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***Abstract*—Currently force feedback in teleoperation is subject to numerous constraints on time delay and accuracy. Nonetheless, results show that implementing this type of feedback in teleoperated robotic surgery gives vastly better results. In this paper we propose a new method of teleoperating the DaVinci surgical robot using force feedback. The various constraints are adressed individually in each section.**

I. Introduction

Over the last couple of decades the use of robotics for minimally invasive surgeries has increased, because of its precession and the reduction in tissue damage [1]. One brand of the operation tools in use is called an Endowrist. These are constructed in such a way, that the operator of the tools has the ability to manipulate it as a human wrist.

The feedback to the operator right now is only done by live video transmissions. Due to this is the only kind of feedback the operator has to guess on how much force there is applied under the surgery e.g to the skin or organs. In experiments it has been shown that haptic feedback has an huge positive effect for the reduction in surgical error [2].

The purpose of haptic feedback is to feedback the external force applied to the end effector back to the operator. This should simulate the situation of the operator doing the operation by hand instead of remote.

The force feedback could be done as direct force feedback calculated from the resistance on the actuators but as the tool is highly non-linear the transparency of the controller will become less transparent. It would be possible to solve this problem by implementing a sensor to the end effector to measure the force but due to the demand of high hygiene the tools have to be sterilized at temperatures over a 100° C which could damage the sensor(s). Furthermore it is stated by law that each surgical tool has to be discarded after a few times in use. This means that the cost of the tool has to stay as low as possible and therefore make the idea of implementing an expensive sensor not ideal.

Therefore the force feedback got to be estimated through the actuators which gives a high demand for the feedback controller as it has to be as precise as possible to feedback the correct force to the operator.

Another important subject is the transparency of the feedback as the operator should have the feeling of doing the operation by hand and not remote. This puts a demand on the speed of the feedback loop as the faster the loop runs the more smooth the force feedback to the operator will feel.

In the first section we will take an overview of our proposed control system as a whole, briefly presenting each of the components and their interaction. The second section will cover methods used to create a dynamic model of the Endowrist and proposed methods of translating the estimated force to actual force fed back to the operator. The third section contains descriptions of various problems pertaining the requirement of transparency and explanations of methods used to address them. Finally, we present (the expected) experimental results in section four and and draw a short conclusion in section five.

II. System overview

Our proposed system

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III. Conclusion

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REFERENCES

[1] Giulianotti, P. C., Coratti, A., Angelini, M., Sbrana, F., Cecconi, S., et al., *Robotics in General Surgery Personal Experience in a Large Community Hospital* Archives of Surgery: pp. 777-784.

[2] H. Kopka and P. W. Daly, *Effects of haptic and graphical force feedback on teleoperated palpation* Robotics and Automation: pp. 677 - 682.

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