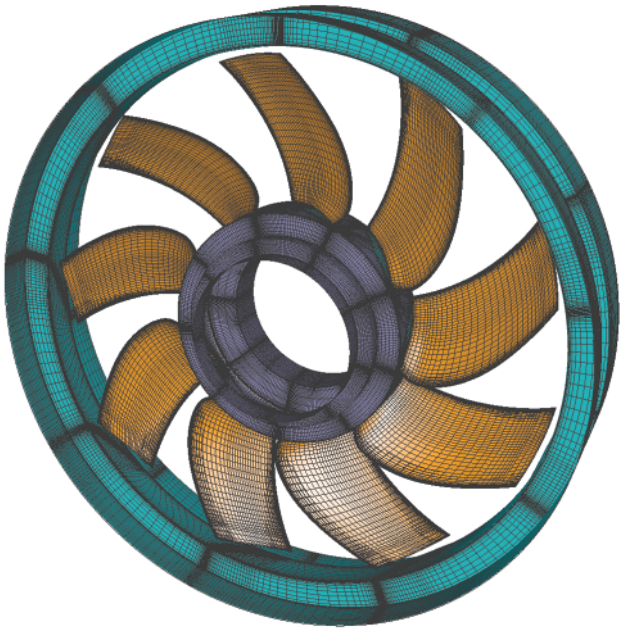
FocalPoint The Newsletter for Gridgen® Users

Volume 10 Issue 2 Fall 2006

Automatic Mesh Generation for Automotive Cooling Fans



This fan grid was created automatically with Valeo's GridgenGlyph script.

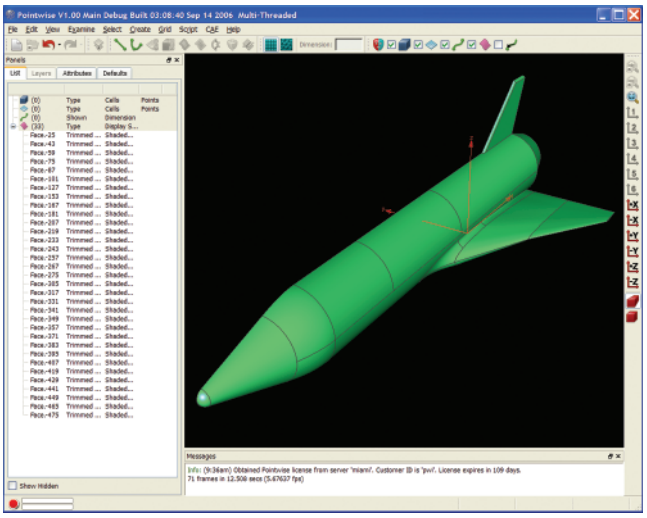
In the ever changing automotive marketplace, manufacturers strive to produce differentiated and attractive products. To do this, they must shorten their development cycle. This challenge is met by the use of numerical tools such as computational fluid dynamics. Tier1 suppliers like Valeo strongly invest in the use of multi-physics simulation software in order to improve both their expertise and their ability to design new parts in a very short timeframe. The constant improvements of fan systems over the years to become more compact, more efficient and less noisy are a clear evidence of the relevance of simulation based design. In part, these results have been achieved with the help of commercial software like Gridgen.

(Continues on page 2)

INSIDE THIS ISSUE

Pointwise – The Next Generation of Reliable CFD Meshing

Members of the Pointwise Advisory Team are now alpha-testing Pointwise, our next-generation meshing software. Pointwise builds upon our 22-years of meshing technology development with the addition of a new, modern interface and streamlined interaction model.



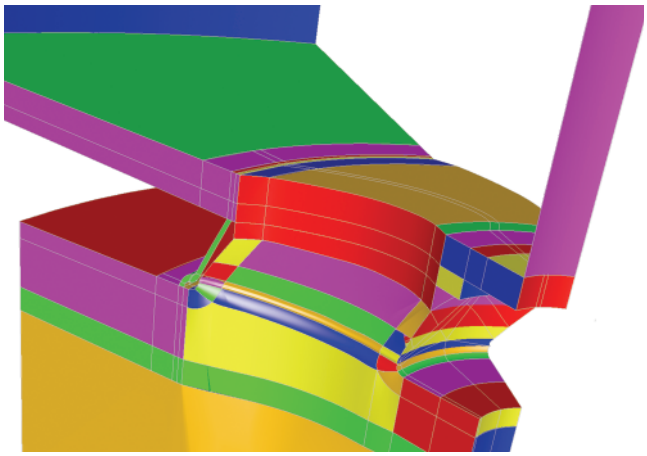
Pointwise has a modern, standard conforming user interface that drastically cuts the learning curve.

