



UNIVERSITÄT ZU LÜBECK



FACH  
HOCHSCHULE  
LÜBECK

University of Applied Sciences

## **Program: Biomedical Engineering**

### **Master's Thesis**

#### **Title:**

DESIGN AND DEVELOPMENT OF A TEST BENCH TO SEPARATE DRUGS  
IN A MULTIPLE-INFUSION SYSTEM USING GAS BUBBLES

#### **Summary:**

Patients in Intensive Care Units (ICUs) require to be supplied with up to 15 different medications simultaneously. Central Venous Catheter (CVC) is a method that suffices for this purpose. However, possible complications or infusion errors can result from the use of CVC. These errors include bleeding, pain, shifting of catheter, blockage or kinking of catheter and infection.

A way to reduce the severity of infusion errors is to minimize the likelihood of catheter blockage and kinking. A possible solution could be the substituting of multiple catheters by one catheter reaching patient's side, and administering drugs through in succession. Meanwhile, drugs must be separated inside the catheter to prevent mixing and undesired reactions.

The separation of different drugs in a catheter in a systematic approach that mimics the conditions at clinic is not totally examined yet.

The Institute for Sensors and Medical Devices at Lübeck University of Applied Sciences, runs a project named Drug Multiplexing. The goal of this project is to find reliable solutions for main problems related to drug administration and to explore other aspects toward a better Drug delivery system.

This thesis will discuss the design, implementation and development of a test bed used to investigate the principle of replacing different catheters by only one catheter. The setup consisted basically of four systems. A 4-channel syringe pump was used for delivering the mimicked drugs and a rotary valve was used for orderly flow of drugs. A matching system to synchronize work of the syringe pumps with the valve was designed and implanted as well as a console with software to control the overall work flow was considered to be the fourth part of the test bed. Finally, the design was realized. It was sufficient to demonstrate the concept and feasibility of a test bed which is envisioned eventually to be State of the Art Drug Multiplexing.

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