Vanderplaats Research & Development, Inc.
Creators of Design Optimization Technologies

VR&D Summer 2008 Newsletter

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1 New Employees In Novi Office

1.1 Dr. Hong Dong joined VR&D in March, 2008, as R&D Engineer, after receiving her Doctorate in Mechanical Engineering from Clemson University. She graduated from Tianjin University, China with a Masters degree in Mechanical Engineering. Her Ph.D. research topic was packing optimization with shape morphing. She developed a physical-based shape morphing method for packing application, and a bi-level approach for layout design with a shape morphing problem. She will work on VisualDOC software development, design process integration, and research on optimization methods. She will also assist clients with commercial applications.

1.2 Dr. Phani Adduri joined VR&D in April, 2008, as Support Engineer. Phani earned a Ph.D. in mechanical engineering from Wright State University. He received his Masters from Lamar University and Bachelors from Andhra University, India. Before joining VR&D, Phani worked with Boeing Commercial Airplanes as a contractor. At Boeing, Phani worked on developing customized software solutions to assist engineers in design and analysis. As a research assistant at Wright State, he developed algorithms to efficiently estimate the reliability of complex structural systems. He used GENESIS extensively during his dissertation work, and will be involved in providing technical support and help with training.

2 New Intern at VR&D

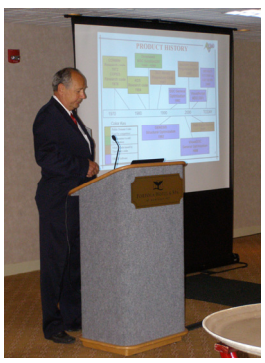
2.1 Romain Migeon joined VR&D in February, 2008, as an intern. Romain is currently a student at the French Institute of Advanced Mechanics, IFMA, in Clermont-Ferrand, France. He is majoring in Mechanical Engineering and will graduate in June, 2009. While he is here he will be helping Novi developers with several tasks including engineering problem solving, creating new training materials and modifying existing ones.

3 Recent Events

3.1 2008 VR&D Design Optimization Users' Conference

VR&D recently hosted the 2008 Design Optimization Users' Conference in Monterey, CA. Attendees represented the European Union, Japan, Korea, Brazil, and the United States. VR&D and attendees enjoyed a wine tasting tour which included several award winning wineries.

We were honored with keynote addresses by both Dr. Simon Xu of General Motors and Ms. Lisa Novelli of the National Composites Center. Several papers were offered showing very sophisticated applications of our GENESIS and VisualDOC software. VR&D personnel gave overviews of our upcoming GENESIS v10.0 and VisualDOC v6.1 releases as well as development of several special purpose optimization algorithms designed to maintain VR&D's leadership position in the optimization field. Ginny Vanderplaats took accompanying visitors sightseeing with lunch in beautiful Carmel. In the evening, we enjoyed a banquet on the wharf, sponsored by DI Square. We are very pleased to have hosted our users and distributors in a beautiful location and there was a strong consensus that future users meetings should be held in Monterey.



3.2

Congress on the Future of Engineering Software (COFES)

Our CEO and our President attended the 2008 Congress on the Future of Engineering Software which took place April 10-13, 2008, in Scottsdale, Arizona at the Scottsdale Plaza Resort.

COFES is an engineering software think tank event which brings executives from design, engineering, architectural, development and technology companies together to understand the role engineering technology will play in the future survival and success of our business.

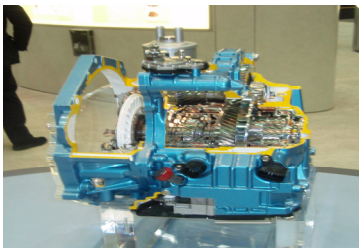
The conference was an interesting venue for us to discuss ways in which optimization can help sustainability, which was the main topic of this year's event.

3.3

2008 SAE World Congress

Vanderplaats R&D attended the 2008 SAE World Congress held at the Cobo Center in Detroit, Michigan. VR&D along with its partner AISIN AW presented the following two papers:

- Kosaka, I., Leiva, J.P., Watson, B.C., and Ide, T., "Techniques to Accelerate Large Scale Optimization with Large Scale Modal Frequency Response Analysis." Presented by Iku Kosaka from VR&D.
- Ide, T., Kosaka, I., Leiva, J.P., and Watson, B.C., "Improvement of NV performance for automatic transmission using large scale optimization," Presented by Takanori Ide from Aisin AW.



