

## Design and Optimization of a 6 Degrees of Freedom Co-Manipulated Parallel Robot for Prostate Brachytherapy

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**Abstract :** In this paper, we propose designing and evaluating a parallel co-manipulated robot dedicated to low-dose-rate prostate brachytherapy. We developed 6 degrees of freedom compact and lightweight robot easy to install in the operating room thanks to its parallel design. This robotic system provides a co-manipulation allowing the surgeon to keep control of the needle's insertion and consequently to improve the acceptability of the plan for the clinic. The best dimension's configuration was solved by calculating the geometric model and using an optimization approach. The aim was to ensure the whole coverage of the prostate volume and consider the allowed free space around the patient that includes the ultrasound probe. The final robot dimensions fit in a cube of 300 300 300 mm<sup>3</sup>. A prototype was 3D printed, and the robot workspace was measured experimentally. The results show that the proposed robotic system satisfies the medical application requirements and permits the needle to reach any point within the prostate.

**Keywords :** medical robotics, co-manipulation, prostate brachytherapy, optimization

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