

Internes Kolloquium

Am **Mittwoch, dem 11. Januar 2012**, um **14:00 Uhr** hält

M.Sc. Stanley A. Mungwe
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im Rahmen seiner beabsichtigten Dissertation einen Vortrag mit dem Titel

Adaptive Control of a Tactile Surgical Navigation System

Der Vortrag findet im OFFIS, Escherweg 2, Konferenzraum F02 statt.

Zusammenfassung:

Commercially available surgical navigation systems provide a remote monitor from which the surgeon receives spatial information about the surgical tool and surrounding tissues. The remote monitor forces the surgeon to look away from the area of interest on the patient, which may increase the risk of injury. Thus non-optical man machine interfaces in surgical navigation have garnered much interest.

A solution proposed by Kneissler et al. (2003) attempts to solve this problem by automatically switching the surgical tool on when it is within the working area and off when it is outside of the working area. Although this provides for redundancy of the surgeon while easing their cognitive burden, it is limited in its uses because it can only be applied to powered instruments.

Thus Hein et al. (2007) proposed a new multimodal surgical navigation system where tactile signals in conjunction with an optical display provide feedback to the surgeon. The tactile signals, which indicate spatial information critical for navigation, are provided through vibroactuators attached to the back of the surgeon's hand. The advantages that come with this new concept include:

- The display is brought right where the surgeon needs it,
- There is minimal gazing away from field of operation,
- Tactile signals can be perceived simultaneously with visual, auditory and other signals,
- Tactile signals can substitute for an overused, impaired, or unavailable sensory channel,
- There is a low risk of the saturation of optical canal and hence
- Low risk of injury.

Results presented in Brell et al. (2008) and Mungwe et al. (2010) show that tactile signals alone can assist a human in performing surgically related tasks, and that a combination of tactile and visual signals provide a tangible performance improvement over visual signals alone. However, large performance differences manifest themselves between deferent users and deferent times. These flaws can be partly accounted for by the following:

- Attentional tunneling/narrowing: In highly demanding situations, the surgeon may focus on a small group of sensory inputs and not feel stimulus,
- An intuitive tactile language, one that requires very little cognitive processing to interpret, may be very difficult to design or require extensive training,
- May be difficult to detect a stimulation if the hand of the surgeon is in motion, whether the motion is self propelled or environmentally caused,
- The increase of cognitive burden and
- The saturation of users to tactile signals.

In order to obtain more consistent and reproducible motor reactions from the human in response to tactile signals, the system must be designed to adapt to the human.

Thus, this thesis presents an adaptive controller for the multimodal navigation system. The concept is to consider the surgical procedure as a control problem with the human as the plant. An adaptive control algorithm is developed, studied and applied to the system and experiments to compare the accuracy of the system with and without adaptation are designed and conducted. As a matter of fact this thesis sets out to achieve the following goals:

- Increase consistency and reproducibility of response to tactile signals,
- Reduce the effect of saturation to tactile signals,
- Reduce the time taken to finish surgical task,
- More precise control of instrument position.

Betreuer: Prof. Dr.-Ing. Andreas Hein

Weitere Kolloquiumstermine sind im WWW abrufbar.