(Continues on page 3)

VALEO

(Continued from page 1)

Valeo chose Gridgen as a tool to help with the development of their fan system product line. Gridgen replaces the previous integrated meshing tools within CFX-TASCflow, which were based on parametric templates to create structured blocks and attach them together.



The script generates geometry for blades, hub, shroud, and inflow and outflow sections.

Input data are relatively limited, since no CAD geometries are available a priori for fans at the earlier stage of development, and for which performance has to be estimated before any physical prototype. ASCII files are simply used to describe the blade profile at different given radii from bottom to top, and the whole topology of the computational domain is extrapolated from these airfoil data by a program written in Fortran. The user specifies values for the numerous parameters which are used to describe the fan geometry (number of blades, hub and shroud diameter, etc.), to dimension the computational domain around the fan mimicking the experimental set-up (length of inlet and outlet domains) and to control the grid quality (thickness of "O-grid" around blade).

Resulting files describe the whole computational topology by curves and surfaces. They are read by Gridgen and converted into the native Pointwise database. All connectors are directly created from curves, whereas the number of nodes and their distribution is completely parameterized in the script. Domains and blocks can be easily built on the base of previous connectors and database surfaces.

All these operations have been scripted in GridgenGlyph files, which have been linked in a final command file. The objective is to have an automated meshing tool for fans. This last point is absolutely needed because meshes must be created iteratively and automatically in a short amount of time (few minutes), if several simulations must be launched everyday to create performance curves for the designer.

In parallel to the creation of such standard grids used daily for fan development, the database and the mesh previously described can also be used partially when there is a specific need for special geometries and more complicated fan system configuration. For instance, removing the rotating ring on the fan and replacing it by a more classical tip clearance between the blades and the stationary shroud requires only a few hours for an inexperienced user, while modifying the shape and the size of inlet or outlet domains can be done quickly.

In summary, Gridgen has provided significant improvement, especially regarding the following aspects:

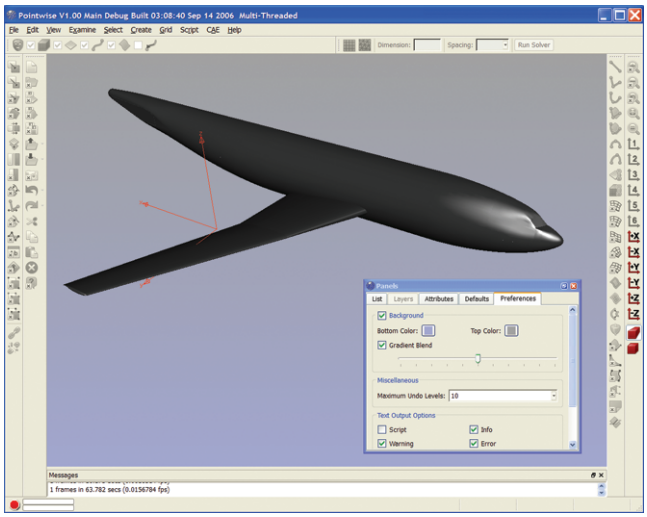
- rapid training of the whole fan system group
- ability to manage complex geometries with structured or unstructured meshes
- smoothing capabilities with outstanding performances
- output format available for all commercial codes and main standards of the market.
- possibility to script by Gyph command, which allows us to automatically create standard meshes.

A first version of the GridgenGlyph script is already in production and used by the whole fan system group and gives the ability to create good quality meshes. The development of a second more advanced version is in progress, and should take more advantage of the extrusion tool (around the blade in particular) and Gridgen's elliptic smoothing capabilities (in the blade to blade passage).

