基于侧向变刚度的轮胎多边形磨损机理分析 Mechanism of Polygonal Wear of Tire Based on Variable Stiffness of Lateral

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关键词： 车辆 轮胎 多边形磨损 变刚度 机理

摘 要： 考虑轮胎接地摩擦的非线性特性，建立了基于侧向变刚度的轮胎多边形磨损模型，并对系统的稳定性进行了分析，指出轮胎的自激振动是一种由系统Hopf分岔引起的稳定周期振动现象，通过数值仿真得到了引起胎面自激振动的车速和车轮前束角范围。结果表明：轮胎多边形磨损为一种典型的非线性自激振动现象，其发生与胎面的侧向振动有关，磨损边数近似等于胎面的侧向振动频率与车轮转动频率之比。所建模型能够很好地解释轮胎多边形磨损的形成机理。 Considering the nonlinear characteristic of tire’s grounding friction, a polygonal wear model of tire was established based on variable stiffness of lateral. Then the stability of system was analyzed, and the self-excited vibration of tire was proved to be a kind of stable periodic vibration caused by Hopf bifurcation of system. Finally, the ranges of speed and toe-in angle which could motivate self-excited vibration were given through numerical simulation. The results showed that the polygonal wear was a typical nonlinear self-excitation vibration phenomenon caused by the tread’s lateral self-excited vibration, and the polygonal number was equivalent to the ratio of the lateral vibration frequency of tire tread to the rotational frequency of tire. This model could explain the formation mechanism of the polygonal wear of tire.

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