Rolling noise reduction through GA-based wheel shape optimization techniques

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ABSTRACT

Railway rolling noise is nowadays a major source of acoustic pollution in urban areas, with nearly up to 12 million people daily affected in Europe by this phenomenon [1]. Hence, the search for ways of decreasing such noise radiation has become a highly active and significant research field.

Following this approach, a Genetic Algorithms-based shape optimization of the railway wheel [2] is developed with the aim of minimizing rolling noise. Different approaches are considered to address the problem, such as directly minimizing radiated Sound poWer Level (SWL) or using the maximization of the natural frequencies if computational efficiency is especially critical.

A parametric Finite Element model is implemented for the wheel based on the most relevant geometric parameters in rolling noise radiation. For the acoustic calculation, the sound radiation models used in the TWINS software [3] are adopted, which also accounts for the whole dynamics of the wheel/rail system. Furthermore, for every candidate wheel proposed, a structural analysis is computed in order to check design feasibility in accordance with the corresponding standard [4].

In all cases, new geometries for the wheel cross section are achieved that reduce the radiated rolling noise.

REFERENCES