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CertaSIM, LLC is the official distributor of the IMPETUS Afea Solver® in North, Central and South America and provides technical support and training for the IMPETUS suite of software.

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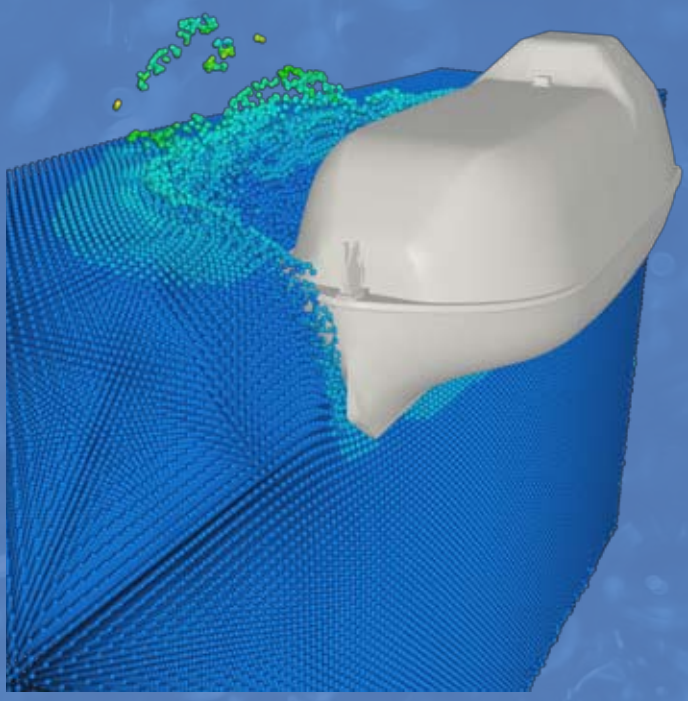
WATER SLAMMING

NEW OPTION!

The IMPETUS SPH development team in France has worked closely with the IMPETUS Consulting Group in Norway in the area of Water Slamming. It covers many areas like lifeboats dropped into the ocean, space capsules returning to earth and landing in water, helicopter & airplane water impact. In order to make it easy to simulate these events in the IMPETUS Afea Solver®, the SPH team has introduced a new command - *SPH_WATER_ENTRY_LAB. It follows the strategy implemented for the SPH module, where ease of use is a key factor, e.g., the SPH particles automatically generated by the IMPETUS Afea Solver® at runtime. The syntax for the new command is:

*SPH_WATER_ENTRY_LAB
entype, enid, L, W, D, N_p, v_{max}
bc_{x0}, bc_{x1}, bc_{y0}, bc_{y1}, bc_{z0}

The structure, rigid or deformable, that interacts with the water is given by an entity type and an entity ID (entype/enid) and the dimensions of the water domain are given by the parameters L, W and D. The total number of the SPH particles is defined by the N_p parameter and the maximum expected velocity of the water is given by v_{max}. The latter is used to calculate the speed of sound. Reflective boundaries are important when modeling water and it can be given using the six bc_{ij} parameters. A more detailed description of the command is given in the IMPETUS User's Manual. This means that only one command is needed to model a Water Entry event in IMPETUS, the *SPH_WATER_ENTRY_LAB. No other SPH, contact nor element commands need to be given.



Different verification models were tested and a generic life boat model was also developed. A movie file for the latter, illustrating this unique feature can be found at:

http://files.certasim.com/download/file/tech-info/videos/Boat-WaterSlamming-1080p.mp4

In this particular model, the lifeboat is modeled as rigid and there are 1 million SPH particles, representing the water.

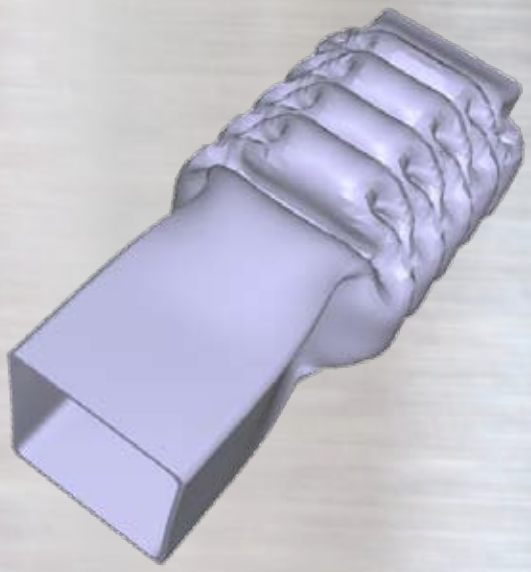
To get more information about the command and the generic lifeboat model, contact support@certasim.com.

