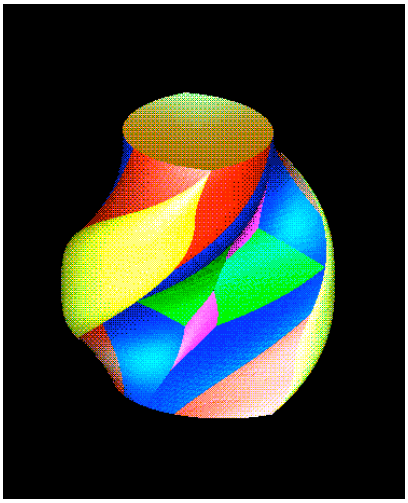
Jean-Paul LAUMOND

Mardi 21 juin 2005
Conférence Géométrie Différentielle

15h00 – 15h45

Geometry of nonholonomic systems

A car moves without sliding. The tangent line to its trajectory supports its direction. Such a constraint defines a 2-dimensionated distribution on a 3-dimensionated manifold (two position parameters and one direction parameter). This distribution is not integrable, i.e. the reachable space for a car remains 3-dimensionated in spite of the no-sliding constraint. A car is said to be a nonholonomic system.
The talk gives an overview of the research performed during the 90's in motion planning for nonholonomic robots. A special focus will be done on effective and exact methods to account for small-time controllability (Lie algebra rank condition): few of them are based on optimal control while other ones apply for the class of so-called flat systems. The general problem remains an open problem that should be addressed by numerical methods based on nilpotent approximations.
Then we will see how these differential geometry techniques may be integrated in computational schemes to allow mobile robots or trailer-trucks to plan their motions in cluttered environments autonomously. We will report on experience feedback based on the mobile robot Hilare and the simulation of the convoys transporting the Airbus A380 components.
The conclusion will open some current research perspectives on human locomotion.



The wave front of a car

Jean-Paul LAUMOND
LAAS-CNRS,
7 Avenue du Colonel Roche
31077 Toulouse, France
Tel: +33 (0)561 33 63 47
Fax: +33 (0)561 33 64 55
jpl@laas.fr