

On the Computation of Equilibrium Configurations of Elastically Coupled Nodes in Potential Fields

Abstract

Elastically coupled nodes exposed to artificial potential fields can be used as a model for path planning of autonomous mobile devices in unknown environments. In doing so, a possible path is provided by a spline interpolation of the nodes in their equilibrium positions. Repulsive potential fields are assigned to non-valid areas and moving obstacles identified by environmental sensors. In general the potential fields are nonlinear functions of position and time. Therefore, the equilibrium positions of the nodes can only be determined numerically. A modification of the Newton-Raphson method for this application is introduced and discussed with respect to its convergence properties. Finally, the method is illustrated by a simulation example.