전라남도 개조전기차 규제자유특구사업 2

차량 주행 노면에 따른 PSD를 활용한 차체 구조 안전성 해석

김강민* · 김민규** · 이태희***

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

Kang Min Kim*, Min kyu Kim**, Tae Hee Lee***

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.

본 연구는 2024년도 중소벤처기업부의 재원으로 개조전기차 주행안전성 실증 사업의 지원을 받아 수행된 연구임 (No.P0023243)

* 한국자동차연구원/연구원
** 한국자동차연구원/선임연구원
*** 한국자동차연구원/센터장
E-mail : gmkim@katech.re.kr

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.

본 연구는 2024년도 중소벤처기업부의 재원으로 개조 전기차 주행안정성 실증사업의 지원을 받아 수행된 연구임 (No.P0023243)

* ㈜목포현대상용서비스 연구소장/차량개발본부장
** ㈜목포현대상용서비스/차량설계팀장
*** ㈜목포현대상용서비스/부사장
E-mail : hrlee@dkmotors.net

안전성을 고려한 Module Battery pack 설계

권순광* · 구득현**

Safety-Conscious Module Battery Pack Design

Soon Kwang Kwon*, Deuk-Hyoun Koo**

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.

본 연구는 2024년도 중소벤처기업부의 재원으로 개조전기차 주행안전성 실증 사업의 지원을 받아 수행된 연구임 (No.P0023243)

* ㈜에스제이테크/수석 연구원
** 서울과학기술대학교 일반대학원 자동차공학과/박사 과정
E-mail : skkwon@welcometosj.com

EV 개조된 화물차의 무게중심과 동적 안전성 변화 연구

박진석*·김평안*·하성용**·이재웅**

Analysis of Center of Gravity and Dynamic Safety in EV-Conversion Trucks

Jin Suk Park*, Pyeong An Kim*, Sung Yong Ha**, Jae Woong Lee**

Key Words : EV Conversion(전기차개조), Center of gravity(무게중심), Dynamic stability(동적안전성), TruckSim(트럭심)

ABSTRACT

Due to the increasing emissions of carbon and greenhouse gases, global warming is accelerating, leading major advanced countries to announce policies prohibiting the sale of internal combustion engine vehicles. Consequently, research on EV conversion, aimed at reducing pollutant emissions by retrofitting existing vehicles, is underway. However, the lack of guidelines, regulations, and empirical evidence regarding the safety of converted vehicles has hindered the proof of their safety. This study prioritizes the application of EV conversion to cargo vehicles with long operating hours and high pollutant emissions, conducting simulations using cargo vehicle models. During EV conversion, changes in vehicle body weight and component replacements cause shifts in the center of gravity. In this research, to enhance rollover prevention and steering stability, driving simulations were conducted based on the TruckSim software, comparing the driving safety of pre- and post-conversion vehicles, and proposing methods for limiting weight fluctuations, optimizing component placement, and optimizing the center of gravity.

본 연구는 2024년도 중소벤처기업부의 재원으로 개조전기차 주행안전성 실증 사업의 지원을 받아 수행된 연구임
(No.P0023243)

* 중부대학교 미래자동차융합공학과/연구원
** 중부대학교 스마트모빌리티학과/교수
E-mail : gomjs123@jmail.ac.kr