

DEVELOPMENT OF NON-PNEUMATIC FIBER COMPOSITES TIRES FOR HAZARD REDUCTION AND ROAD SAFETY IMPROVEMENT

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ABSTRACT

Pneumatic tires are one of the greatest inventions in recent human history. They have influenced the development of automobile industry. Although modern tires provide good ride comfort and vibration absorption, they are still subjected to adverse problems such as wear, puncture or blowout that in some cases could compromise the road safety and lead to accidents of different severities. The source of hazard in pneumatic tires is mainly due to their dependence on air. Therefore, by introducing the concept of non-pneumatic tires such limitations can be avoided. Recently, the literature was enriched by several research works intended to develop non-pneumatic tires utilizing spokes as deformable members to produce a similar ride comfort as with the conventional pneumatic tires. However, most of these designs suffered from dynamic and structural issues that prevented them from being introduced to the market. The objective of this project is to develop a non-pneumatic tire that would eliminate the hazards of conventional tires, and at the same time, tackle the issues of existing non-pneumatic tires. The concept, based on elastic sidewall, has been developed using Finite Element Methods (FEM) to study the overall behavior of the tire and to optimize the design variables. Simultaneously, experimental data were collected from a conventional pneumatic tire and then used in FEA software to match the same ride comfort. The tire has gone through many stages of modifications until a final geometry-material combination was obtained. The tire was manufactured using fiber glass composites and tested statically (off-road) and dynamically (on-road). The results were satisfactory as for the first prototype. New prototypes are being generated to further enhance the quality of ride.