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NUMERICAL SIMULATION OF ROLLING TIRES USING ISOGEOMETRIC ANALYSIS

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Tire industry has been using the Finite Element Analysis (FEA) as an important part in the workflow of the design and study of tires. Robustness and accuracy of the numerical simulations is rapidly increasing with different techniques for the proper characterization of the inelastic material behavior. Moreover, in order to avoid the limitations of FEA in relation to the accuracy of the geometrical representation, Isogeometric Analysis (IGA) has been proved efficient in numerous fields [1]. Within this approach, the geometry is described in an exact manner using a set of Non-Uniform Rational B-Splines (NURBS) basis functions, which is also used for the field variables.

In this contribution, numerical simulations for rolling tires using IGA are presented. An Arbitrary Lagrangian-Eulerian (ALE) formulation is used to describe the rolling phenomenon at steady state. In this formulation, the reference frame is neither attached to the material particles, nor fixed in space. While there are many advantages of this type of formulation, particularly with respect to computational time, the treatment of inelastic material models requires special attention. Different numerical examples are presented, where the modeling of complex tire geometries is done in a CAD software using NURBS. Tire maneuvers like acceleration, braking and free rolling are described in detail with special attention to the contact behavior using higher order basis functions. The flexibility of this models for mesh refining while keeping the exact geometry is highlighted. Important remarks and a discussion on the results obtained close this presentation.

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