For more information about the script VALEO is using, please contact Yves-Marie Lefebvre at yves-marie.lefebvre@sirehna.com. ■

Pointwise

(Continued from page 1)



Pointwise features Undo & Redo among many new features.

A Modern, Standard, Customizable GUI

As you can see, Pointwise's user interface has a modern, standard appearance that invites and facilitates usage by new users. Combine that with use of standard selection mechanisms and hot keys (for example, Ctrl+A for Select All and Ctrl+C for Copy) and the software's learning curve is cut dramatically.

Pointwise's interface is extremely flat when compared to Gridgen's. Instead of deeply nested menus, 100% of commands can be accessed directly from the menu bar. Furthermore, frequently-used commands are available from the toolbars with 1-click access. Experienced users will find that the interface can be customized to match their work style including window sizes, toolbar locations, and commands on toolbars.

Supporting commands like the entity list, display attributes, layer manager, and default parameters have been implemented separately from the menus and toolbars allowing them to be available at all times.

Powerful, New Features

Pointwise's beauty is more than skin-deep. Several new commands significantly reduce your mesh generation effort.

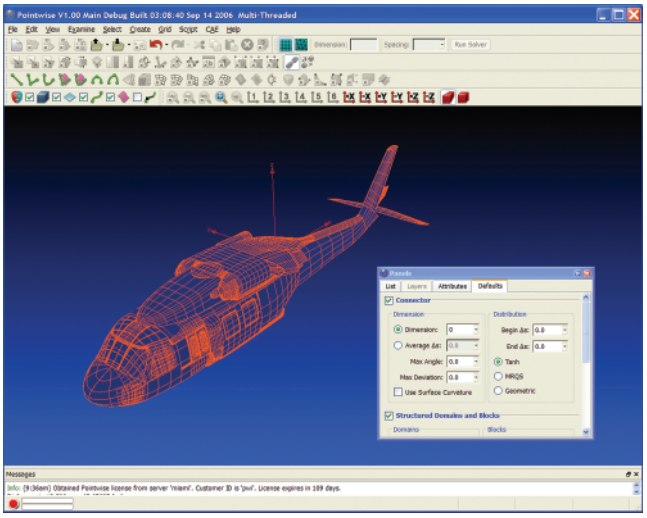
- Undo and Redo are available to help you recover from inadvertent actions and unexpected results.
- Curve drawing no longer requires that you drag around a 3D cursor. The software tracks the cursor location and places points directly where you are pointing - including drawing on the database. The GUI remembers coordinates you enter for easy recall and editing.
- A new, automatic tool for domain and block assembly has been implemented. Rather than defining each edge or face manually by selecting boundaries and the demarcations between them, you simply select all the connectors and domains and Pointwise assembles the grids for you.
- Support for 64-bit operating systems

The transition from Gridgen to Pointwise will be gradual and the two products will both be available for production use during the transition period. They will share the license manager so you can choose which product to use. To aid in the transition, the two products will be fully compatible. Pointwise can read and write Gridgen native grid (.gg) and database (.dba) files and run Gridgen scripts.

Beta Testers Sought

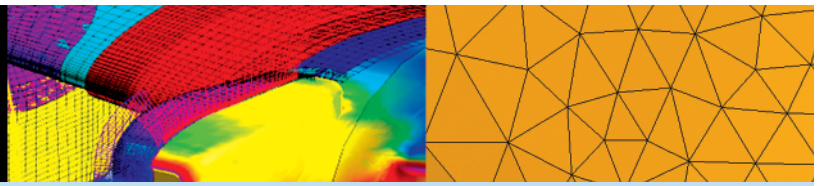
Pointwise will be available for beta testing in January 2007 and we are seeking a dedicated group of volunteers to work with us on testing the product. If you are interested in being a Pointwise beta tester, send your name and email address to pointwise@pointwise.com.

A special Introduction to Pointwise seminar will be held in conjunction with the AIAA Aerospace Sciences Meeting in Reno on 7 January 2007 for all beta testers and other interested parties. This seminar will be a great way to kick-off your beta testing. Watch www.pointwise.com for an announcement about registration for this seminar. ■



Experienced users can customize Pointwise's GUI to match their work style.

