Development of a non-destructive defect determination system for electronic parking brake (EPB) based on Machine Learning

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This study aims to develop a machine learning-based non-destructive defect detection system for electronic parking brake. While many automobile parts can be diagnosed for defects through noise and vibration analysis, electronic parking brakes pose a unique challenge due to their complex combination of components, including motors, stoppers, and pistons, resulting in a high defect rate and making defect analysis difficult. Furthermore, a comprehensive defect database for electronic parking brakes is currently lacking. In response to these challenges, this study focuses on two key aspects. First, we establish a comprehensive defect database covering various defect types in electronic parking brakes. Second, we develop a machine learning-based non-destructive defect detection system. The data for this system is collected through microphone measurements during electronic parking brake operation and the acquisition of voltage and current data. Principal Component Analysis (PCA) is then applied to extract features in both the time-domain and frequency-domain. Subsequently, we employ Support Vector Machine (SVM) learning to create an electronic parking brake defect detection system. To validate its effectiveness, we apply the developed system to real-world electronic parking brakes used in actual processes. In preparation for future applications, we derive an optimal model, taking into account computational resources and processing time, to ensure its practicality and efficiency.