

**Name:** Univ.-Prof. Dr.-Ing. Dr. med. Steffen Leonhardt

**Address:**

Philips Chair of Medical Information Technology (MEDIT)  
Helmholtz-Institute of Biomedical Engineering  
RWTH Aachen University  
Pauwelsstr. 20, D-52074 Aachen  
Phone: +49 (0) 241-80 23211



**Education and Scientific Activities**

1985 - 1987	M.S. degree in Computer Engineering, SUNY at Buffalo, NY, USA.
1982 - 1989	Dipl.-Ing. degree in Electrical Engineering, Technical University of Darmstadt, Germany. Major in Control Engineering.
1989 – 1998	Medical School, J.W. Goethe University Frankfurt, Germany. Part-time Ph.D. student at TU Darmstadt.
1995	Doctorate in Electrical Engineering (Dr.-Ing.), “magna cum laude”
2001	Doctorate in Medicine (Dr. med.), “summa cum laude”
Since 2003	Full Professor and Head of the Philips Chair of Medical Information Technology at RWTH Aachen University.

**Professional Activities**

- Associate editor of “Biomedizinische Technik” (official journal of the German Society of Biomedical Engineering, DGBMT), since 2006
- Organisation of the 4<sup>th</sup> Workshop on *Body Sensor Networks* (BSN 2007) in Aachen in March 2007.
- Liaison Officer (“Vertrauensdozent”) of the German National Academic Foundation (“Studienstiftung des Deutschen Volkes”) at RWTH Aachen University, since 2004.
- Head of the joint VDI/VDE GMA-DGBMT working group AUTOMED (“Automatic Control in Medicine”), 2003-2004.
- Scientific Advisory Board of the VDI/VDE Society for Measurement and Automatic Control (GMA), since 2001. Head of the control applications sections, since 2007.
- Senior Member of the IEEE Engineering in Medicine and Biology Society (EMBS) and Control Systems Society (CSS).
- Member of the German Association for Electrical, Electronic & Information Technologies (VDE), subsection German Association of Biomedical Engineering (DGBMT).
- Member of the Association of German Engineers (VDI), subsection VDI/VDE Society for Measurement and Automatic Control (GMA)
- 5 years of industrial experience as a R&D project manager at Dräger Medical AG & Co. KG, Lübeck, Germany (1999 – 2003)

**Awards**

- Fulbright Scholarship for Graduate Studies at SUNY at Buffalo (1985-1987)
- Scholarship of the German National Academic Foundation (“Studienstiftung des Deutschen Volkes”, 1985-1988)
- **2<sup>nd</sup> Price** in the medical software contest "**Medizin-Software '92**" at MEDICA 92 (World largest medical devices fair, 18.-21. Nov. 1992)
- **1<sup>st</sup> Price** in the medical software contest "**Medizin-Software '97**" at MEDICA 97 (World largest medical devices fair, 19.-22. Nov. 1997)
- Dean’s price for the most outstanding medical thesis of the year, J.W. Goethe University Frankfurt, Medical School, 2002.

## Selected MEDIT Research topics related to “Wearable Biomedical Sensors and Systems”

### 1. The wearable Aachen “Thirst Sensor”

In this project, we want to address the problem of dehydration and malnutrition of the elderly patient by using bioimpedance spectroscopy. Ongoing research addresses hardware design, investigation of textile electrodes, physiological modeling of fluid distribution and experimental investigations in local elderly homes and – for comparison - during dialysis.

Project “NutriWear” funded by BMBF (German Federal Ministry of Research)

#### Selected References:

- o L. Beckmann, G. Medrano, S. Leonhardt, “Tragbares Bioimpedanz-Spektroskopie Messgerät (in German)”, Joint Annual Meeting of the German, Austrian and Swiss Biomedical Engineering Societies, ETH Zürich, Switzerland, 6.-9. September 2006.
- o G. Medrano, L. Beckmann, N. Zimmermann, T. Grundmann, T. Gries and S. Leonhardt, “Bioimpedance Spectroscopy with textile Electrodes for a continuous Monitoring Application”, 4<sup>th</sup> International Workshop on Wearable and Implantable Body Sensor Networks (BSN 2007), Aachen, 26.-28. März 2007.
- o [www.google.de](http://www.google.de): check for “durstsensor”



### 2. Wearable SaO<sub>2</sub> sensing

In this project, we develop electronic components and signal processing algorithms for an in-ear measurement device for heart rate and SaO<sub>2</sub> detection. We also focus on signal processing and artefact cancelation. Finally, we aim at applying the device in sleep surveillance and for monitoring in the ICU.

Project “In-Monit” funded by BMBF (German Federal Ministry of Research)

#### Selected References:

- o S. Vogel, M. Hülsbusch, D. Starke und S. Leonhardt, „Herzraten-Monitoring mit einem mikro-optischen In-Ohr Sensor (in German)“, 41st Annual Meeting of the German Biomedical Engineering Society - BMT 2007, Aachen, 26.09. - 29.09.2007.



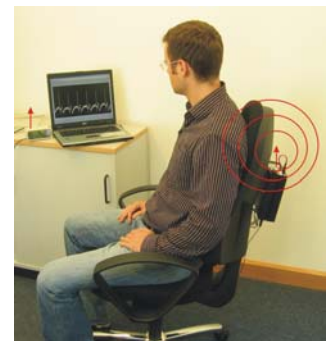
### 3 . Capacitive measurement of biopotentials

In this project, we are establishing and improving a capacitive technique to measure biopotentials without conductive contact (i.e., through cloth). A major challenge is how to deal with movement artefacts and with static charges. First demonstrators have included office chairs and car seats, but the final goal is textile integration for mobile use.

Project will be funded within the EU project “HeartCycle” starting Jan. 2008

#### Selected References:

- A. Aleksandrowicz, M. Walter und S. Leonhardt, „Ein kabelloses, kapazitiv gekoppeltes EKG-Messsystem (in German)“, Biomedizinische Technik, Vol. 52, Nr. 2, pp. 185–192, 2007.



### 4. Inductive measurement of vital signals using eddy currents

In this project, we are developing a magnetic contact-free technique to measure changes in bioimpedance related to heart and lung activity. Due to its simplicity, we have developed a single coil setup for mobile application, but we also work on multi-coil scenarios. One future step is a complete textile integration.

Project will be funded within the EU project “HeartCycle” starting Jan. 2008

#### Selected References:

- o S. Leonhardt, A. Aleksandrowicz and M. Steffen, “Magnetic and Capacitive Monitoring of Heart and Lung Activity as an Example for Personal Healthcare”, 3rd IEEE-EMBS Int. Summer School and Symposium on Medical Devices and Biosensors, MIT, Boston, USA, Sept.4-6, 2006.
- o M. Steffen, A. Aleksandrowicz and S. Leonhardt, “Mobile Non-contact Monitoring of Heart and Lung Activity”, IEEE Trans. on Biomedical Circuits and Systems, submitted for publication.

