



# 전라남도 개조전기차 규제자유특구사업 2





## 차량 주행 노면에 따른 PSD를 활용한 차체 구조 안전성 해석

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### Vehicle Body Durability Analysis Using PSD Based on Road Surface Conditions During Vehicle Operation

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**Key Words** : Random response(랜덤 진동), PSD(파워 스펙트럼 밀도), Finite-element analysis(유한요소해석), Durability(내구성), EV conversion(개조전기차), Regulation-free special zone(규제자유특구)

#### ABSTRACT

In this study, finite element analysis was utilized to pre-verify the driving safety of Electric Vehicle(EV) conversion using actual vehicle driving data. The actual driving of the vehicles was conducted according to the Car Loading Standard(CARLOS). Time-series acceleration graphs collected during these drives were transformed into Power Spectral Density(PSD) load graphs through Fourier transformation, and the derived PSD load graphs were applied to the vehicle Body In White(BIW) analysis model to assess the structural safety of the vehicle during driving. The analysis results showed that despite the increase in weight due to the production of EV conversion, the stresses experienced by the vehicle body material were lower than its yield strength, suggesting that there would be no issues with structural safety during driving.

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## 개조 전기차 제작 기술개발과 중량 증가에 따른 현가장치 및 제동장치 구조 변경 연구

이흥열\* · 오태호\*\* · 장석남\*\*\*

### Development of Modified Electric Vehicle Manufacturing Technology and Research on Changes in Suspension and Braking System Structure Due to Weight Increase

Heungreol Lee\*, Taeho Oh\*\*, Suknam Jang\*\*\*

**Key Words :** Converted electric vehicle (개조전기차), Special zone for regulatory freedom (규제자유특구), Finite element analysis(유한요소해석), Suspension(서스펜션)

#### ABSTRACT

When converting an internal combustion engine car into an electric car, it is equipped with a motor and a battery, which are key components, and the weight of the battery increases the weight of the existing vehicle. This increase in vehicle weight has a direct impact on the safety of the vehicle, including driving. Accordingly, it is necessary to improve the performance of the suspension and braking system. In particular, in the case of passenger cars, there is no choice but to mount them in the trunk due to the limitation of the battery mounting space, and research on the performance improvement of rear suspension and braking system is essential. Review the analysis of vehicle weight gain and the improvement of the suspension structure for the result, and conduct a design review to improve brake calipers and pads on braking systems. Conduct a finite element analysis of the design review to analyze the structural safety and compare it with the existing internal combustion engine vehicle to identify the improvement effect. When the analysis of the improvement effect is completed, a prototype is built and applied to the actual vehicle and verification will be completed by conducting real road driving verification.

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## 안전성을 고려한 Module Battery pack 설계

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### Safety-Conscious Module Battery Pack Design

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**Key Words :** Module battery pack(모듈배터리팩), Cylindrical lithium-ion cell(원통형 리튬이온 셀), Vibration analysis(진동해석), External short circuit(외부 단락), Fire prevention system(화재전이방지시스템)

#### ABSTRACT

Ensuring the safety of the traction battery in electric vehicles is paramount. Preventing internal damage to the battery due to external shorts when connecting the battery pack to the vehicle is a crucial task. Additionally, both the battery module and external casing must be designed to withstand vibrations based on the vehicle's driving patterns. In the event of a fire, automatic fire suppression devices should be installed inside the module and battery pack to enable swift fire suppression.

The nickel plating used to connect cells should be designed with welding points spaced apart to prevent event propagation in case of cell damage. This structure plays a crucial role in increasing safety by preventing event propagation. The battery system of electric vehicles must incorporate various technologies and design elements for safety, which plays a crucial role in ensuring user safety and vehicle reliability.

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