

IMPROVING PASSIVE SAFETY BY COMPUTER SIMULATION

Jan Štych¹

Increasing of safety is necessarily - as every other development - a trial and error process. Traditional way to verify the results of development is construction and testing of many prototypes. This is time consuming and expensive. Proven alternative is a virtual simulation. Automotive industry was the first using it almost exclusively for crash tests. This remains the main role today, but the development of technology and increasing of computer power has enabled usage of simulation in new areas. Today is simulation used in the process of manufacturing (stamping, welding ...) and allows direct analysis of the influence of the manufacturing process in crash test result. Simulation gives an accurate description of inflating behavior of airbags. Simulation is also used in comfort, for example in the development of car seats is possible to evaluate effect of vibration transmitted to occupants. Simulation can be used to test the durability of road barriers, where you can virtually check the behavior before physical test.

Company ESI Group, a leading global supplier and innovator in this field, has a constantly evolving portfolio of software tools enabling realistic and predictive simulations.

The effectiveness of software tools is enhanced by a common environment to define the role and easy portability of the results from one area to another simulation, i.e. you can make very accurate simulation of crash tests, with the influence of manufacturing processes of individual components. MECAS ESI, Czech branch of ESI Group, provides distribution of computer simulation tools and support in Central and Eastern Europe.

Key words: simulation, crash, safety, FEM

1 Introduction

Increasing of safety is necessarily - as every other development – a trial and error process. Traditional way to verify the results of development is construction and testing of many prototypes. This is time consuming and expensive.

Proven alternative is a virtual simulation. Automotive industry was the first using it almost exclusively for crash tests (Fig.1). This remains the main role today, but the development of technology and increasing of computer power has enabled usage of simulation in new areas. Today is simulation used in the process of manufacturing (stamping, welding ...) and allows direct analysis of the influence of the manufacturing process in crash test result.

Simulation gives an accurate description of inflating behavior of airbags. Simulation is also used in comfort, for example in the development of car seats is possible to evaluate effect of vibration transmitted

¹ Ing. Jan Štych, Ph.D., MECAS ESI s.r.o., Brojova 2113/16, 326 00 Plzeň, Czech Republic, tel.: +420 377 432 950, E-mail: jan.stych@mecasesi.cz

to occupants. Simulation can be used to test the durability of road barriers, where you can virtually check the behavior before physical test.

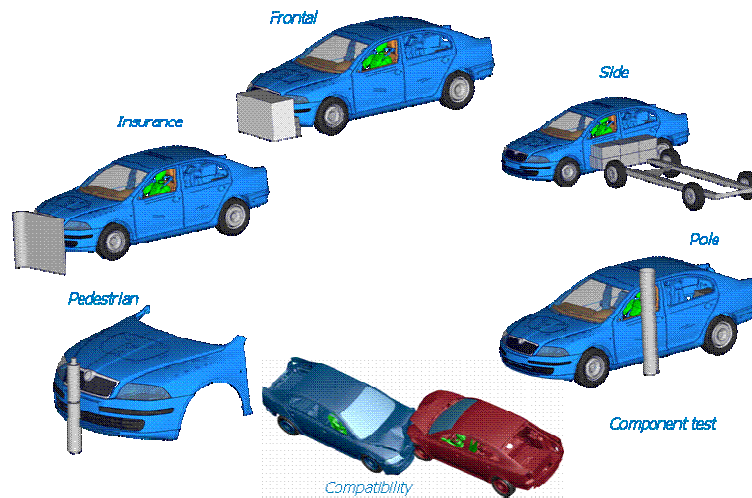


Fig. 1 Typical crash test simulations.(Courtesy of Skoda Auto)

2 Crash simulation with respect of manufacturing process

Today is the simulation used in the manufacturing process (stamping or welding ...) and allows direct analysis of the context of the manufacturing process in crash test (Fig.2). Taking into account the production processes brings higher accuracy of the resulting simulation.

Similarly, simulation can show the influence of accurate description of the initial state of the object on the results – i.e., stress arising from gravity, or to evaluate the importance of the behavior after the crash - springback. To obtain such information and the results requires the cooperation of several types of solvers using different algorithms, and the transfer of the results.

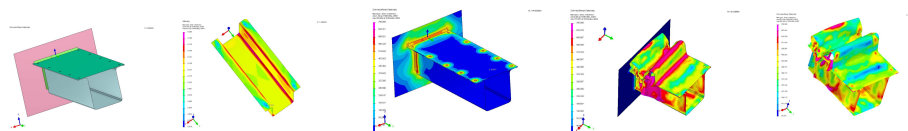


Fig. 2: Simulation chaining – stamping, welding, crash, springback.

If we are in a scope of a large model (full car) focusing on selected detail part, today's technology allows us - so-called solver "coupling". Within the standard simulation run another calculation, which provides more detail. Results are continuously transmitted to the main calculation.

3 Road barrier crash simulation

Crash simulation is also used in the legislative process of certification of road barriers. Design of road barrier can be checked with simulated crash (Fig. 3) before the expensive physical test is performed.

