Study of Airbag Inflation Model in MADYMO

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ABSTRACT

In order to effectively protect occupant during collision accident, the static and dynamic test of airbag must be executed to obtain the airbag deployment thickness and time, and to assess the airbag protection performance on the research and development stage. The simulation analysis of airbag based on the CAE technology has been widely used for its cost effectiveness. Thus, the numerical simulation of static deployment test and impact test of airbag can be implemented. There are two options to simulate airbag inflation process in the MADYMO software package. One is the Uniform Pressure model, the other is Computational Fluid Dynamics model. The calculation of Uniform Pressure model is very short in CPU time, and the numerical stability is good. However, the airbag deployment process using with uniform inflation is different with the inflating gas of real inflator. Especially, the Uniform Pressure model can not simulate the interaction between the deploying airbag and the occupant head in the initial stage of deployment. The Computational Fluid Dynamics model provides an advantageous tool to simulate the details of airbag deployment. In order to study the difference and adaptation between two inflation models of airbag in MADYMO, frontal and side airbag are analyzed to compare the Uniform Pressure model and Computational Fluid Dynamics model in the static deployment test simulation. The simulation results are also compared with those obtained from experimental tests to evaluate the adaptation of those two inflation models of airbag. Finally, the sled model equipped with airbag is considered. The analysis of occupant injuries considered those two inflation models during impact simulation is also discussed. The results indicate that the numerical model proposed in this study has considerable potential for guiding the future development of safety and efficiency of airbag.

Keywords : Frontal airbag, Side airbag, Static deployment test, Computational Fluid Dynamics, Sled test, MADYMO

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