
사고재현 및 사고사례 분석 II



실차 실험 바탕 보행자 AEBS 사고 재현 시뮬레이션에 대한 연구

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A Study on the Simulation of Pedestrian AEBS Accident Reconstruction Based on the Vehicle Experiment

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Key Words : ADAS(첨단운전자지원시스템), AEB(긴급제동장치), Traffic accident analysis(교통사고 분석), PreScan(자율주행 및 ADAS 차량 시뮬레이션 프로그램)

ABSTRACT

최근 운전자의 편의와 안전 성능을 향상시키기 위한 목적으로 첨단운전자지원시스템인 ADAS(Advanced Driver Assistance) 기능이 장착된 차량이 널리 보급되고 있다. 긴급제동장치인 AEBS(Autonomous Emergency Braking System)가 사고 예방에 도움이 된다는 많은 선행 연구 결과와 함께 국토교통부는 2022년부터 AEBS 장착 의무화 대상을 초소용차를 제외한 전 차종으로 확대하고 레벨 3 수준의 자율주행 차량을 상용화하겠다는 계획을 발표한 바 있다. 이에 따라 AEBS 장착 차량의 보행자 교통사고 시 사고 재구성 단계에서 사고 원인이 ADAS 센서의 결함에 의한 것, 사고 당시 보행자의 위치가 센서가 감지할 수 없는 영역에 있어 발생한 한계 상황에 의한 것, 또는 그 외 날씨와 같은 외부 요인에 의한 것인지에 대한 분석이 필요하다. 본 연구에서는 PreScan과 MATLAB/Simulink 환경에서 보행자 AEBS 작동 로직을 구성하였으며 시뮬레이션 결과와 아이오닉5를 이용한 실차 실험 결과를 비교하여 시뮬레이션 이용 보행자 AEBS 사고의 해석 가능성을 확인하고자 한다. 실험 시나리오로 EuroNCAP AEB VRU(Vulnerable Road User) 테스트 시나리오 중 보행자가 가만히 서있는 상황(SP), 보행자가 주행 방향 기준 오른쪽에서 왼쪽으로 도로를 횡단하는 상황(CPNA)에 따라 실차 실험을 수행하였으며, 실험결과를 바탕으로 시뮬레이션 로직을 수정하였다. 그 결과 약 10 km/h부터 약 40 km/h까지 속도에서는 충돌까지 걸리는 시간인 TTC(Time to Collision) 경향이 실험과 시뮬레이션 결과가 유사한 것으로 나타났으며 약 50 km/h 이상의 속도에서는 TTC의 차이가 있는 것으로 확인되었다. 향후 시나리오 별 TTC 오차를 줄이고 SP 상황에 대한 실차 실험의 TTC를 CPNA 등 다양한 시나리오의 시뮬레이션에 활용 가능하지 확인하고 실험 차종을 다양하게 확대하여 실제 보행자 AEBS 사고 해석에서의 시뮬레이션 활용성을 높일 계획이다.

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비조화비 영상속도 측정의 정확도 개선

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Improving the Accuracy of Cross Ratio Image Speed Estimation

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Key Words : Curved road(곡선 길), Forensic video(법 영상), Speed(차량 속도), Pixel(화소),

ABSTRACT

In vehicle speed is estimated using CCTV images in traffic accidents such as vehicle-to-vehicle, vehicle-only, vehicle-to-pedestrian, etc. Speed estimation using CCTV images measures the driving distance using road lanes and surrounding structures, It is done by measuring time.

However, with this method, it is difficult to estimate the speed when there are no lanes or structures in the section to estimate the speed, so the National Institute of Scientific Investigation of the Republic of Korea uses a method of estimating the speed using the cross ratio.

However, when estimating the speed of a vehicle using the cross ratio in CCTV images, it is used in straight sections, but it is difficult to use because errors occur in curved sections and when image distortion is severe.

In this study, after experimenting with a camera for a vehicle driving on a curved road and a driving vehicle with severe image distortion, the speed was measured by the method of 'improving the accuracy of cross ratio video speed measurement' presented in this study, Compared to VBOX, which is an accurate speed measuring device, it was verified that the accuracy was high.

Therefore, it is expected that the method of 'improving the accuracy of cross ratio image speed measurement' presented in this study can be used in real cases even for images of vehicles driving on curved roads and severely distorted images.

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변속레버 오조작으로 인한 엔진 꺼짐 사고의 재구성

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Reconstruction of Engine-Off Accidents Due to Shift-Lever Misoperation

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Key Words : Engine-off accident(엔진 꺼짐 사고), Shift lever(변속 레버), Blackbox(블랙박스), EDR(사고기록장치)

ABSTRACT

In December 2019, there was an accident that a Palisade overturned in Iksan, Jeollabuk-do, and the media reported that the vehicle overturned after the engine was turned off without intention while going downhill with the shift button pressed R(rearward).

In an internal combustion engine vehicle, when driving on an incline in the opposite direction to the shift lever operation direction, the engine may be turned off due to reverse rotational force. These engine-off accident situations can be reconstructed through analyzing the voltage-drop observed in the black box, the frequency analysis of the engine sound, the vehicle reversing light observed on CCTV, the engine RPM of the EDR data, etc. In general, in a vehicle to which a vacuum booster type brake is applied, the braking force may be significantly reduced because the vacuum is not sufficiently formed, and it is difficult to stop the vehicle, which may lead to an accident. Therefore, the driver's careful attention is required when operating the shift lever(or shift buttons, shift dial), and it would be more desirable if the vehicle manufacturer could supplement the safety features to prevent such a situation.

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PreScan을 활용한 ADAS 차량의 사고 재현 시뮬레이션 연구

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A Study on the Accident Reconstruction Simulation of ADAS Vehicle Using PreScan

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Key Words : PreScan(자율주행 및 ADAS 차량 시뮬레이션 프로그램), Autonomous driving(자율주행), ADAS(첨단 운전자지원시스템), AEB(긴급제동장치), Traffic accident analysis(교통사고 분석)

ABSTRACT

In recent years, the technology for autonomous driving has been advancing rapidly, leading to the announcement of the 'Mobility Innovation Roadmap' by the Ministry of Land, Infrastructure and Transport in Korea. The goal of this roadmap is to commercialize level 3 partial autonomous driving, the world's highest level, by 2027. ADAS(Advanced Driver Assistance System) functions, which improve driver convenience and safety performance, are mostly equipped in recently released vehicles and range from level 0 to level 2 in autonomous driving technology. Among the various functions of ADAS, AEBS(Autonomous Emergency Braking System), which analyzes traffic accidents, is the most closely related to the vehicle's braking. This study developed a simulation technique for reproducing accidents related to AEBS based on real vehicle experimental data, and it was applied to the analysis of actual ADAS vehicle accidents to identify the causes of accidents. AEBS operating logic was constructed using PreScan in the MATLAB/Simulink environment. AEBS operating and limit characteristics were reflected in the logic through real vehicle experiments on the accident vehicle and similar vehicles, and the cause of the AEBS malfunction during the accident was identified by reproducing the accident situation through simulation. This study expects to enable accurate accident analysis by performing AEB operation simulation in the event of a traffic accident involving autonomous driving vehicles or vehicles equipped with ADAS functions in the future. Furthermore, continuous research will be conducted on pedestrian AEBS to increase its usability.

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