

Closed-Form Three-Dimensional Path Generation Based on Polynomial Interpolation of Waypoints

A polynomial-based three-dimensional path generation method is proposed. The path between neighboring waypoints is constructed using polynomials in the local path-frame, instead of interpolating given waypoints in the inertial coordinate system. A local path-frame is defined for each of the path segments between neighboring waypoints as a rectangular coordinate system with its origin on the prior waypoint and one of its axes in the direction from the prior waypoint to the following waypoint. To guarantee the curvature continuity of the path, quintic polynomials are used for interpolation. The coefficients of the interpolating polynomials are determined analytically using the information of the position, unit tangent vector, and curvature vector boundary conditions. The proposed algorithm does not require any iterative numerical procedures. It may be stated that the proposed algorithm is appropriate for the problem that on-line path-replanning is required. Numerical simulation is performed to demonstrate the performance of the proposed method.