Masterarbeit

Environmental Impact Assessment: Comparison of Railway Noise between Hydrogen Fuel Cell Train and Diesel Train

Railway transportation plays an essential role in developing world economic activity since it ensures the exchange of goods and the movement of people, creating broader markets. In this sector, energy sources have evolved from coal to diesel and electricity. Diesel traction damages the environment and human health; these include greenhouse gas emissions and noise pollution. However, new alternatives such as hydrogen and battery-powered trains significantly help in the search for pollution-free traffic, but at the same time, they emit lower noise levels compared to diesel trains. Train noise is mainly produced by the combination of rolling, traction, and aerodynamic noise, depending on the operating speed. The effects of train noise on people living near the tracks are a general annoyance, sleep disturbance, and cardiovascular diseases.

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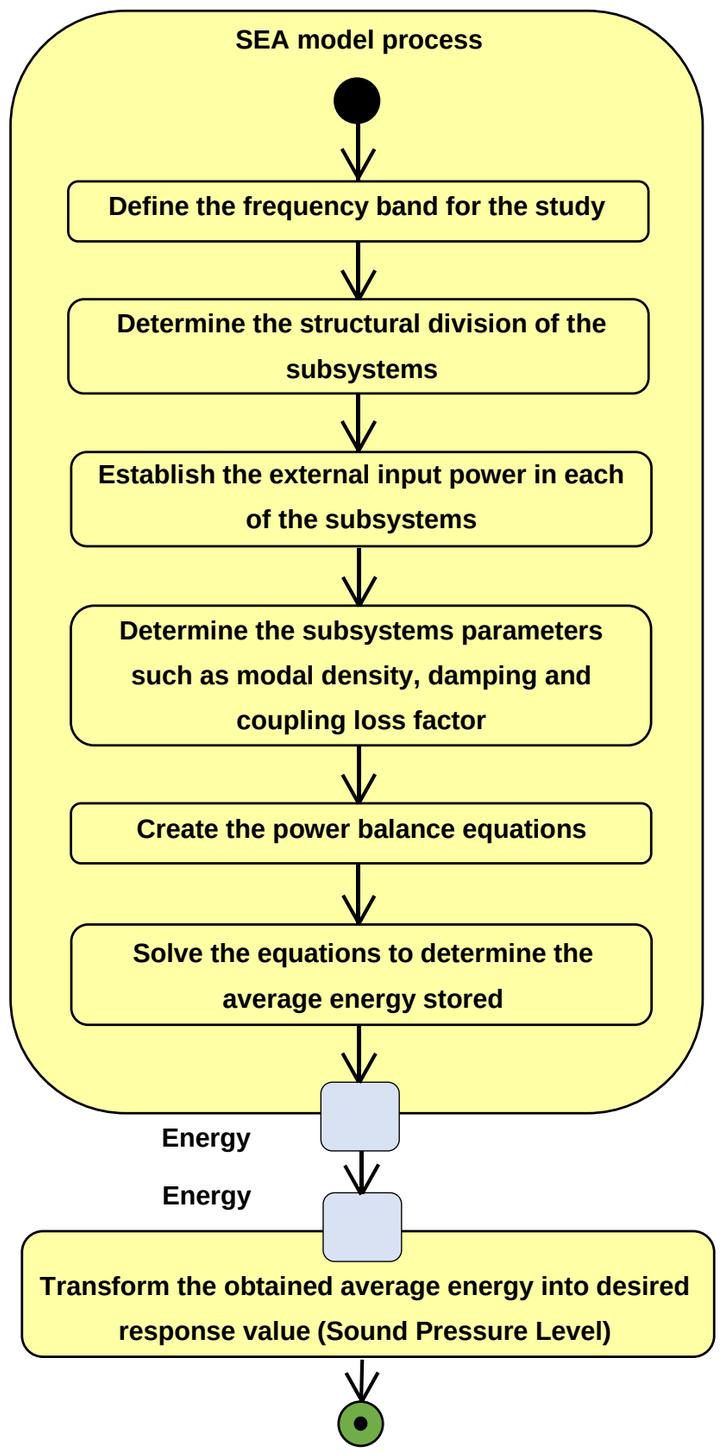
In 2002, the European Union (EU) approved the creation of Directive 2002/49/EC in response to the increasing effects of noise pollution on people. Also, in 2016, the Technical Specifications for Interoperability (TSI) related to noise was established through the commission regulation No. 2014/1304, which aims to set noise emission limits in new or existing train systems within the EU according to the speed of operation.

It was determined that Hydrogen Multiple Unit (HMU) generates less noise compared to the Diesel Multiple Unit (DMU) at all operation speeds at which the test was conducted. Those noise levels were verified according to the TSI, depending on the speeds. The knowledge of the external noise generated by the train is not only interesting to determine the levels that affect the people but also helps to know which parts of the train contribute in a more significant proportion. Therefore, the railway industry needs to predict the noise levels towards the outside and thus work on vehicle design to reduce them. For this purpose, the basic theory of the Statistical Energy Analysis (SEA) methodology is presented, which serves to identify and analyze the contribution of noise and vibration of the structural and acoustic parts of the train. The final part of this work focuses on showing a SEA model that explains the differences between DMU and HMU at different operating speeds.



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