the smartphone. For this reason, the proposed signal conditioner does not require the battery in own device. In addition, the microphone output and the earphone input can be used at the same time by using control software of smartphone, which parallelized processing of the earphone output and the microphone input. The proposed signal conditioner was verified through the measurement of surface electromyogram using discrete parts and smartphone (iOS). As a results of evaluation, the proposed system was operating correctly. The proposed active diode with bulk regulation transistor can eliminate the dead region by using a control signal from the comparator, which construct active diode. Next, we apply the proposed active diode with bulk regulation transistor to the integrated voltage rectifier circuit. The proposed active diode with bulk regulation transistor and voltage rectifier circuit were fabricated using a 0.6 μm standard CMOS process. From experimental results, the proposed active diode with bulk regulation transistor eliminates the dead region perfectly, and the proposed voltage rectifier circuit generates +2.86V (positive side) and -2.70V (negative side) under the condition that the amplitude and frequency of the input sinusoidal signal are 1.5V and 10kHz, respectively, and the load resistance is 10 kΩ.

（注１）　論文博士の場合は、「専攻、入学年度」の欄には審査を受ける専攻のみを記入し、入学年度の記入は不要とする。
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