ABSTRACT

The Heavy vehicle wheel rim, which is one of the basic structural elements of motor vehicle tyre assemblies, connects the vehicle body and the tyre and enables the wheel rotation. It also transmits vertical and lateral tyre forces to the axle housing or the axle beam. Because of the position and function in vehicle suspensions, they are categorized as safety components. Therefore, it is necessary to guarantee a predicted durability of this component that should not fail under service loads.

Generally, it has been observed that failure of the Heavy vehicle wheel rims before its life span occurs due to fluctuating loads, known as fatigue failure. With fatigue, components fail under stress values much below the ultimate strength of the material and often even below the yield strength. What makes fatigue even more dangerous is the fact that they occur suddenly, without warning. The failure begins with a minute crack that is so small that it may not be detected by non-destructive methods such as X-ray inspection. The crack may get initiated by internal cracks in the component or irregularities in manufacturing. Once a crack has formed, it propagates rapidly under the effect of stress concentration until the stressed area decreases so much that it leads to a sudden failure.

Fatigue is a complex phenomenon that is affected by a number of factors, such as the surface finish of the component, environmental effects, heat treatments, presence of stress concentration factors, etc. It is therefore important to carefully analyse components subjected to fluctuating loads so that the desired reliability can be built into these components.

The aim of this project is to study origin of fatigue failure that occurred near the bolt holes of a heavy commercial vehicle wheel rim during dynamic radical fatigue test. The cause of this damage was studied by using finite element
analysis. In order to determine fatigue failure, CAD model is developed and further analysed. In this way, stress concentrated regions, where fatigue failure is expected, were determined. The fatigue life of the damaged wheel was estimated using the stress-life (S-N) approach, utilizing the ultimate tensile strength of the processed wheel material.

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