1143-49-519 **Domenico D'Alessandro*** (daless@iastate.edu), Department of Mathematics, Iowa State University, 440 Carver Hall, Ames, IA 50011. *Geometric Optimal Control of a Class of Quantum Systems.*

In the control of finite dimensional quantum systems, a very common class of time optimal problems is amenable of explicit solutions. These are called K-P problems. The K-P structure refers to an underlying Cartan-type K-P decomposition of the Lie algebra su(n) such that only the operators corresponding to the P part of the decomposition appear in the Schrodinger equation of the system. The time optimal control problem is equivalent to finding appropriate sub-Riemannian geodesics. We describe the case of a two level quantum system (qubit) and use it to illustrate the general theory. In particular, we explicitly derive the minimum time trajectories between any two states for this system. This analysis also reveals some general features of the optimal synthesis such as: the cut locus, the geometry of the set of reachable states at each time and the sub-Riemannian diameter. Furthermore, such an analysis leads to the general consideration of the role of symmetries in optimal control problems. The explicit nature of the solution of the optimal control problem provided lends itself to generalizations to other systems of interest in applications. We shall in particular illustrate the case of N qubits controlled in parallel in minimum time. (Received August 21, 2018)