

Cloud-based Pedestrian Protection App

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Abstract

Democratize as the meaning says “make (something) accessible to everyone,” is the main objective of today’s industry to have simulations accessible to everyone to achieve significant improvements in development time and consistent outputs.

In this paper we would like to present the workflow of a cloud-based Pedestrian Head Impact simulation. The Head Impact simulation will be executed through an embedded workflow, which internally executes several existing and validated process templates on cloud. Once the process execution is completed, the results are uploaded to the cloud and made available for download and visualization on the web.

Introduction

Simulation plays a vital role in virtual product engineering. To develop better products and to satisfy time-to-market expectations, most of the industries have captured their operational best procedures and carry out virtual tests by converting these best practices to automated processes using templates. This approach has been implemented and proven successful in organizations, as it has improved collaboration and efficiency within dispersed departments and suppliers. It also ensures that the industry standards are in place and at the same time consistency and validity in the output is maintained.

Another huge advantage is that process automation enables an increase in the number of simulations for better decision making. This makes it even more important to effectively manage the simulation content, as most of the business decisions are made based on the outcome of these simulation results. As these simulations are quite CPU-intensive, they easily become a bottleneck for a company’s IT-infrastructure as well as a threat for IT-budgets. Many software vendors support industry to overcome their software and hardware limitations with pay-per-use HPC cloud offerings. Besides cloud solutions solving HPC issues, there is an emerging need to solve industry/domain-specific engineering challenges through Apps.

These Apps can be ‘fit-for-purpose’, ‘ready-for-use’ and accessible on private as well as on public cloud. Such a vertical App is the Pedestrian Protection App. Execution of the Head Impact simulation through predefined and integrated workflows is one part of the solution. The other important part is to manage and organize the output of those processes.

Engineering organizations are more and more open to manage simulation data and processes, not as an isolated silo, but rather as part of their overall product development life cycle. There is an immense need to have solutions like a Simulation Data Management (SDM) system to seamlessly maintain and reuse the results of automated processes, to manage multi-domain simulation content on a central server, and thus provide support to accelerate the project.

ESI’s VisualDSS Collaborative Cloud Modeling Platform for Virtual Prototyping, enables engineers to create multiple projects and studies or iterations related to various load cases. In case of Tier 1 suppliers who cater to OEM’s multiple geographical locations, the ingrained Simulation Data Management App provides controlled access to data sets for internal and external reviews with appropriate access rights.

The inbuilt visualization tool facilitates viewing of data model, published results and reports on the web. The outcome of any study can be effectively shared and communicated across the team, as it allows all the basic operations of post-processing to be performed on the web. Engineers can choose, extract and publish only those results which are relevant to the study or project, thereby empowering the management to make the right decision by getting a quick insight into the results interactively. This ability eliminates the need to transfer huge chunks of data. Results can be archived for model summary, becoming part of the PDM system and can still be viewed interactively as and when required.

Background of Pedestrian Head Impact according to EuroNCAP [*1]

Most pedestrian accidents occur within city areas where speeds are moderate. To estimate the potential risk of head injury in the event of a vehicle striking an adult or a child, a series of impact tests is carried out at 40 km/h using an adult or child head form impactor.

The head form test area is defined as the outer structure that includes the upper surface of all outer structures. It includes, but is not limited to, the bonnet, wings, windscreen scuttle, wiper arms/spindles, windscreen frame, A-pillars and roof. It is bounded by the geometric trace of the 1000mm wrap around line in the front, the Bonnet Side Reference Lines and the 2100mm wrap around distance (WAD).

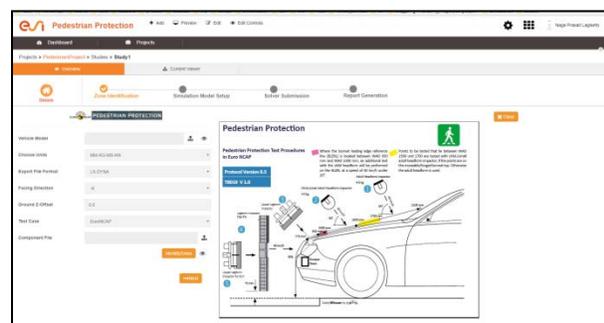
The child head form impact zone is at the wrap around distance between the 1000mm - 1500mm and the adult head form impact zone is between 1500mm-2100mm.

What is Pedestrian Protection App?