The first paper gives an overview of theoretical aspects of frequency response optimization while the second paper presents a practical application of it. We take this opportunity to recommend a paper written by Dr. Donald M. Baskin and several colleagues at Chrysler and MB-Technology N.A., LLC, discussing the use of topology, topometry and topograpy optimization. The name of the paper is: "A Case Study in Structural Optimization of an Automotive Body-in-White Design". The SAE number of this paper is 2008-01-0880."

3.4

14th Annual ARC Conference

Vanderplaats R&D attended the 14th Annual ARC Conference held in Ann Arbor, MI, May 20–21, 2008. Hong Dong and her advisor, Dr. George Fadel, presented the paper, "Physics Based Shape Morphing and Packing for Layout Optimization." In this work, a mesh based morphing method based on a mass-spring physical model is developed to morph objects whose shape can be changed arbitrarily. Decomposition and multilevel approaches are used for incorporating component shape design into the layout design process.

4.1

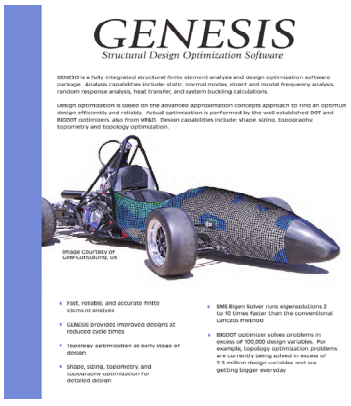
GENESIS v.10.0

GENESIS is a fully integrated finite element analysis and design optimization software package. It allows users to perform sizing, shape, topology, topography and topometry optimization. We recently released version 10.0., below is a list of the most important new features and enhancements:

- The linear equation solvers and the eigenvalue solvers now work with shared memory parallel computers.
- New I/O handling in solver.
- STRDOT optimizer has been implemented.
- Discrete DOT optimizer has been implemented.
- Topography optimization now allows the use of mirror, cyclical and extrusion fabrication constraints.
- Topography now runs faster. Some key routines have been improved by using efficient sorting routines.
- Topometry optimization now allows for extended regions for global symmetries.
- Composite ply angle symmetry in topometry is now possible, repeating angles on symmetric elements is now an option.
- Topometry now runs faster. Some internal routines have been changed to speed up the process.
- Topology optimization can now allow the use of stamping fabrication constraints.
- New Force approximations are now available for shell and composites responses.
- Multiple DTABLEs are now allowed.
- Alternative non structural mass input.
- Now the user can control the printing of the OPT and DNS files.
- Partial history files are now allowed.
- SPCD has been re-coded to be more efficient when large numbers of dofs are enforced.
- Warning messages are now limited to 10 messages per warning code.
- New table at end of output file shows number of warnings and errors for each warning/error code.
- Natural basis vectors created with the DVSHAPE commands now are printed with maximum precision.
- Automatic Inertia Relief Support
- User supplied failure index for composite analysis and optimization.
- New Property data for K2UU and M2UU allows sizing and topometry for super-element matrices.
- Linear Gap elements are now supported.

Software upgrade packages have been sent out. If you would like to be able to download the upgraded version please email, Jennifer Krejci, at Jennifer@vrand.com.

Release Date: May 2008



4.2

Design Studio for GENESIS v.10.0

Design Studio for GENESIS is a design oriented pre- and post-processor graphical interface for the GENESIS Structural Analysis and Optimization Software. The following is a list of the new features included in the release:

- New model visualization options: depth cue and translucency
- New view controls
- New selection options: center anchor, circle and ellipse shape
- Preferences file
- New shape domain creation trail: Drag out domains on the screen
- Natural perturbation vector creation
- Ease-of-use enhancements to morphing set trail: automatically create shape design variables
- Enhanced sizing trail: see non-designed property values
- Quick sizing additions: quick-design PBAR, PBUSH and PELAS
- Create elements: simple meshing or individual elements
- New grid modification options: morph mesh with shape changes or displacements
- Enhanced coincident grid control: preview merge candidates
- Morphing set preview: see possible shape changes without running GENESIS in check mode
- New post processing input/output: read OUTPUT2 files, export animated GIF files
- Enhanced GENESIS console: "stop light" indicator for Genesis run
- Model checking: highlight element free edges
- Model documentation: attach comments to data
- Simplified property creation: automatically make new groups
- Support all new GENESIS features including: new topology fabrication constraints, extended topometry regions, topography symmetry, composite failure equations, automatic inertia relief, parallel threads
- Support 3-D mouse devices for view control

Release Date: May 2008

4.3

SMS v.10.0

SMS is a very efficient and fast eigenvalue solver used by GENESIS and also offered by VR&D to third party FE programs such as MSC Nastran. SMS is very easy to use for Nastran users: they only have to add two lines in their input data to specify some DMAP information and the rest is automatically done. SMS is also available for TMG Nastran and other third party software. Contact us if you would like to use SMS with your FE program.