Gridgen Product News



Anisotropic Tetrahedral Extrusion

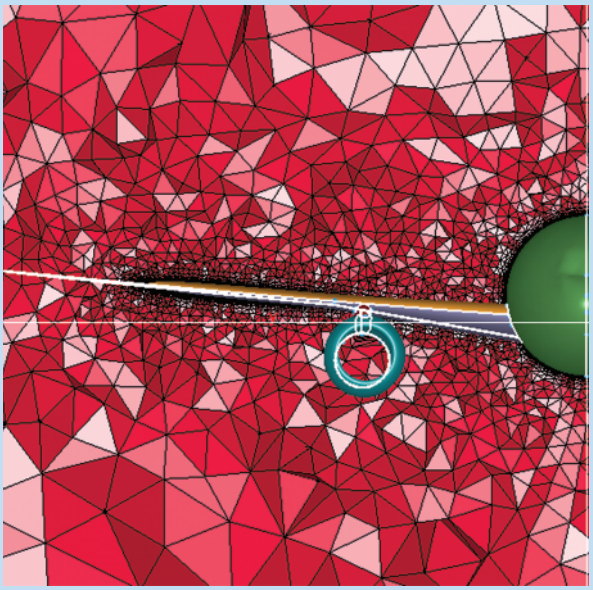
Anisotropic tetrahedral extrusion is a new, highly automated, hybrid meshing technique that is available in Gridgen Version 15.10. The time required to generate interactively the DLR-F6 mesh shown here including downloading the CAD file off the internet, solid model creation, surface meshing, and anisotropic tetrahedral extrusion of a 6 million cell mesh with viscous clustering was only a couple hours. Here's an overview of how the method works.

Anisotropic tetrahedral extrusion begins with an unstructured (triangle) surface mesh. Each node on the mesh is extruded in a prescribed direction (orthogonal to the mesh) and step size. The extruded node is reconnected to the base mesh and produces tetrahedra that are anisotropic (flat) but have an included right angle.

Mesh quality is optimized as each node is extruded using a method of steepest descent. Cell volume and general skewness measures can be optimized. Extrusion of nodes continues until the resulting tetrahedra become isotropic at which time extrusion stops and the remaining volume is filled using the Delaunay (isotropic) mesher.

As each node is extruded, the new location is checked for proximity to other nodes. If a collision is detected, the extrusion distance is reduced and proximity retested. When a collision is unavoidable, extrusion is disabled. However, extrusion is only disabled locally so adjacent nodes will continue to extrude.

A mesh refinement test is applied prior to extrusion in order to determine whether the expansion is too large in convex regions. If so, a node is inserted at the centroid of the triangle and extrusion proceeds. A decimation test is performed after extrusion in order to remove anisotropy from the mesh. If an extruded node is too close to adjacent tetrahedra, the node is removed from the base mesh and extrusion is repeated. Decimation helps the mesh transition smoothly to an isotropic farfield tetrahedral mesh.



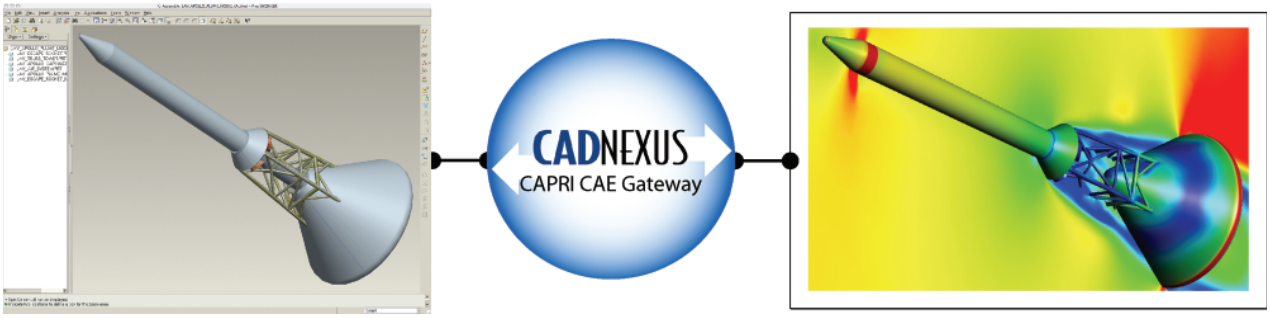
This anisotropic tetrahedral mesh with viscous resolution was generated in less than 3 hours from CAD file download.

