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Performance comparison of half and full toroidal traction drive CVTs

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Toroidal CVT is an ideal automotive transmission system in terms of simplicity, fuel economy and performance. It consists of two discs forming a toroidal cavity and a power roller enclosed in a casing containing lubricant at very high pressure. In order to get the CVT with lesser mechanical losses, efficiencies of full-toroidal and the half-toroidal drives are estimated analytically. The present investigation aims at establishing the design guidelines for the geometry and dimension parameters of this CVT layout for uniform axial loading and optimal ratio range. First a kinematic analysis is done in order to find the speed ratios followed by the dynamic analysis where forces on different parts are analyzed. For estimating the torque losses through the bearings, the SKF model for the frictional torque calculation (in case of ball /roller bearing) or hydrodynamic lubrication theory (in case of journal bearing), is used. These frictional torque losses are distributed among the input and output shafts depending upon the ratios of the final input and output torque. A fully developed isothermal fluid film contact model between the discs and rollers, based on the results of EHL theory, is used to evaluate the slip and spin losses. With this method, the traction coefficient and slip can be predicted within 10% accuracy which makes the optimum control of the normal force of the power transmitting contact of a toroidal CVT. The effects on efficiency due to variation in traction drive parameters (half cone angle, cavity radius, fluid property) are also found out.

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A novel four wheel vehicle

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A new arrangement of wheel location has been considered for a four wheel vehicle so that the turning radius can be reduced greatly. The front axle is to use one wheel only instead of two wheels of a conventional vehicle. The middle axle is to use two wheels and the rear axle is to use one wheel. The single wheels of the front and rear axle will be placed at the mid position so that the arrangement becomes symmetrical. This arrangement helps us to follow the law of correct steering for all angular positions. The steering mechanism will be such that the front and rear wheels will rotate equal amount but in opposite directions. A crossed four bar mechanism has been used to rotate the front and rear wheel while the vehicle is taking a turn. The rotation of each wheel will be 30 degree and the maximum steering error is 0.2 degree only. The wheels on the middle axle will not be rotated due to steering but are connected to the differential gear box to transmit motion. The intersection of the front and rear wheel axis will be always on the axis of the middle axle. Hence pure rolling will take place while the vehicle is taking a turn. The design enhances the life of the tires and parking of this vehicle will be easier. Each wheel of the middle axle shall have two tires so that it can bear more load and increases stability of the vehicle while taking a turn.

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