CRUSHING OF EXTRUDED ALUMINUM PROFILES

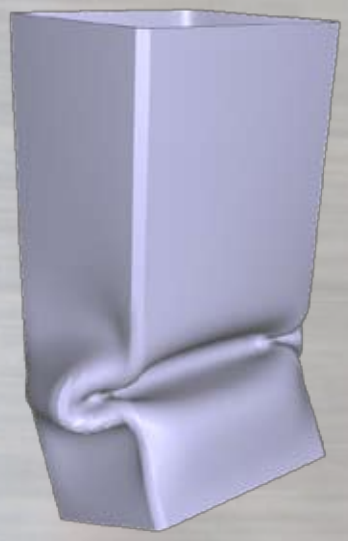
CertaSIM's R&D Group has just released a new public report describing how to model crushing of extruded aluminum profiles in the IMPETUS Afea Solver®. The report covers a literature study which reveals that it is necessary to use solid elements in order to capture the real 3D deformation of a crushing profile. Furthermore, the modeling techniques that should be applied in IMPETUS for this application are shown, as well as two verification examples which are described in detail. These compare numerical results with experimental data. The examples include global buckling and modeling of progressive buckling.

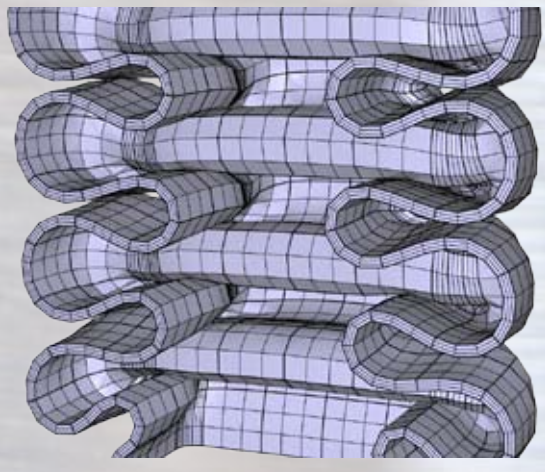
The report is titled: "Modeling Crashworthiness of Aluminum Profiles with the IMPETUS Afea Solver®", M. R. Jensen, # CS-0033-083114, 79 pages. Both the report and the command files for the models can be obtained by CertaSIM's customers by contacting sales@certasim.com.

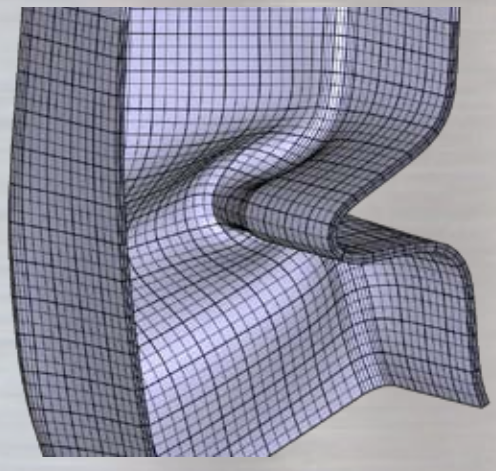
Progressive



Global







RDECOM-TARDEC Generic Vehicle Hull Model in IMPETUS

The motivation for the development of a Generic Vehicle Hull by RDECOM-TARDEC is best explained by this statement from the Army:

Many unclassified studies from past researchers have utilized fictitious vehicle geometry due to the non-availability of realistic information. Due to the sensitive nature of the work performed by the Department of Defense, data generated from testing military vehicles is usually classified, making it difficult to share data in the public domain. In order to increase the operational relevance of studies performed by the wider scientific community, the US Army Tank Automotive Research, Development and Engineering Center (RDECOM-TARDEC) has fabricated a generic vehicle hull to help evaluate blast mitigation technologies, and also shared an FEA model of the same for purposes of this research.

The FEA model provided by RDECOM-TARDEC was developed for another solver, so the Army provided CertaSIM, LLC the CAD files of the structure so that an IMPETUS FEA model could be created. The model was created by IMPETUS Afea AB (Sweden), it took less than 3 days for an experienced modeler to create the 24,902 element model, which consists of 24,688 quadratic hexahedron elements and 234 quadratic pentahedron elements. The development of the model took advantage of the ASET™ Element technology which is the basis for the IMPETUS Afea Solver and followed our recommended meshing strategy to build a very detailed and accurate model.

