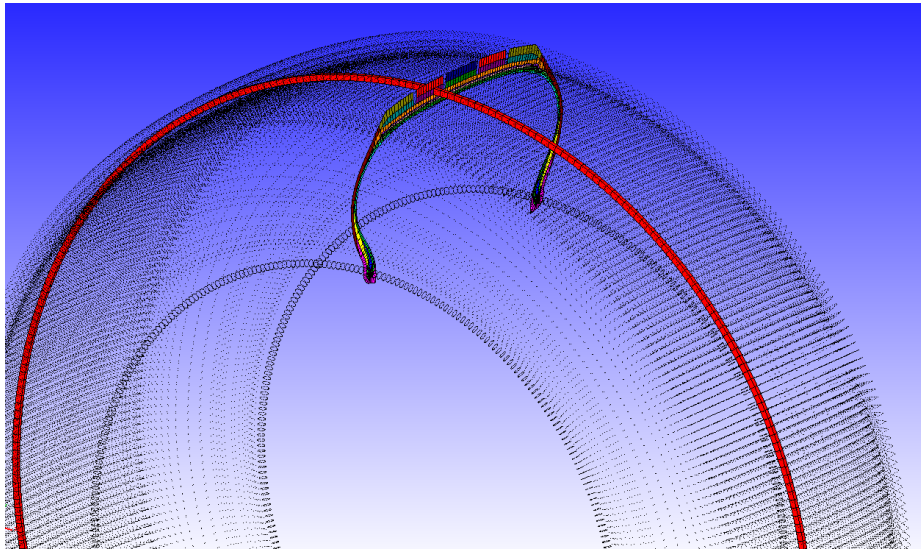


Sensitivity computation for a system of weakly coupled PDEs

DTO/SIM Team –Michelin Technology – Talk by T. Homolle and L. Huet

Rolling tire mechanics yields complex problems with large deformations, non-linear, incompressible materials, and contact. It has been nonetheless simulated with success for years using finite element analysis. Tire design requires finding the right design parameters to enhance rolling properties such as rolling resistance. It is usually solved by an optimization loop, whether automated or with a human designer. Computing the sensitivity of properties of interest is key in improving the process. In our talk we will demonstrate how to take into account weak coupling between the 3D large deformation problem on a fast time scale, and the associated 2D-axisymmetric heat diffusion problem, on a slower time scale, in order to compute the sensitivity of rolling resistance with respect to material properties.



While classical adjoint methods can be used to compute the respective partial derivatives of rolling resistance with respect to design parameters for the deformation problem and the heat diffusion problem, taking into account thermo-mechanical coupling requires the non-trivial computation of cross-derivatives of formulations with respect to degrees of freedom (i.e. the deformation field and the temperature field). The issue boils down to computing the derivatives of heat sources with respect to deformation. It is solved by independently applying an adjoint method on each streamline in the tire.