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Motion Planning on Lie Groups with Applications to Spacecraft Attitude Guidance and Docking

This talk will present a general (kinematic) optimal control problem, quadratic in cost, defined on the frame bundle and isometry group of the planar forms that are subject to prescribed boundary conditions on the group. This class of optimal control problem lifts to an integrable Hamiltonian system and the extremals are solved explicitly in terms of Jacobi elliptic functions. A simple structure preserving shooting method is then used to match the boundary conditions at the level of the group. It is then shown how the results of these general optimal control problems can be used in practical motion planning for spacecraft both in applications to attitude guidance and docking.