The *PBLAST command is used to generate the Soil and High Explosive (HE). The command activates the Discrete Particle Method (DPM) module which is used to model Air, Soil and HE. A cylindrical 8kg C4 charge was placed at a depth of 20 cm and the "generic" dry soil option was used to model the soil. The simulation time was 20 ms. A total of 4 million particles were used to represent the Soil and HE. Air was excluded from the simulation since it has an insignificant affect when modeling a buried mine scenario impacting a vehicle chassis. However, if one has doubts one can easily include air with the *PBLAST command by setting the "air" parameter equal to 1.

Also included in the model was the 50th Percentile Hybrid III Dummy model that was developed by IMPETUS Afea AB (Sweden) for use in blast scenarios.

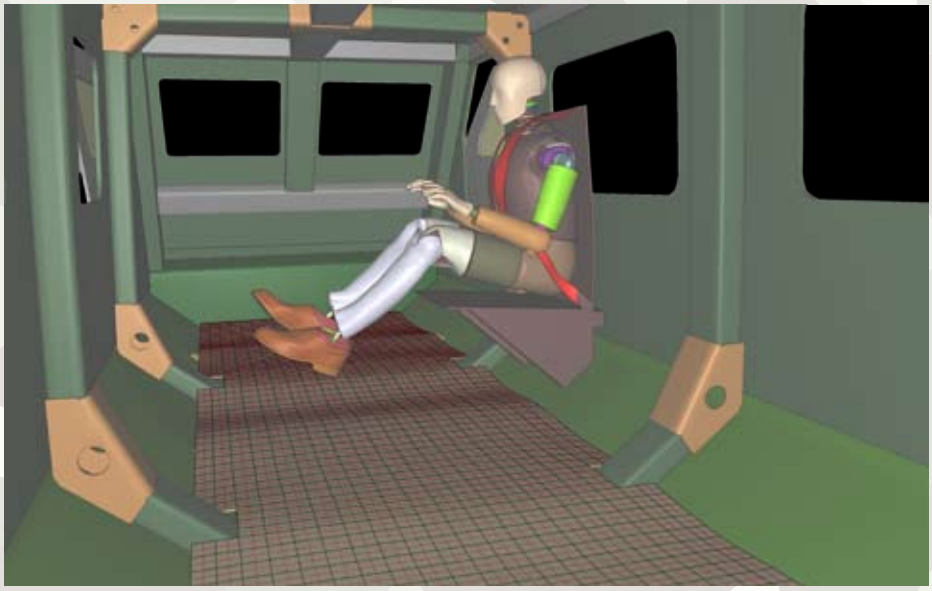
The *PBLAST command is compact in nature and simple to specify:

*PBLAST
entype, enid, air, soil, he, N_p
bc_{x0}, bc_{x1}, bc_{y0}, bc_{y1}, bc_{z0}, bc_{z1}, μ
gid_{glob}, gid_{soil}, gid_{he}, x_0, y_0, z_0, t_0, t_{end}
pack, ρ_s, k_s, μ_s, ξ_s
ρ_{he}, e_{he}, γ_{he}, v_{he}, D_{he}

One gives the structure that comes into contact with the air, soil and HE particles. Also given is the total number of particles. Domains are given for the particles as well as reflective boundaries can be specified. There are built-in standard formulations for the soil and HE but the user can also define her/his own. Details on the command can be found in the IMPETUS User's Manual and in the CertaSIM Buried Charge Class Notes.

The class notes with the work-shop examples cover the *PBLAST command in great detail. The notes and examples are available for CertaSIM customers.

The model ran on a NVIDIA K40 GPU and since IMPETUS takes full advantage of GPU technology, the computational time was only 12 hours. This is for a full Generic Hull model including a deformable Blast Dummy, DPM description of the soil/HE and all elements being higher order fully integrated 3D solid elements even welds are modeled with solid elements. Further, the computation is done in double precision. The next step in this project is to verify the experimental data when it is released.