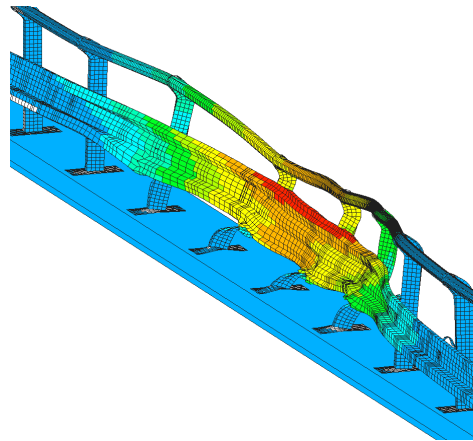


Fig 3 Road barrier deformation after crash simulation. (Courtesy of Mittal Steel)

4 Comfort

Simulation is also an effective tool in the field of comfort. In the development of car seats is possible to evaluate the effect of vibration transmitted to passengers. This application is another example where is necessary number of successive calculations (Fig.4) - production of the seats, positioning of dummies, assessment of pressure distribution (which affects the feeling of comfort) and analysis of vibration transmission.

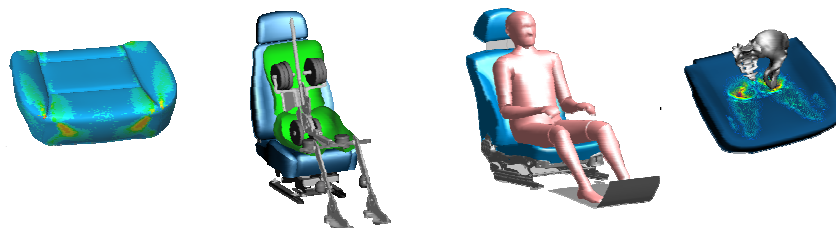


Fig. 4: Car seat comfort simulation.

5 ESI Solution

ESI is a world leading software editor for the numerical simulation of prototype and manufacturing process engineering in applied mechanics. The key to ESI's success is the use of realistic material physics, providing "as good as real" virtual solutions, in order to replace the lengthy trial and error processes on real prototypes.

ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on product performance.

ESI's products represent a unique collaborative and open environment for Simulation-Based Design, enabling virtual prototypes to be improved in a continuous and collaborative manner while eliminating the need for physical prototypes during product development. This solution allows a productivity gain, innovation acceleration and significantly reduced costs.

The effectiveness of software tools is enhanced by a common environment to model setup, easy interaction between applications and simulation evaluation (Fig.5).

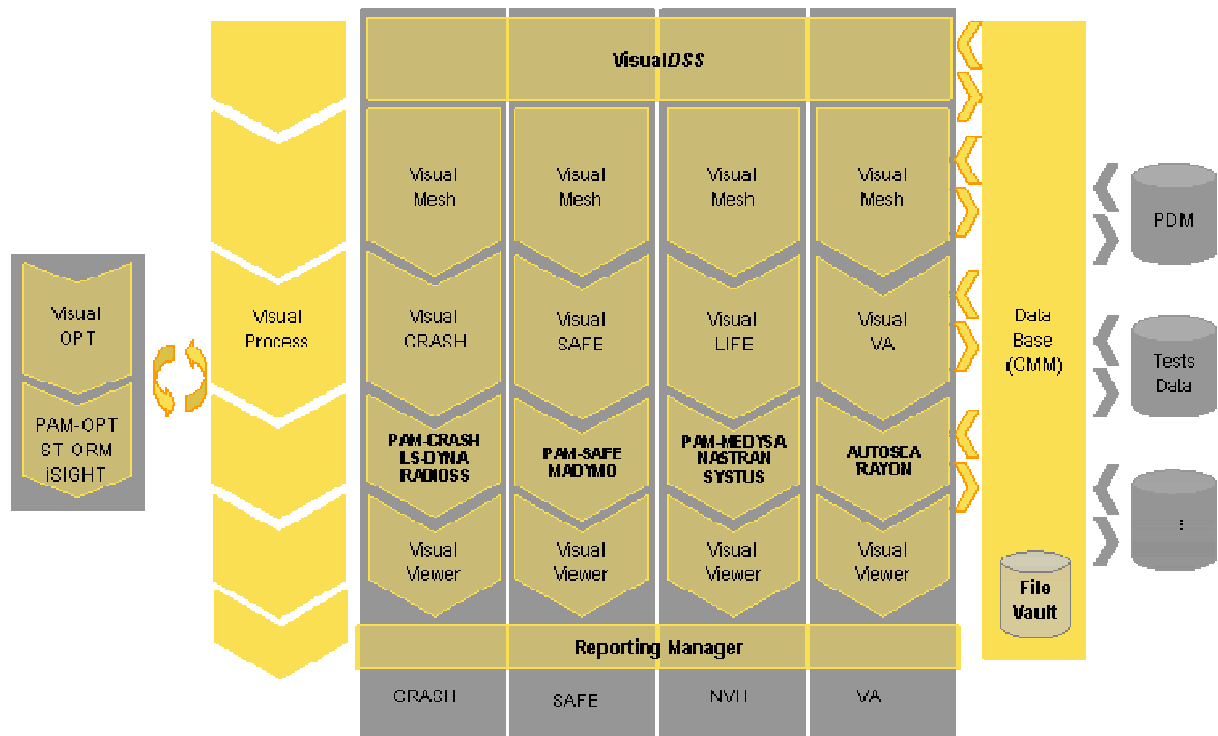


Fig. 5: Visual Environment .

MECAS ESI, Czech branch of ESI Group, provides distribution of computer simulation tools and support to users in Central and Eastern Europe.

6 Conclusion

Development of technology and increasing of computer power has enabled usage of simulation in a wide spectrum of industrial applications. Using simulations we can replace the lengthy and costly trial and error processes on real prototypes.