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Off-road tyre modelling II: effect of camber on tyre performance☆

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Abstract

The problem of off-road vehicle tyre-terrain interaction is that it is difficult to model accurately. For an off-road vehicle over medium to firm terrain, the tyre load may be entirely supported by the tips of the lugs, or with a minimum carcass contact with the terrain. In this case, the effect of the lugs should be taken into consideration. The forces at the interface between lugged tyre and the soil, including normal and shear stresses, are discussed in this paper. The multi-spoke tyre model was developed to study the effect of tyre lugs on the forces between tyre and terrain and it has been extended to predict the tyre forces and moments in the case of combined lateral and longitudinal slip for a *cambered* tyre. The influence of slip angle, *camber* angle and soil hardness on off-road tyre performance has been investigated. A computer program was developed using MATLAB software. The results were derived as tyre forces and moments in the three directions along the tyre contact length. A comparison between the results of the multi-spoke tyre model of a smooth off-road tyre and an off-road tyre with straight lugs, in the *cambered* case, has been made. The results indicated that slip angle, *camber* angle and soil characteristics have a strong effect on off-road tyre performance. The modified mathematical model results help the off-road tyre engineering designers to predict accurate values of tyre forces and moments in this complex case.

Keywords: Off-road vehicle performance; Tyre forces; Tyre modelling; Lugs; Camber angle

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