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CVT CHAIN MODELLING: A CONTINUOUS MODEL VS. A MULTIBODY APPROACH

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ABSTRACT - The CVT transmissions represent nowadays a possible answer to the requirements of the modern automotive market in terms of reduction of the polluting emissions, without penalising the drive feeling and comfort. Since a great deal of research has been spent in the last two decades to optimize the CVT drivetrain, it is evident, indeed, that the modelling of the CVT transmission plays a fundamental role for the design and control of the transmission itself. Actually, the chain drives gained high interest if compared to the pushbelts for their low manufacturing costs and for the ability to easily scale the chain design for extremely high torque applications.

We developed a bidimensional lumped mass multibody model of a CVT chain drive. A pin-jointed chain has been considered where each pin is modelled as a mass point with two translational degrees of freedom. The chain pins are connected with *n* links, replaced by massless spring-damper elements. The pulley deformation is taken into account employing the Sattler's sinusoidal approximation of the deformed groove angle. The outcomes of the simulations of the multibody model, in terms of forces distribution and kinematic behaviour, have been compared with a well-known CVT model, the CMM model, which describes the chain as a one-dimensional continuum body. Our simulations show, indeed, a good agreement between the two models; however, we remark the drawbacks of the multibody approach in terms of time needed to perform the simulations, and the difficulty encountered in choosing the correct initial conditions. This is in contrast with the continuous characterization of the CMM model, whose simple formulation is very useful to estimate the performance of the chain transmission in terms of traction capabilities and efficiency with small computational effort.