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Development of a Regression Based Model to Predict Subjective Perception of Squeak and Rattle Noise

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Abstract : Advancements in electric vehicles have significantly reduced the powertrain noise and moving components of vehicles. As a result, in-cab noises have become more noticeable to passengers inside the car. To ensure a comfortable ride for drivers and other passengers, it has become crucial to eliminate undesirable component noises during the development phase. Standard practices are followed to identify the severity of noises based on subjective ratings, but it can be a tedious process to identify the severity of each development sample and make changes to reduce it. Additionally, the severity rating can vary from jury to jury, making it challenging to arrive at a definitive conclusion. To address this, an automotive component was identified to evaluate squeak and rattle noise issue. Physical tests were carried out for random and sine excitation profiles. Aim was to subjectively assess the noise using jury rating method and objectively evaluate the same by measuring the noise. Suitable jury evaluation method was selected for the said activity, and recorded sounds were replayed for jury rating. Objective data sound quality metrics viz., loudness, sharpness, roughness, fluctuation strength and overall Sound Pressure Level (SPL) were measured. Based on this, correlation co-efficients was established to identify the most relevant sound quality metrics that are contributing to particular identified noise issue. Regression analysis was then performed to establish the correlation between subjective and objective data. Mathematical model was prepared using artificial intelligence and machine learning algorithm. The developed model was able to predict the subjective rating with good accuracy.

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