ABSTRACT

Hydroplaning phenomenon is one of the major factors that must be considered to ensure safe driving on wet road surfaces. In this paper, the approach to numerical simulation of the physical hydroplaning characteristics using patterned tire is described. A detailed 3-D patterned tire model is constructed by in-house modeling program and the water flow is considered as incompressible. The complex tire material compositions are effectively modeled using composites, and rubber properties generalize the Mooney-Rivlin model. The finite element method (FEM) and the advanced finite volume method (FVM) are used for structural and for fluid-tire interaction analysis, respectively. Performance prediction of hydroplaning via coupling of computational fluid dynamics (CFD) and FEM has delivered a detailed insight into the local mechanisms and root causes of hydroplaning. Numerical examples were verified by comparing the experimental test results and it is confirmed to indicate similar correlation tendency and high reliability. The effect of driving velocity, pattern groove size, and pattern direction on hydroplaning phenomenon of tire is discussed and logical results were obtained.

Keywords:

Tire, Hydroplaning, Finite Element Method, Computational Fluid Dynamic, Fluid Structure Interaction.