Institut für Textiltechnik und Lehrstuhl für Textilmaschinenbau
RWTH AACHEN UNIVERSITY

Project title: Stimulate

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The STIMULATE research campus (Solution Centre for Image Guided Local Therapies) is a joint research project of Siemens Healthcare GmbH, Otto von Guericke University (OvGU) Magdeburg and the STIMULATE Association, of which RWTH Aachen University has been a member since 2020. In the STIMULATE research campus, an interventional therapy approach is being pursued in which needles are inserted into the center of the disease under computer tomography- or magnetic resonance imaging-supported control in order to destroy the tumour through local energy delivery. However, imaging systems available to date have been developed primarily for diagnostics and are only provisionally adapted for navigation during operations. One of the reasons why interventional imaging via magnetic resonance imaging (MRI) for operations has not yet become widely accepted is image distortions, so-called artefacts. Compared to computer tomography, these often occur with MRI and disturb the image quality. Particularly in connection with MRI during interventional procedures, these are often motion artefacts, i.e. image disturbances caused by patient movements. One sub-project therefore aims at an innovative correction of the imaging. On the basis of pressure measurements on the patient table, movement states can be derived. These movement models are already known in in-patient care, but have not yet been further developed for complex movement corrections in imaging procedures.

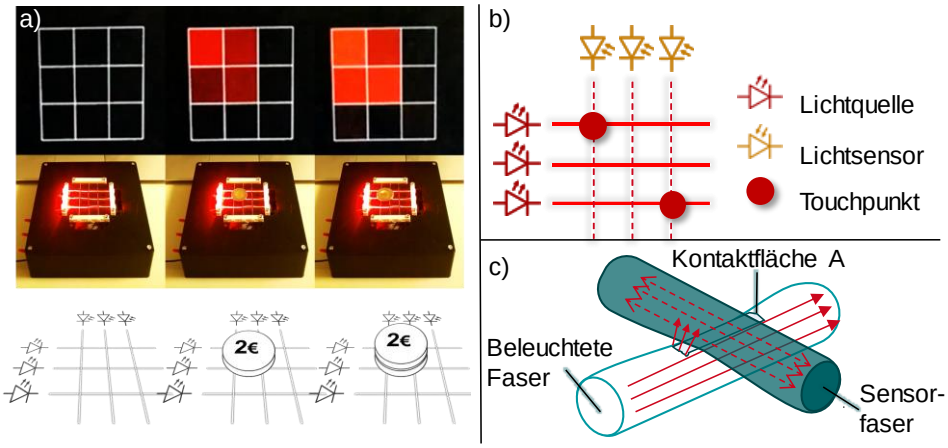

Figure 1: Pressure load measurement using cross-coupled polymer optical fibres (POF): a) Photo of 3x3 demonstrator, b) Schematic figure of 3x3 demonstrator, c) Principle of cross coupling.

The Institut für Textiltechnik (ITA) of RWTH Aachen University is involved in this sub-project with the process for producing polymer optic fibres (POF)

with different degrees of hardness and, at the same time, sufficiently low optical attenuation. The POFs serve as sensor fibres for two-dimensional pressure measurements in MRI, where conventional pressure measurements based on capacitive or piezoelectric modes of operation do not work due to the high electromagnetic fields. The light cross-coupling between the POF in an array is exploited to enable conclusions to be drawn about the load on the respective coupling points (see Figure 2c). To optimise this coupling, the fibres are first simulated with a raytracing algorithm and then meltspun with different optical polymers. Figure 2a) and b) show the current 3x3 demonstrator.

The fibres produced by ITA are contacted with LEDs and photodiodes by ITP GmbH, Chemnitz, whose signals are read out and processed by Incoretex GmbH, Aachen. The OvGU, Magdeburg is developing a model for reconstructing the movement profiles of the patients in the MRI (see Figure 2) from the measured pressure distributions.

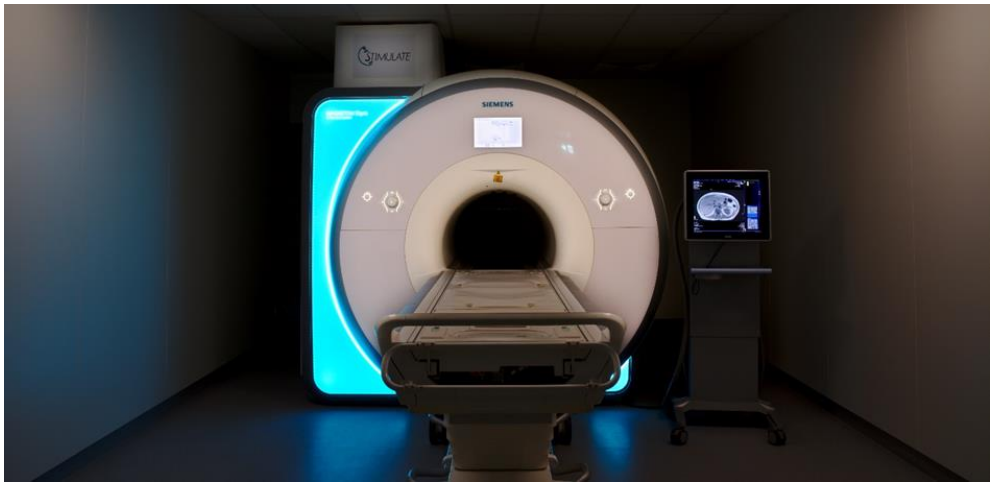

Figure 2: Magnetic resonance scanner at the STIMULATE research campus in Magdeburg, Photo: Thomas Gerlach, Forschungscampus STIMULATE

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