1044-49-144 **Peter Crouch** and **Nikolaj Nordkvist*** (nikolaj@hawaii.edu), Department of Mechanical Engineering, University of Hawaii at Manoa, 2540 Dole ST. - Holmes Hall 302, Honolulu, HI 96822. *Optimal Control Problems and Geodesics on Quadratic Matrix Lie Groups.*

The classical geodesic problem on a quadratic Lie group G has solutions generated by a set of differential equations on $G \times \mathfrak{g}$. On a restricted set these equations are equivalent to a symmetric set of equations on $G \times G$—this is the so-called "symmetric representation" of the geodesic problem. It turns out that these two sets of equations are nothing but restrictions of two equivalent sets of equations giving the solutions to the optimal control problem on $Gl(n)$ with controls constrained to be in $\mathfrak{g}$.

If the controls for the optimal control problem on G are further constrained to a certain subset of $\mathfrak{g}$ the extremals are generated exactly by the symmetric representation. By restricting the corresponding flow to a suitable invariant set it becomes Hamiltonian, and at least for $G = SO(n)$ we are able to prove that this flow represents the extremals for the optimal control problem with control constrained to the interior of the prescribed set. (Received August 29, 2008)