1040-93-135 **Fatima Silva Leite*** (fleite@mat.uc.pt), Department of Mathematics, University of Coimbra, Largo D. Dinis, 3030-401 Coimbra, Portugal. *The geometry of rolling.* Preliminary report.

Rolling maps describe how one smooth manifold rolls on another, without twist or slip. The most well studied of these nonholonomic mechanical systems is the rolling sphere. The main difficulty when extending notions of rolling to other manifolds is that geometric intuition is easily lost.

We will focus on the geometry of rolling a Riemannian manifold on its affine tangent space at a point. Both manifolds are equipped with the metric induced by the Euclidean metric of the embedded space. This rigid motion generates a curve of contact on each manifold and an important feature in the geometry of rolling is the relationship between the covariant derivatives of the velocity vector fields along these curves of contact. This motivates a new approach to interpolating curves on Riemannian manifolds.

The equations of a rolling motion can be described by a control system with constraints on velocities, evolving on the Euclidean group of rigid motions, describing simultaneously rotations and translations in space. Choosing the controls is equivalent to choosing the curves along which the two manifolds touch. Issues like controllability and optimal control of rolling motions can then be addressed. (Received January 30, 2008)