# Fatigue Analysis of Light Truck Frame Based on Virtual Proving Ground Technology㊀

Dong Qiangqiang, Han Jie, Liu Zhonghai, Wu Yang, Cao Jian
*CATARC (Tianjin) Automotive Engineering Research Institute Co., Ltd.*

**Abstract**: The fatigue durability problem of the chassis has become a focal point in recent years for the research and development of commercial vehicles. However, traditional load measurement methods cannot directly measure the boundary loads of the chassis. To address this issue, this study focuses on a certain light-duty truck and utilizes the CRG road model as an excitation source to construct a full-vehicle multibody dynamics model with the FTire model. This leads to the establishment of a Virtual Proving Ground (VPG) system to extract fatigue loads on the vehicle components. Experimental load spectrum data is obtained through road spectrum acquisition tests conducted at an automotive test facility. By comparing the test data with simulation data, the results show good agreement in the time domain and relative damage characteristics, confirming the accuracy of the virtual proving ground simulation results. Finally, fatigue analysis methods are applied to the chassis model based on the virtual proving ground simulation data, identifying high-risk areas and performing optimization to ultimately eliminate the high-risk regions of chassis fatigue. The VPG technology not only enables early acquisition of fatigue loads on vehicle components for fatigue analysis and optimization but also provides high-precision load spectra extraction.

**Key words**: frame, Virtual Proving Ground, load decomposition, fatigue analysis, structural optimization

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