The cut locus $C(p)$ of a point $p$ on a surface $F$ is by definition the set of cut points of $p$. In rough terms the cut locus consists of those points in the surface where the geodesic circle from $p$ ‘crosses over itself’ when progressing through increasing radii as indicated in figure 1.

Cut loci have applications in e.g. robotics: to understand globally what are the shortest pathways in configuration space; and in optics: to understand the structure of focal points of light rays radiating from a point and constrained to lie in a surface.

On a sphere we have $C(NorthPole) = SouthPole$ and $C(SouthPole) = NorthPole$. But what does the cut locus look like on more general surfaces? What is the structure of the cut locus for various points on, say, a cylinder, an ellipsoid, a paraboloid, a torus, a surface of revolution?

There is an interesting conjecture - and several nice pictures - in the recent paper [3] by R. Sinclair and M. Tanaka concerning the structure of cut loci on surfaces of revolution of torus type generated by closed profile curves in the profile plane.
2 Methods involved

Solving the geodesic differential equation system together with a method to trace the crossings of the geodesic circles from given initial points and a method to extract the cut locus from these crossings.

2.1 Estimated specific types of work loads

- Theory: ***
- Maple: ****

References

