The 10th TSME International Conference on Mechanical Engineering
10th – 13rd December 2019
Pattaya, Thailand

# Development of Transient Dynamic Finite Element Model for Drum Testing of Non-Pneumatic Tire

**R Rugsaj[1,2], and C Suvanjumrat[1,2,*]**

[1]Department of Mechanical Engineering, Faculty of Engineering, Mahidol University, Salaya, Nakhon Pathom, 73170, Thailand
[2]Laboratory of Computer Mechanics for Design (LCMD), Department of Mechanical Engineering, Faculty of Engineering, Mahidol University, Salaya, Nakhon Pathom, 73170, Thailand

* Corresponding Author: chakrit.suv@mahidol.ac.th

**Abstract**. Non-pneumatic tire (NPT) or airless tire must be designed to meet the required performance such as weight, load carrying capacity and resistance to cyclic loading. The tire dynamic response are also needed to be observed since the tire are constantly subject to cyclic loading while rolling. Drum testing method is preferred over other rolling tire testing method since various factors from the vehicle suspension system and pavement structure are eliminated. This article aimed to develop the finite element (FE) model based on transient dynamic approach for drum testing of NPT. The finite element model of NPT was created using Ogden hyperelastic material model. The FEM of NPT, which composed of Tread band and Spokes, was model using 3D hexagonal and 2D Quadrilateral elements respectively. The rebar elements and tying equation were used to model steel belt layers of the NPT. The FE model of NPT was then assigned to contact with the rigid drum surface using Coulomb's friction model. The finite element analysis of drum testing method of NPT as the drum was assigned to be rolling at speed of 11 km/hr. The NPT spoke deformations at each position and angle was compared to the experiment to prove validity of the model. The analysis results of spoke deformation was shown to be in a good agreement with the experiment at the average error of 3.51%. The developed FE model of NPT based on transient dynamic approach can be used to evaluate the important dynamic response of NPT during rolling and can be useful in designing the NPT.

**Keywords:** Non-pneumatic tire, Finite element method, Transient dynamic, Drum testing, Hyperelastic.