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Author: Angelo Taibi Mirco Andreotti Gianluigi Cibinetto
Angelo Cotta Ramusino Giacomo Gadda Roberto Malaguti
Luciano Milano Paolo Zamboni



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Development of a plethysmography system for use under microgravity conditions

Angelo Taibi^{a,b,*}, Mirco Andreotti^b, Gianluigi Cibinetto^b, Angelo Cotta Ramusino^b, Giacomo Gadda^a, Roberto Malaguti^b, Luciano Milano^a, Paolo Zamboni^c

^a*Dipartimento di Fisica e Scienze della Terra, Università degli Studi di Ferrara, via Saragat 1, 44122 Ferrara, Italy*

^b*INFN, Sezione di Ferrara, via Saragat 1, 44122 Ferrara, Italy*

^c*Centro Malattie Vascolari, Università di Ferrara, via Aldo Moro 8, 44124 Ferrara, Italy*

Abstract

We present a novel application of strain-gauge plethysmography that is suitable to detect blood volume variations in the human venous system. The plethysmography system uses capacitive sensors that are electrically connected to a portable electronic unit to record changes of blood volume over time. Such system has been developed within a project that aimed to monitor the cerebral venous return of the astronaut during an experiment on the International Space Station. In this work, we describe the novel solution in which measurement of elongation is directly obtained by charging the sensor capacitance with a constant current. We also report the full characterization of the plethysmography system and an example of the experimental protocol that has been performed in microgravity condition. Remarkably, the system we propose is able to detect cross-sectional area variations of neck veins with enough sensitivity to be useful for studies concerning cardiac oscillations.

Keywords: strain-gauge plethysmography, capacitive sensors, cerebral venous outflow, International Space Station

*Corresponding author

Email address: taibi@fe.infn.it (Angelo Taibi)

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