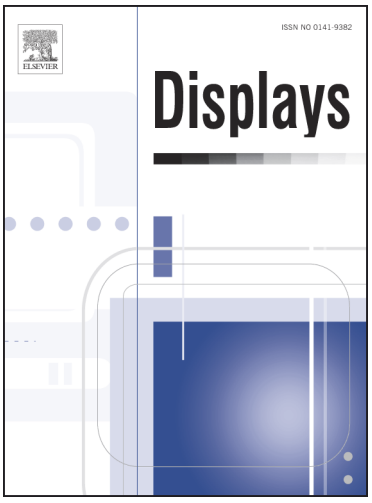

Design and Implementation of Haptic Virtual Fixtures for Preoperative Surgical Planning

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Design and Implementation of Haptic Virtual Fixtures for Preoperative Surgical Planning

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Abstract: *Haptic virtual fixtures (VFs) are force feedback mechanisms that enhance the human performance of tele-operative procedures where visual guidance suffers from many limitations. Many papers have explored the integration of VFs with tele-robotic procedures. However, only a few studies have included preoperative planning to their assembly. We created a novel VF design using procedures that require navigation along a path. Our design is based on the assembly of VF elements that fit along the path. To improve the design, we performed experiments to define the optimal properties in terms of highest accuracy and shortest task completion times for path-following procedures. The feasibility of the proposed method was tested on a preoperative simulated surgical planning task. Results demonstrate that the integration of the proposed VFs, which combine haptic force-field guidance and forbidden-region constraints with visual cues, increases accuracy and reduces the time taken to perform tasks.*

Keywords: *Virtual fixtures, Surgical planning, Haptic guidance, Forbidden region, Tele-robotic surgery*