

F. Jean : *Control of non-holonomic systems and sub-riemannian*

The sub-riemannian geometry is the underlying geometry for so called non-holonomic controlled systems. In the study of such systems, it plays the same role as euclidian geometry in linear systems. One of the objectives of this course is to show how a fine understanding of metric structure of sub-riemannian manifold, in particular their tangent metric structure, allows to approach problems of control for non-holonomic systems. After an introduction to non-holonomic systems (illustrated in particular by recent examples coming from neurophysiology), the first part of this course will concern the metric structure of sub-riemannian manifolds (privileged coordinates, nilpotent approximation, « ball-box » theorems, Hausdorff dimension) tangent structure (metric tangent space, desingularisation, uniform estimates for the distance function). The second part will deal with problems of the planning of motions for non-holonomic systems, in particular, methods recently developed in Ruixing Long's thesis (in collaboration with Yacine Chitour and FJ). Complexity questions in planning in presence of obstacles, and non-holonomic interpolation will be also treated.