Benjamin Sheller* (bsheller@iastate.edu) and Domenico D’Alessandro. The Cut Locus in $K-P$ sub-Riemannian Problems.

We consider here a class of sub-Riemannian problems on Lie groups $G$ where the dynamical equations are of the form $\dot{x} = \sum_j X_j(x)u_j$ and the $X_j = X_j(x)$ are right invariant vector fields on $G$ and $u_j := u_j(t)$ the controls. The vector fields $X_j$ are assumed to belong to the $P$ part of a Cartan $K-P$ decomposition. These types of problems admit a group of symmetries $K$ which act on $G$ by conjugation. Under the assumption that the minimal isotropy group in $K$ is discrete, we prove that we can reduce the problem to a Riemannian problem on the regular part of the quotient space $G/K$. On this part we define the corresponding quotient metric. For the special cases of the $K$-$P$ decomposition of $SU(n)$ of type $A_{III}$ we prove that the assumption on the minimal isotropy group is verified. Moreover, under the assumption that the quotient space $G/K$ with the given metric has negative curvature we prove that the cut locus has to belong to the singular part of $G$. As an example of applications of these techniques we characterize the cut locus for a problem on $SU(2)$ of interest in the control of quantum systems. (Received February 05, 2019)