

Injury prediction considering the driving posture

JSOL – Tokyo, Japan



ODYSSEE CAE simplifies complex crash scenarios.

JSOL is an ICT service coordinator that 1255 companies trust. JSOL merges leading technology and business acumen guiding its customers to achieve success. JSOL is skilled with CAE, machine learning, and artificial intelligence, providing companies with unrivaled support and analyses.

JSOL operates in four business areas: Manufacturing, Distribution and Services, Public Services, and Finance. Their customer-oriented business policy maintains their very high long-term customer retention. Their solutions include leading-edge technology using machine learning and engineering software to provide analysis ranging from materials to collisions and occupant safety.

JSOL Headquarters is in Tokyo. With their four other locations in Japan, they have 1200 employees.

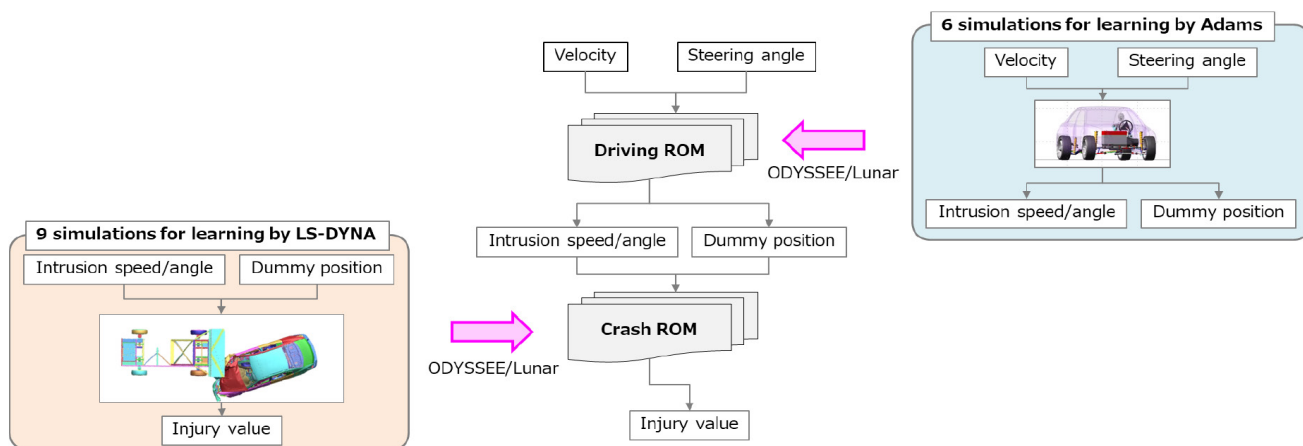


Fig 1: Incorporation of ODYSSEE into a two-tiered engineering challenge to find the injury value

Challenge

JSOL is looking towards the future to help its customers achieve their future success today. The future contains autonomous and connected cars, which would change the postures and positioning of the occupants inside. The traditional occupant posture does not reflect the change of posture due to car movements or the future positions of the occupants in automated cars. The occupant's posture and positioning greatly determine the injuries during the crash. JSOL is creating an analysis model to evaluate an occupant's injury based on driving maneuvers. The challenge of this analysis is the need to use two engineering programs to model the two phases of a lane change crash. The driving pre-crash simulation is performed by ADAMS and details the transient posture change of the occupant during a lane change. The crash phase is performed by LS-DYNA, uses the ADAMS model inputs, and calculates the injury value. ODYSSEE CAE can help JSOL simplify and quicken the analysis of the complicated crash allowing their partners to make the road safer.

Solution

JSOL uses ODYSSEE CAE to help predict the injury value during a lane change. The crash is separated into the pre-crash driving and the crash phase to accommodate the differing phenomenon times (6s and 0.14s). Adams is used to model the driving stage and simulates the effect of the lane change parameters (initial velocity and steering angle) on the posture and crash vector. LS-DYNA receives the occupant posture and the crash vector to generate the injury score. ODYSSEE CAE was used to replace both software with reduced order models. The driving model was taught with 6 Adams simulations to predict the transient posture change and crash vector responses. The crash model was trained with 9 LS-DYNA simulations to predict the injury score accurately based on the previous model outputs. The two reduced order models were coupled with the results of the driving model being used as the inputs for the crash model. The resulting combined ODYSSEE CAE model quickly determines the injury value of an occupant during a lane change crash.