The SMS eigenvalue solver has been updated to run in multiprocessor machines. An example running with 4 processers showed a 66% time reduction when compared to running with 1 processor.

Release Date: May 2008

VisualDOC v.6.1

VisualDOC is a general-purpose optimization tool that allows the user to quickly add design optimization capabilities to almost any analysis program. All optimization settings and integration with analyses are completed through the graphical interface in general, it is not necessary to do any programming. We recently released a beta version of v.6.1. Here are some of the new features and enhancements included in v.6.1:

- ***Improved Restart Capability:***
  Now the user has an option of loading any point from any previously run task as an initial point in VisualDOC. This enables starting optimization tasks of one type (for example, DGO) from the point where an optimization task of another type (for example, RSA) stopped. This capability expands the traditional restart capability, which works within the task of the same type.

- ***Eliminated duplicate analyses in RSA:***
  When the point that should be analyzed in the course of Response Surface optimization is close to the point that has already been analyzed before, no new analysis will be performed and the results from the previous analysis will be used. This feature will especially help in optimization with computationally expensive analyses.

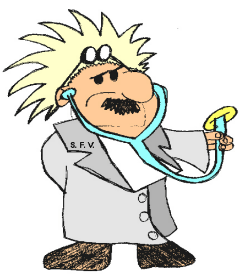
- ***Discrete variables in DOE:***
  It is now possible to use discrete/integer design variables in DOE tasks. VisualDOC will adjust the DOE geometry to accommodate the requirement that one or several design variables can only assume the predefined discrete values.

- ***New Parallel Computing Library:***
  VisualDOC switched from LAM to Open MPI library for the case when the user wants to run the analyses code in parallel on several different computers. This will keep the code up-to-date with a more widely used high performance library.

- ***Parallel Element in VisualScript:***
  The new release of VisualScript allows users to define which analyses they want to run at the same time. These analyses are combined in a single Parallel Element container and will be run at the same time when VisualScript is executed.

- ***Remote Run in VisualScript:***
  Now the users have an ability to run analysis on a remote computer in VisualScript. Combining Remote Run and Parallel Element capabilities in VisualScript allows the users to perform several analyses at the same time on different computers.

- ***VisualScript-Morpher Interface:***
  VisualScript users now have the ability to perform shape optimization using non-linear structural analysis in LS-Dyna, CFD with Fluent, and many other codes that have the interface to the DEP Morpher. VisualScript now has a specialized interface to the DEP Morpher that will make this kind of shape optimization easier.



Beta Version Available Now

5

New Training Classes Being Offered In Novi

VR&D Optimization Training

Last year we opened a new training room in our Novi office. The training room has multiple computers which allow us to give hands on training for engineers interested in gaining experience in optimization. Last year in Novi and at client sites we trained over 70 engineers in GENESIS and more than 50 engineers in VisualDOC and/or general optimization. We are now offering several new classes, among them:

- Advanced Topology Optimization
- Advanced Sizing and Topometry Optimization
- Advanced VisualDOC Integration
- Design of Experiments (DOE)

We will continue offering on-site classes and customized training sessions. Check our website for information on all our classes and for schedules: http://www.vrand.com/Training.html or contact us for more details by email at: training@vrand.com or via telephone at (248) 596-1611 x101.

6

GENESIS: Tips and Tricks

Tips and Tricks: Multiple Processors, 64 bit capability & hard disks

- To take advantage of multiple processors use the following executive control command:
  THREADS=n (e.g. n=4 for requesting four processors)
  On Unix/Linux, you can also use the -t option to the GENESIS script:

```
genesis -t 4 myinput.dat
```

- To take advantage of true 64 bit capability in GENESIS use the following executive control command:
  LENVEC=n (e.g. n=4G or 4000M to use 16Gb of memory or n=500M to use 2Gb)
  On Unix/Linux, you can also use the -L option to the GENESIS script:

```
genesis -L 4000 myinput.dat
```

- To take advantage of inexpensive hard disk storage space, install your disk on your local machine. Running over the network makes GENESIS and any other program run slower.