The entire process of pedestrian safety analysis is very iterative, involving lot of calibration of the models and re-running of simulations for any change in input, for each target/hit point. Pedestrian Protection App is an easy to use and 'fit-for-purpose' tool. The complete workflow required for pedestrian safety is executed through an embedded workflow. The existing process templates for Zone Identification, Impactor Positioning & Model Setup, Job Submission and Report Generation, as per the latest EuroNCAP [*1] regulation, are executed in the backend, supported by an easy to use interface. These templates are built with attention to detail, following the industry standards. Once the process execution is complete, the results are uploaded to the cloud and made available for download and viewing on the web [*2]

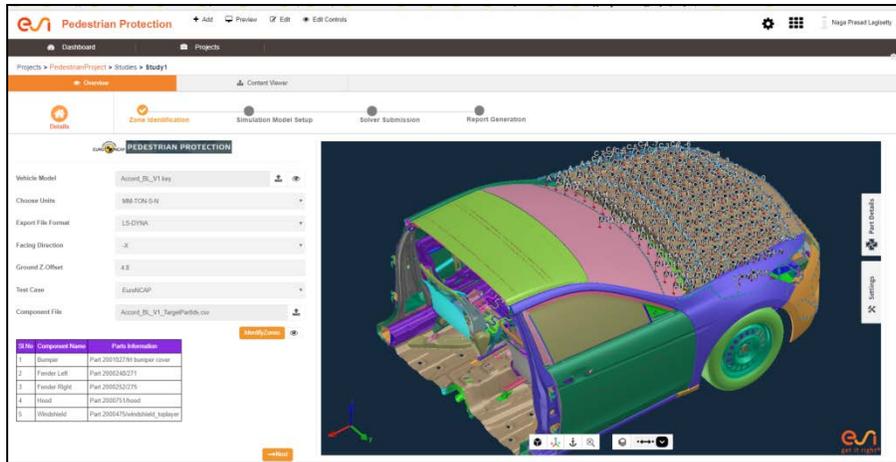


VisualDSS Login Page

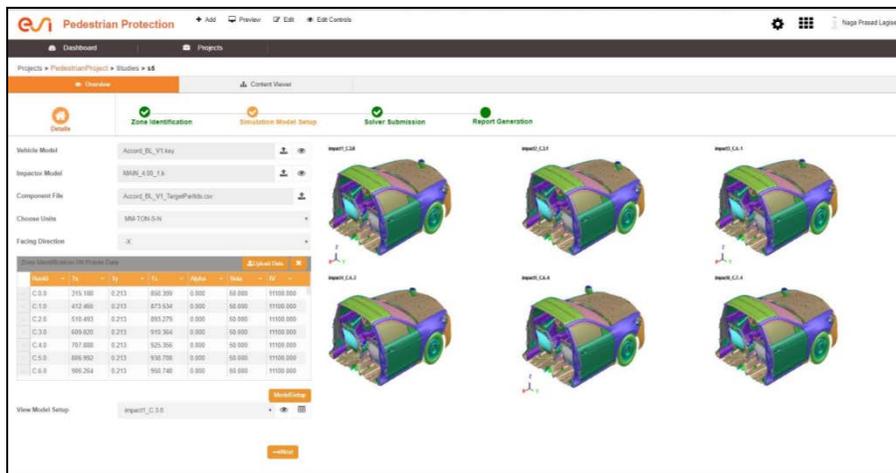


Overview of Pedestrian Protection

Zone Identification: will take vehicle model, unit system, identification of required parts as inputs and compute vehicle markings like Bonnet Side Reference lines, Bumper Reference Lines, Bonnet Leading Edge Reference Line, Bonnet Rear Reference Line, Wrap Around Distances and finally generate Head Form Grid/Target Points.



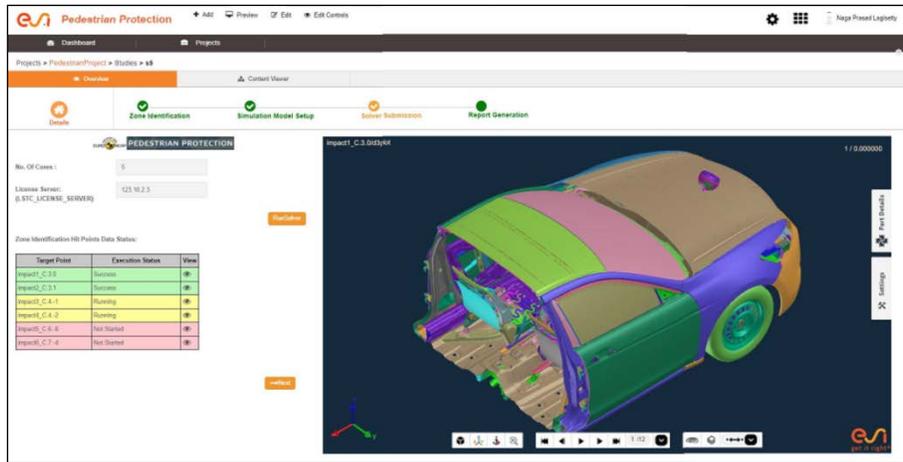
Impactor Positioning and Model Setup: positions the impactor for each point obtained from the previous step. Creates the required simulation data like initial velocity on the impactor, contact definitions, boundary conditions and control cards. The positioned vehicle model along with the positioned impactor is exported.