Head Acc.

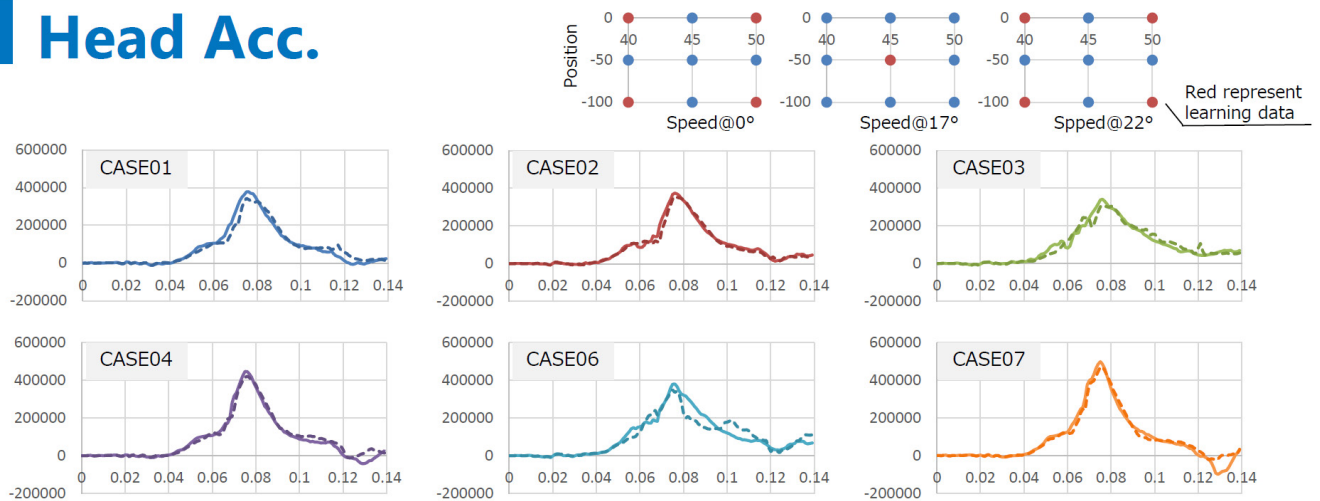


Fig 2: The head acceleration during the crash accounting for the posture change during the driving scenario. ODYSSEE CAE prediction is the solid line, LS-DYNA simulation is the dashed line.

Results

ODYSSEE CAE simplified the complicated crash simulation that required two engineering simulation softwares into a two-stage coupled ROM. The resulting output was both highly accurate and provided real-time results. The driving ROM predicted time curves were indistinguishable from the ADAMS simulations. The crash ROM accurately captured the dynamics found in the LS-DYNA simulation. Compared to the initial FEA simulation, the ROM predicted the overall injury score with an accuracy of 98.6%. The original two-phase simulation was over 19hrs long, while ODYSSEE CAE predicted a similar result in less than a second. ODYSSEE CAE at this speed would be able to predict the entire design space with acceptable resolution in the same timeframe as a single FEA simulation. The model generated was easy for any designer to use without specialised knowledge to obtain accurate and usable results quickly. ODYSSEE CAE helps JSOL to provide reliable and practical solutions to their customers.



By using ODYSSEE CAE's ROM, the results of parameter changes can be easily obtained by non-specialists without having to worry about complicated setting changes or errors."

Masahiro Takeda,
CAE Engineer

Key highlights

Product: ODYSSEE CAE

Industry: Automotive

Benefits:

- ODYSSEE CAE simplifies complex crash scenarios



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Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

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