

Supplementary Information

Path Planning of Surgical Robot for Minimally Invasive Surgery on Riemannian Manifold.

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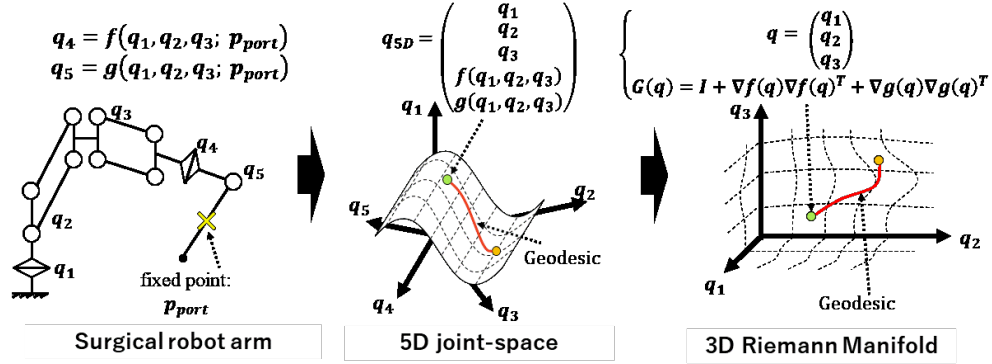


Figure S1. The position space of the five-link robot arm for minimally invasive surgery is transformed into a Riemannian manifold to perform path planning in the joint space.

Contribution of the paper are as follows.

1. A method for path planning in joint space by transforming the position space into a Riemannian manifold is proposed for surgical robot for minimally invasive surgery. An edge cost function is defined to search for a desired path in the joint space and reduce the range of motion of the joint.
2. By representing concave obstacles in the position space as a combination of non-concave obstacles in the joint space, the distance to the obstacles can be efficiently calculated using a gradient algorithm.
3. Experimental result demonstrated that the method can generate trajectories with reduced joint motion.

Video S1 showed the movement of the surgical robot using the proposed path planning method.