An explanatory introduction video that captures the detailed features of the model and the simulation can be viewed at:

http://files.certasim.com/download/file/tech-info/videos/TARDEC-GenericVehicleHullModel-1080p.mp4

IMPETUS Afea Solver in 2014 and What to Expect in 2015

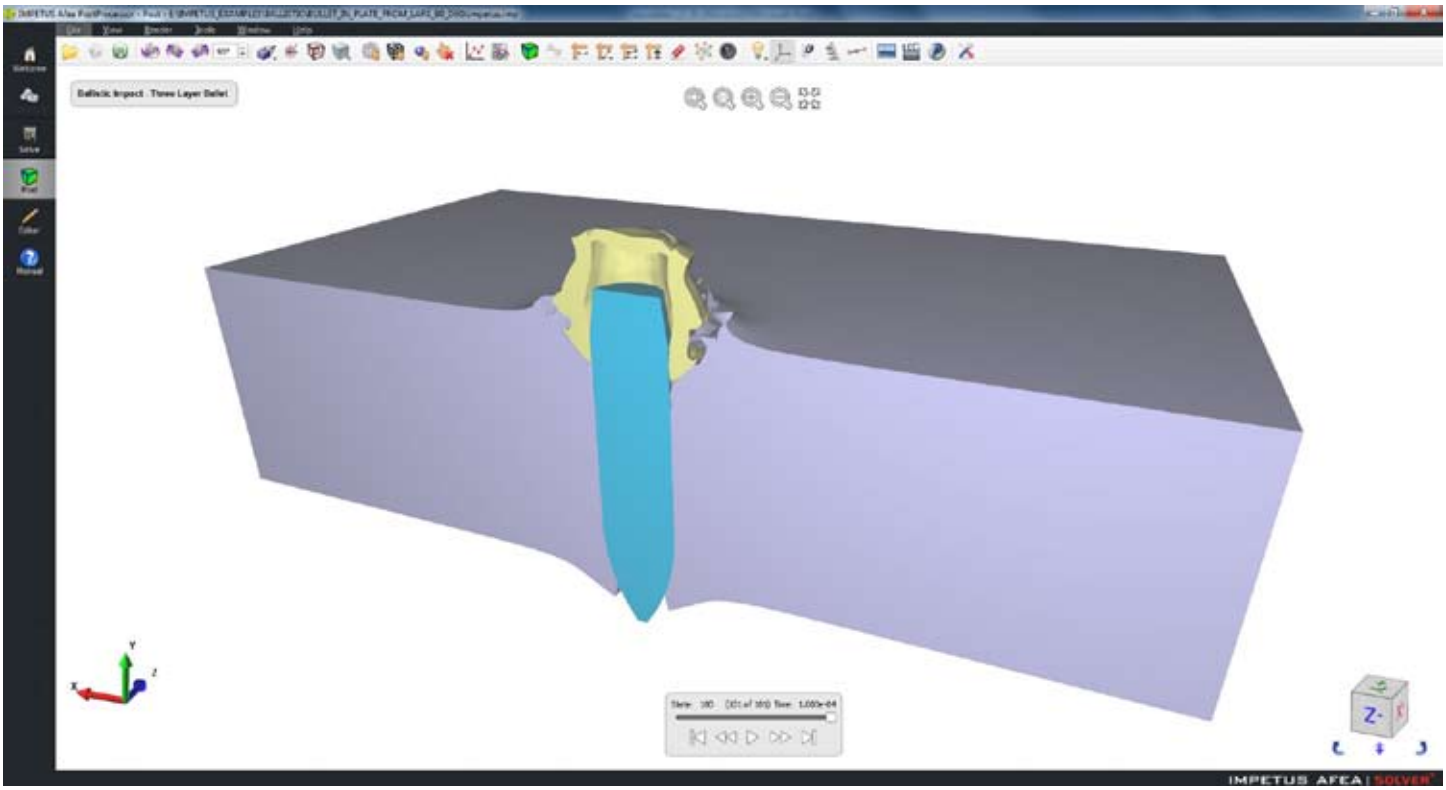
In a recent interview with Dr. Lars Olovsson, CTO at IMPETUS AB, Sweden, he reflected over the events in 2014 and what 2015 will bring. Dr. Olovsson is the chief strategist behind the IMPETUS Solver and his staff in Stockholm, Sweden develops the main part of IMPETUS, the structural FE module including the DPM module.

"2014 represented a shift in the solver development process. We now have a mature framework with most necessary core functionalities in place and can allow ourselves to focus more on verification, validation and on improving the user experience. This does not mean that development of new features has stopped. 2014 was actually quite a productive year. Worth mentioning is some fantastic progress with a new GPU-based contact algorithm. Our goal is to deliver a fast enough contact algorithm that always works. "Always" is a strong word, but this is really our goal. We hope to make it official in 2015. It is going to be a major step forward in our effort to strengthen our position as having the most accurate explicit solver in the world. For 2015 many interesting things are planned, but our strategically most important investment is in a large user interface project. Setting up models will soon be much easier."

