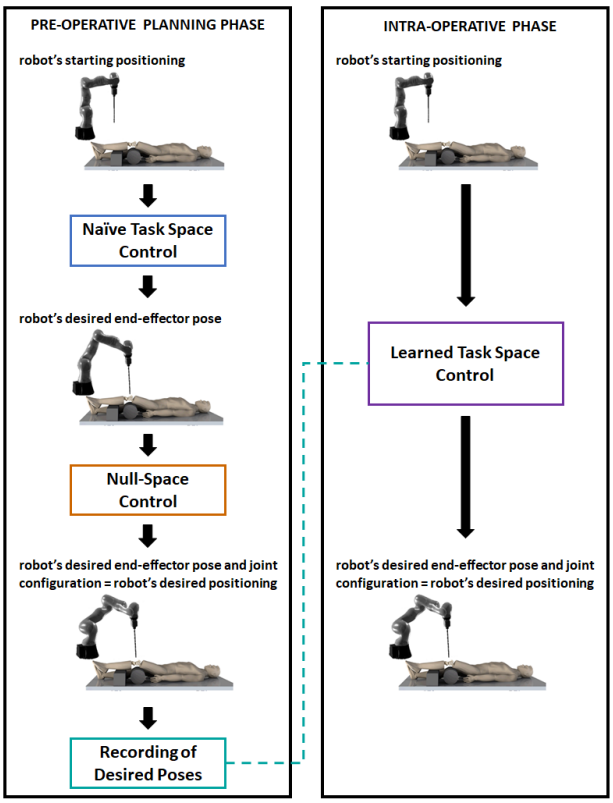
University of Basel

Department of Biomedical Engineering

Reducing Time and Surgeon Mental Workload for Robot Positioning in Operating Room using Learned Desired Null-Space Joint Configurations

Robotic arms in surgery (BIROMED-Lab)



Proposed control system usage in a surgical setting (Image: Riccardo Parini)

Master Thesis by Riccardo Parini (Politecnico di Milano) at BIROMED-Lab.

The main advantages in applying robot-assisted surgical systems in clinical practice are the perfect symbiosis between the strengths of humans, namely surgeons or their assistants, and robots. While surgeons are versatile, sensitive, ethical and able to acquire qualitative information, robots provide high accuracy, multitasking capabilities, and various types of control schemes.

However, the functionalities that would allow a surgeon to optimally collaborate with the robot are still missing. Certainly, one of these missing functionalities is the possibility for the surgeon to correctly position the surgical robot in the operating room during the intra-operative phase without wasting time and exerting unnecessary mental workload.

In this work, we implemented a novel control system for a surgical robotic arm, which allows reducing the time and the mental workload required from a surgeon to position the surgical robot in the operating room at the onset of the intra-operative phase. The proposed control system was used to telemanipulate a 3D model of a KUKA LBR iwaa 14 robotic arm that holds an actuated endoscope used to perform minimally invasive laser osteotomy at the level of the patient's knee (1). The proposed control system was evaluated with a study that showed a reduced overall effort for operators compared to a standard control system.

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References:
(1) Karnam, M., Parini, R., Eugster, M., Cattin, P., Rauter, G., Gerig, N.: An intuitive interface for null space visualization and control of redundant surgical robots. In: Automation in Medical Engineering. Infinite Science Publishing (2020)