Comparision of Anisotrophic Tetrahedral Extrusion and Prism Extrusion

	Prism Extrusion	Aniso Tet Extrusion
Detects Collisions	No	Yes
Inserts Nodes	No	Yes
Removes Nodes	No	Yes
Anisotropy	No	Yes
Layers of Varying Depth	No	Yes
Smooth Blend to Adj Mesh	Maybe	Yes

Anisotropic tri meshing has also been added to the unstructured domain solver. Useful unto itself, this method is designed for creating symmetry plane meshes for the anisotropic tetrahedral extrusion. Finally, tetrahedra in the extruded layers can be combined into prisms to reduce cell count.

Partner Highlight



CADNexus

CADNexus' CAPRI CAE Gateway platform provides reliable feature-based integration between best in class CAE applications and the strategic CAD system in an organization to enable true simulation-driven design. Our customers can base their simulations directly on fully associative native import of CAD models and access parametric design knowledge to drive modifications of the CAD models from the CAE environment. As a result, our customers can improve product quality, accelerate time to market, and reduce engineering inefficiencies and costs.

CADNexus offers vendor-neutral solutions that link major parametric CAD packages to diverse CAE tools such as commercial preprocessing and simulation packages. CAPRI's fully customizable environment, in addition, lets users easily implement custom preprocessor formats, integrate in-house legacy/proprietary tools, and exploit other advanced functionality to capture and automate the steps in a CAD-based design process.

The enterprise version of CAPRI provides a secure and scalable solution for design collaboration, platform independent deployment, and unparalleled flexibility for CAE applications that need on-demand access to CAD resources in an organization.

CADNexus has recently developed an interface between CAPRI and Gridgen linking Gridgen with CAD packages such as Catia V5, Pro/ENGINEER, UG NX, and Solidworks

For information on our products and services, visit us on the web at www.cadnexus.com.■

Interested in our Gridgen Teaching Partnership?

Recognized academic institutions already having at least two Gridgen academic licenses can add ten additional licenses for the duration of a class at no additional charge. For more information about our teaching licenses, please contact Heather McCoy at hlmccoy@pointwise.com.

213 South Jennings Avenue Fort Worth, Texas 76104-1107 Toll-free 888-GRIDGEN
Tel (817) 377-2807 Fax (817) 377-2799 focalpoint@pointwise.com www.pointwise.com

FocalPoint is a publication of Pointwise, Inc. It is for Gridgen users and people interested in learning more about Gridgen and numerical grid generation. It includes information about the latest release of Gridgen, future development plans, and tips on how to get the most out of Gridgen while saving time in grid generation.

POINTWISE®

213 South Jennings Avenue
Fort Worth, Texas 76104-1107

FocalPoint The Newsletter for Gridgen® Users

Volume 10 Issue 2 Fall 2006

New Faces at Pointwise

Meet our newest employees...

Xiaohang (Wenny) Wang joins Pointwise as an engineer in our Support & Consulting Department. She will receive a PhD in December in Mechanical Engineering with a minor in Applied Mathematics from Iowa State University where her research involved CFD simulation of supercritical CO2 pipe flow. Wenny's B.S. and M.S were earned at Huazhong University of Science and Technology in Wuhan, China. Make sure to say hi to Wenny if you phone in for support.

Mike Eggleston joins Pointwise as our computer systems administrator and supports all of the company's information technology needs. Mike earned a BS in MIS with a mathematics minor from Tarleton State University in 1987.

Pointwise Consulting Services

Here's something you may not have known about the Pointwise Support Group - we can provide consulting services. If you need help with a difficult grid, extra hands during a peak workload, or Gridgen customized for your computing environment, we can assist.

Training Services

Are you looking to improve your grid generation skills? Pointwise may have the training class for you. Check out our training webpage at www.pointwise.com/support/train.shtml for a course near you.