V 43

Sensor components of a miniaturized implant for haemodynamic controlling

Jens Weidenmüller, Fraunhofer IMS, 47057 Duisburg, Germany, Michael.Goertz@ims.fraunhofer.de
Özgü Dogan, Fraunhofer IMS, 47057 Duisburg, Germany, Oezgue.Dogan@ims.fraunhofer.de
Alexander Stanitzki, Fraunhofer IMS, 47057 Duisburg, Germany, Alexander.Stanitzki@ims.fraunhofer.de
Mario Baum, Fraunhofer ENAS, 09126 Chemnitz, Germany, Mario.Baum@enas.fraunhofer.de
Dirk Wünsch, Fraunhofer Institut für Elektrische Nanosystem, System Packing, Chemnitz, Deutschland
Maik Wiemer, Fraunhofer Institut für Elektrische Nanosystem, System Packing, Chemnitz, Deutschland
Michael Görtz, Fraunhofer IMS, 47057 Duisburg, Germany, Michael.Goertz@ims.fraunhofer.de

Continuous monitoring of physiological parameters in cardiovascular areas allows early detection of critical conditions which may lead to clinical symptoms and hospitalization, if not treated in time. Thereby early diagnostics, optimization of therapy and reduction of therapy costs can be achieved.
In medical applications it is generally recommended to obtain high-precision pressure measurements. Especially controlling of haemodynamics in pulmonary artery requires a very accurate detection of physiological changes in pressure having the additional challenge of a very high miniaturization level. Therefore, the concept of the presented implantable multi sensor system utilizes, amongst others, capacitive pressure sensor elements which are monolithically integrated in a CMOS process and suitable for medical implants due to their design. Additionally, activity and inclination elements, a temperature sensor unit and different self-monitoring functions, e.g. monitoring of the supply voltage, are implemented. Thus, further information about the patient are obtained, so that inaccuracies or faulty pressure measurements can be corrected in consideration of these measurands.
The core element of the implant is a multi-functional Application Specific Integrated Circuit (ASIC, recently developed at Fraunhofer IMS) which is able to handle all measurements but also power management and communication with the extracorporeal electronics. The implantable device operates without any battery. Each component is simulated and designed in such a way, that very low power consumption allows telemetric operation distances up to 15 cm. The communication is according to the international standard for passive RFID item level identification for air interface communications at 13.56 MHz (ISO/IEC 18000-3). The antenna is located within a ceramic interposer, which connects all components with each other. First results show that the multi sensor system, without any encapsulation layer, fulfill requirements to obtain high accuracy pressure measurements with errors < 2 hPa.

V 44

Flow characterization in a multiplexing infusion system

Saif Abdul-Karim, Medizinische Sensor- und Gerätetechnik, Fachhochschule Lübeck, Lübeck, Deutschland, saif.abdul-karim@fh-luebeck.de
Yanglei Tan, Medizinische Sensor- und Gerätetechnik, Fachhochschule Lübeck, Lübeck, Deutschland, yanglei_tan@foxmail.com
Jörg Schroeter, Medizinische Sensor- und Gerätetechnik, Fachhochschule Lübeck, Lübeck, Deutschland, joerg.schroeter@fh-luebeck.de
Bodo Nestler, Medizinische Sensor- und Gerätetechnik, Fachhochschule Lübeck, Lübeck, Deutschland, bodo.nestler@fh-luebeck.de

Multi infusion systems impose life-threatening risks to patients (e.g. dosing errors). Several studies have stressed that unknown or ambiguous factors in drug administration might cause or contribute to the occurrence of many adverse drug events. In a previous work, we characterized the flow behaviour of a multi infusion system as one of these factors. Here, we present the flow behaviour in a drug multiplexing infusion system in vitro. A drug multiplexing infusion system is aimed to reduce the dosing errors that present in classical multi infusion systems. The idea of drug multiplexing is to administer medications in one catheter (instead of multi channels) reaching the patient to minimize the number of connection tubes. The flowing medications are separated by a separation medium. This helps to decrease the total dead volume of the delivery and also to reduce the potential of patient infection (e.g. bacterial infection). Therefore, a dedicated set-up was built. Solutions were prepared to resemble real medications. The solutions were delivered in varying flow rates via a central catheter into a flow-through cuvette in the set-up. An algorithm was developed and implemented for the dosing flow profiles. On-time measurements were carried out for the determination of solutions' concentrations by UV-VIS spectrophotometery. The drug multiplexing infusion system has a much lower compliance effect than in the multi infusion system. Results showed that, in drug multiplexing infusion system, the medications have higher dosage accuracy than normal multi infusion systems. Furthermore, less dosing fluctuations were noticed in the multiplexing infusion system. The influences of dosing rates, separation quality, influence of dye precipitation and of absorbance on the recorded spectra were noticed. However, the accurate dosage of the multiplexing infusion system can be affected by residuals in the selective valve, set flow rate, air supply and by the properties of the dosed solutions.

V 45

Concept of a small-size and low-cost respirator for one way usage

Henning Jürß, Allgemeine Elektrotechnik, Universität Rostock, Rostock, Deutschland, henning.juerss@uni-rostock.de
Martin Degner, Allgemeine Elektrotechnik, Universität Rostock, Rostock, Deutschland, martin.degner@uni-rostock.de
Hartmut Ewald, Allgemeine Elektrotechnik, Universität Rostock, Rostock, Deutschland, hartmut.ewald@uni-rostock.de

This paper describes the concept of an innovative low-cost respirator with potential use as disposable. It mainly consists of a respiration mask, including a ventilation blower and integrated sensors and electronics. All functionality will be realized by the mask system. With this feature, the respirator does not need external devices and the commonly used respiratory tubes. On the contrary to conventional emergency-respirators, which usually are large, heavy and expensive, this low-cost respirator will be characterized by a lightweight and space-saving construction. All parts of the respirator are located closely to the patient, so the limited space around the patient will be free for alternative usage. Therewith it will be a particularly suited respirator in case of disaster or pandemic event, when it is essential to transport many of stocked respirators quickly and with little effort to a worldwide point of usage.
The respirator benefits of a simple design and contains sensors to ensure a safe operation. The airway pressure will be monitored to protect the patient and to allow pressure-controlled ventilation. Conditions like airway occlusion or leakage will be identified and indicated automatically. Preliminary researches with a model-based algorithm indicates the capability to identify the static lung parameters resistance and compliance and, by implication, the calculation of gas flow and the applied tidal volume, too. Cost and functionality will be clearly reduced in comparison to conventional emergency-respirators, implying a simplified handling. Nevertheless the respirator will feature the capability to adjust the parameters end-inspiratory and exspiratory pressure, I:E and respiration rate. The control will be realized by an operating panel or by using external mobile devices, which will be capable to visualize data. With a mean power consumption of P_{Mean}<20 W, powered out of line voltage or a battery, the respirator ensures operation, even in case of patient transport or blackout.