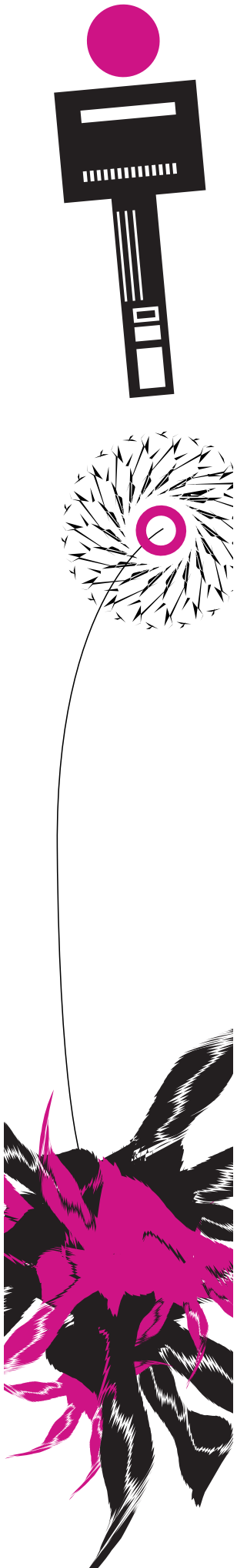

ROBOTICS AND MECHATRONICS

CREATING A MR SAFE ROBOTIC PLATFORM

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Contents

1 Abstract

MRI scanners are very common and widely used medical imaging systems. At the moment, the imaging and treatment stages are separated meaning that the patient is repeatedly moved into and out of the MRI scanner. Large steps into the direction of automated localisation and positioning have been taken for breast biopsies with e.g. the Stormram and Sunram systems. However, there seems to be a larger trend toward more such systems for various purposes in and around the MRI scanners. At the moment, each separate line of research generally starts with designing a suitable and specialised MR Safe or MR Conditional robot.
It would be vastly advantageous to the development of new MRI procedures and methods if there is a solution available that enables 'plug-and-play' functionality on at least the robotic positioning part of the issue. Therefore, this research focuses on creating a universal 6 DOF, MR Safe robotic platform which can be used with different tool-tips in order to enable further development in all manner of MRI procedures such as e.g. cryo-ablation, which are candidate for being performed inside MRI scanners.
A universal 6 DOF, MR Safe robotic platform has been created which uses compressed air to actuate MR safe, pneumatic motors and gearboxes located in each joint. These actuators have demonstrated a torque as high as 17.7 N m at 5.0 bar of pressure. The overall robot arm is capable of exerting a force of 8.3 N. When the exerted force is kept below 2.5 N the deviation of the end-effector can be <2 mm.
Combined with the easily interchangeable end-effector and the use of only MR Safe materials it can be concluded that the result is a usable, universal 6 DOF MR Safe robotic platform which is able to enable further development of MRI procedures and equipment.