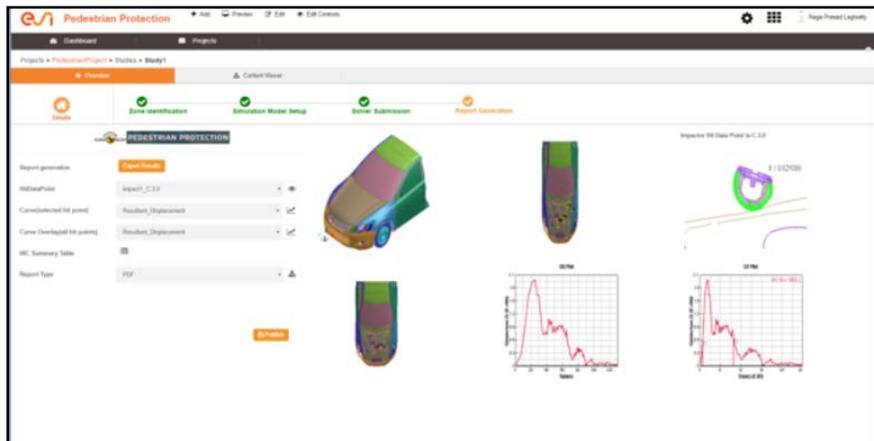
Job Submission:

Scenario1: User connects to Pedestrian Protection App on ESI’s VisualDSS Cloud for guided workflow, while the simulation itself runs on local machines. This is possible, with a valid LS-DYNA® installation.

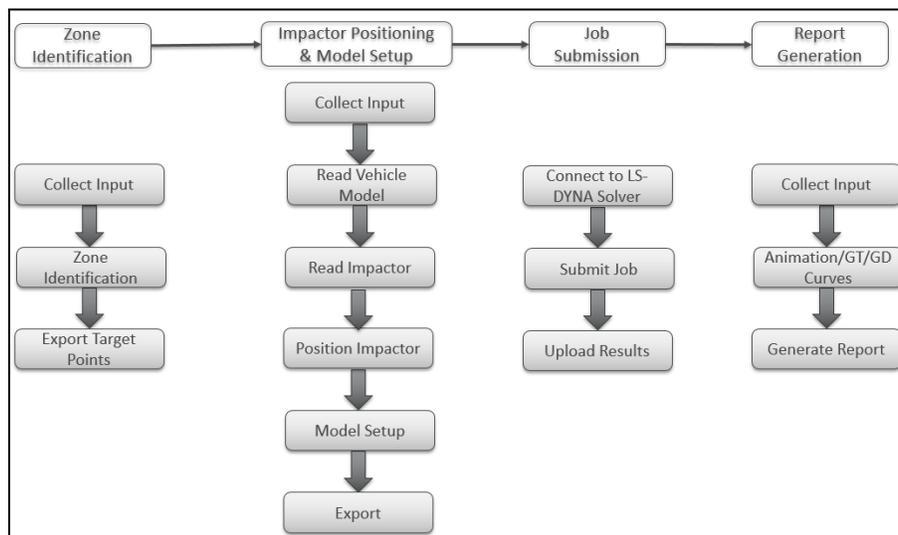
Scenario2: User connects to Pedestrian Protection App on ESI’s VisualDSS Cloud for guided workflow, while running the simulation on cloud



Report Generation: will automatically generate the HIC summary report with G-T and G-S curves.



The Simulation Data and Process Management framework by default allows the engineer to build and chain the above process into an integrated solution.



Benefits of Cloud based Apps in Simulation Industry

Cloud-based Apps democratize the simulation setup by helping the non-simulation experts reap the benefit of executing a sophisticated simulation. As the entire setup is hosted on cloud, it reduces the cost associated with related hardware installation/configurations, their maintenance and annual (long-term) licensing of the various required software products. The App can be used on demand to meet the project delivery, with easy accessibility from anywhere, real-time multi-user collaboration with data, project and workflow sharing and multiple layers of security to data protection based on strict industry standards.

Execution of the Pedestrian Protection load case of Head Impact according to EuroNCAP with many iterations creates a lot of data. The management and storing of this simulation data in one and same environment provides a unique benefit for users.

Keywords

Pedestrian Safety, Head Impact, Process Automation, Simulation Data/Content Management, Cloud, Pedestrian Protection, Democratization, Vertical App, Collaboration Platform.

References

[1] EuroNCAP:

Euro NCAP Assessment Protocol – PP v9.0.2;

<http://www.euroncap.com/en/vehicle-safety/the-ratings-explained/pedestrian-protection/head-impact/>

[2] Image Courtesy

carhs: SafetyCompanion 2018