Steering optimal design of a three wheeled tilting vehicle.

D. Dopico[1], A. López[1], E. Sanjurjo[1], A. Luaces[1], J. Cuadrado[1].

[1]Universidade da Coruña, Mendizabal, s.n., Ferrol, Spain.

Three wheeled tilting vehicles in tadpole configuration are an alternative to common bicycles and motorbikes. The dynamics of such a vehicle can be adjusted to mimic the "equivalent" bicycle dynamics, but the engineer must face additional design problems compared to a common bicycle design.

In this work, the steering optimization of the tilting three wheeled vehicle multibody model shown in Figure 1 is addressed. The steering system should satisfy Ackermann's steering condition, not only for null roll angles (the typical design for a car steering) but also for any combination of roll and steering angles. Moreover, the relation between the handlebar rotation and the wheels angles should be approximately equivalent to the single handlebar-wheel mount of a common bicycle. The optimization performed is gradient-based and relies on the multibody sensitivity equations derived in [1].

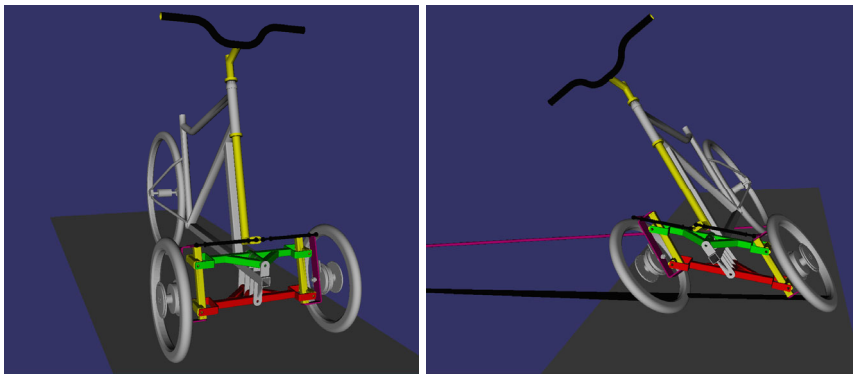

Figure 1. Three wheeled tilting vehicle (unoptimized configuration).

[1] D. Dopico, F. Gonzalez, A. Luaces, M. Saura, D. Garcia Vallejo. Direct Sensitivity Analysis of Multibody Systems with Holonomic and Nonholonomic Constraints via an Index-3 Augmented Lagrangian Formulation with Projections. Nonlinear Dynamics, vol. 93, no. 4, pp. 2039-2056, 2018.