NEW FEATURES IN THE
IMPETUS Afea Post-Processor

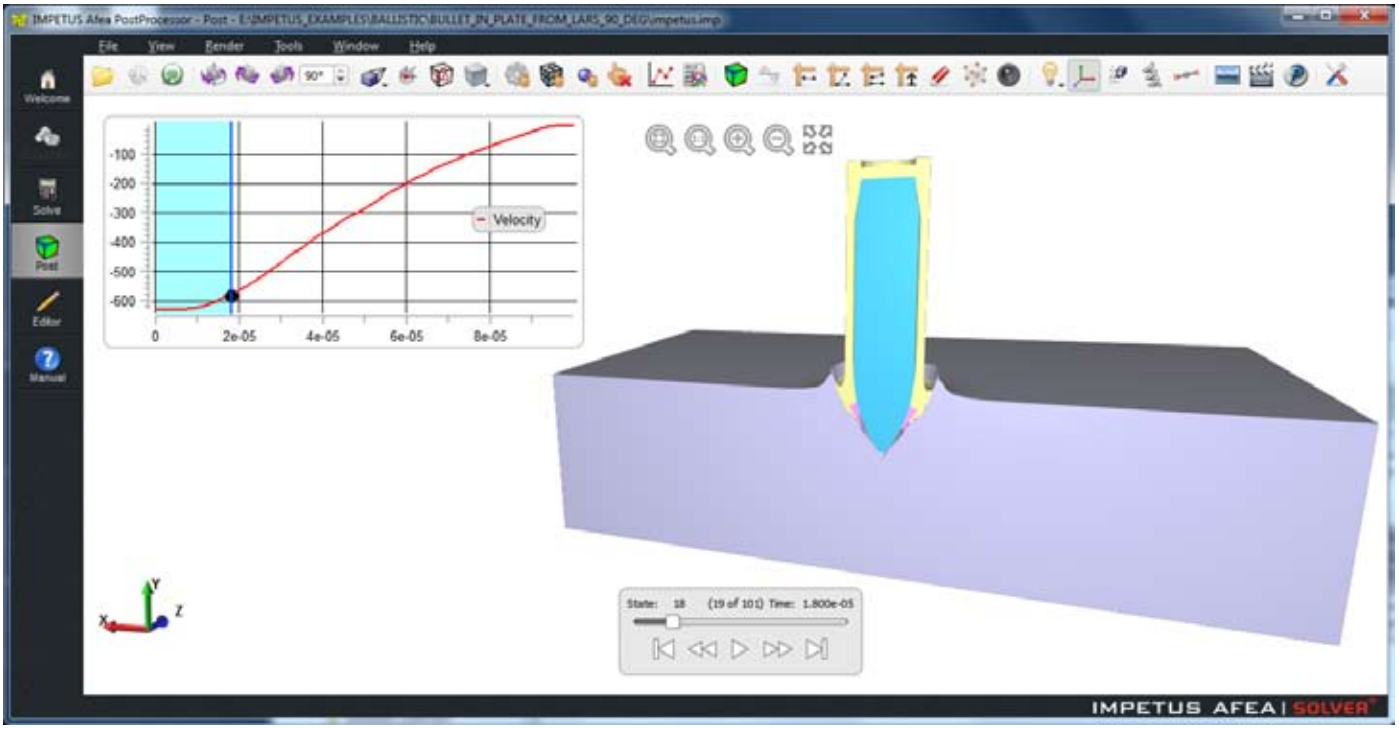
Features are constantly being added to the IMPETUS Afea Post-Processor, among some of the latest additions are the "View Cube" and the "Overlay Plot on 3D Window" feature.

The View Cube is located in the lower right corner of the graphic window and allows for rotating the view by clicking on the cube with the mouse.



The Overlay Plot on 3D Window is a feature that can be used to add a 2D plot onto the 3D graphic. It is a very powerful and flexible option with many possible user settings if one chooses to do so. It is located in the 2D plotting menu both for the entity plots and the ASCII file plots. Some of the options include size, color, plot values, time line, etc. If the model is animated, the vertical time line will show the position on the 2D plot that corresponds to the current time of the animation. The icons in the 2D plot menu include the ones for the Overlay Plot on 3D Window and the Highlight Current Time.

When the 2D plot is added to the 3D graphic plot, a click with the right mouse button on the 2D plot will activate the pop-up menu for formatting the 2D plot, by specifying location, size, etc.



The latest version of the IMPETUS Afea Post-Processor can be obtained by contacting CertaSIM support but if the machine running the Post-Processor is on the internet, the program will automatically ask the user if they want to update.