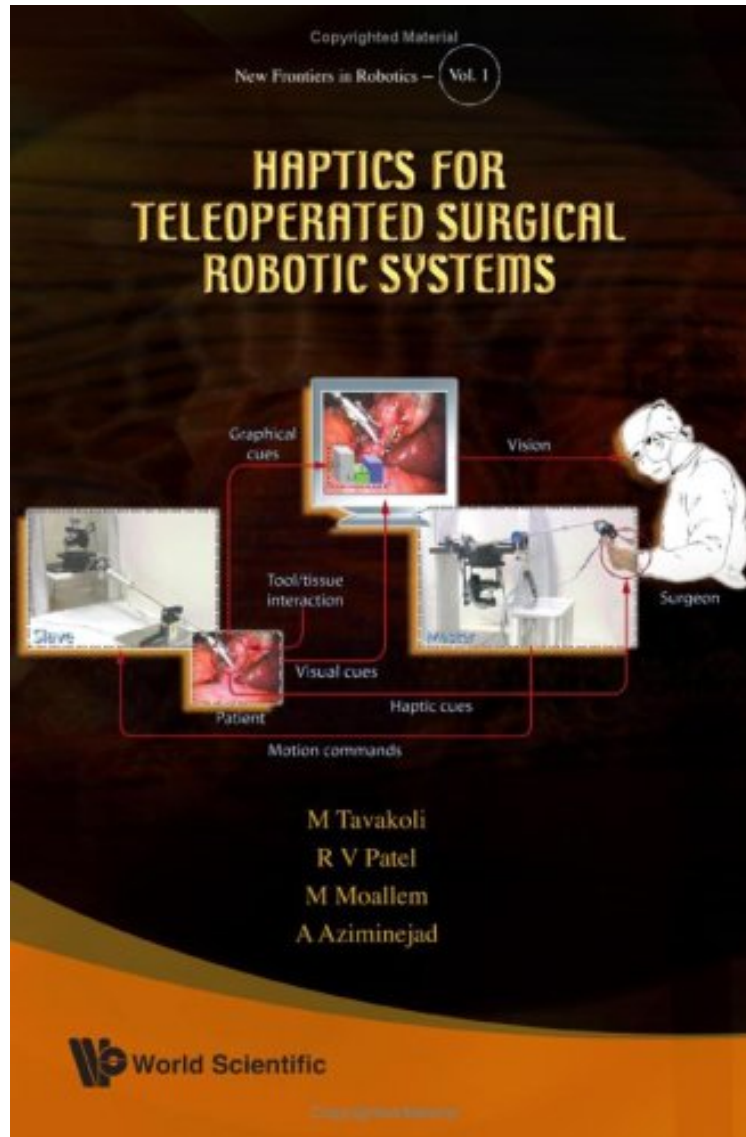


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## Haptics for Teleoperated Surgical Robotic Systems (New Frontiers in Robotics)

*M Tavakoli, R V Patel, M Moallem, A Aziminejad*  
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An important obstacle in Minimally Invasive Surgery (MIS) is the significant degradation of haptic feedback (sensation of touch) to the surgeon about surgical instrument's interaction with tissue. This monograph is concerned with devices and methods required for incorporating haptic feedback in master-slave robotic MIS systems. In terms of devices, novel mechanisms are designed including a surgical end-effector (slave) with full force sensing capabilities and a surgeon-robot interface (master) with full force feedback capabilities. Using the master-slave system, various haptic teleoperation control schemes are compared in terms of stability and performance, and passivity-based time delay compensation for haptic teleoperation over a long distance is investigated. The monograph also compares haptic feedback with visual feedback and with substitution for haptic feedback by other sensory cues in terms of surgical task performance. Readership: Researchers in robotics, teleoperation, haptics, virtual reality, sensor technology, human machine interaction, and minimally invasive surgery and therapy.