



## VR&D Summer 2010 Newsletter

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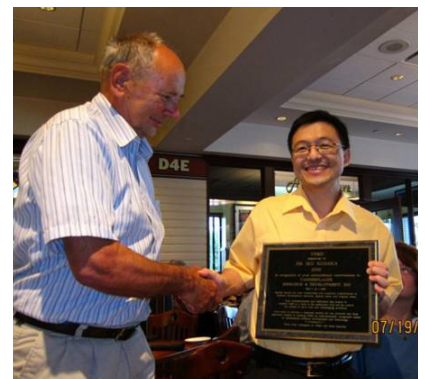
## 1.

### Awards

#### 1.1 VR&D Excellence Award Presented to Dr. Iku Kosaka

Thirteen years ago we hired Iku Kosaka to help us in the development of the GENESIS software. At that time, Dr. Kosaka had just graduated from University of Iowa with a Ph.D in Engineering Mechanics. The focus of his research at the University of Iowa was in non-linear topology optimization. Little did we know at that time Iku would become an invaluable asset to VR&D and would also help in many other aspects of our business. Dr. Kosaka has contributed in the development of Design Studio and has written an ESL interface to help couple GENESIS and LS-Dyna. He has also helped us to expand sales both nationally and internationally focusing on expanding the use of VR&D software in Japan. He has worked closely with our clients to develop very innovative solutions to meet their needs. Dr. Kosaka has also written several interesting papers on applications and methods such as Sound Pressure Optimization.

Please join us in congratulating Iku Kosaka for his very well deserved award.



## 2. *New Distributor in Korea*

### 2.1 **Solugen Co., Ltd.**

We are pleased to announce that Solugen Co., Ltd. has signed an agreement to become our distributor in Korea. Solugen was founded in 2007 in Seoul.

VR&D welcomes Solugen to its family of distributors around the world. For more information on Solugen, please visit their website: [www.solugen.kr](http://www.solugen.kr)



## 3. *Recent Events*

### 3.1 **COFES 2010: Congress on the Future of Engineering Software**

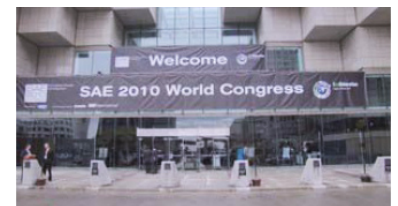
Our CEO, Dr. Gary Vanderplaats, attended the 2010 Congress On the Future of Engineering Software (COFES) which was held April 16-19, 2010 in Scottsdale, Arizona. The event took place at The Scottsdale Plaza Resort. COFES is an engineering software think tank event which brings executives from design, engineering, architectural, development and technology companies together to understand the role that engineering technology will play in the future survival and success of our business.



### 3.2 **2010 SAE World Congress**

Vanderplaats R&D engineers attended the 2010 SAE World Congress that was held in Detroit, Michigan at the Cobo Center. Together with engineers from Aisin AW and AW Engineering they presented the paper entitled ***“Improvement for Noise Performance for Automatic Transmission using Sound Pressure Optimization”***. The authors of the paper included: Takanori Ide and Masaki Otomori from Aisin AW Co., Ltd., Yohei Kitamura from AW Engineering Co., Ltd., and Iku Kosaka, Juan Pablo Leiva, and Brian C. Watson from Vanderplaats Research & Development, Inc. Mr. Ide presented the paper. The abstract of the paper is as follows:

A design process to improve noise performance for automatic transmissions of vehicles is presented. The proposed process uses a newly developed sound pressure optimization technique. Additionally, useful and necessary techniques including Topometry Optimization and beta method are described and used to reduce sound pressure response caused by structural vibration. As a demonstrative problem, the design process is successfully applied to improve the noise performance of the AISIN AW FWD automatic transmission.



On April 15, 2010 VR&D hosted a Non-linear Responses in Optimization Seminar. Our Main Speaker was Professor Gyung-Jin Park from Hanyang University in Korea. Dr. Park gave an excellent review on the ESL method and presented recent research in the area. Additional speakers included: Dr. Brian C. Watson who presented Design Studio Software; Dr. Iku Kosaka who presented the ESL Interface; Mr. Gary Quinn who presented a work on topology optimization of a vehicle; and finally, Dr. Santosh Tiwari who presented recent advances in the VisualDOC Software.

The seminar was held at Walsh College in Novi, Michigan.



## 6th China-Japan-Korea Joint Symposium on Optimization of Structural and Mechanical Systems - CJK OSM6

CJK-OSM is a series of biannual symposia which have stimulated and promoted research and interest in all aspects of the optimization of structures and mechanical systems.

Vanderplaats R&D attended this symposium and presented two papers.

The first paper is entitled “**Freeform Optimization: A New Capability to Perform Grid-by-Grid Shape Optimization of Structures**” written by Juan Pablo Leiva. The abstract of this paper is as follows:

This paper presents a new capability for performing a special type of shape optimization. Traditional shape optimization is often performed by using perturbation vectors that are linked with grid coordinates and design variables which an optimizer can change. In this work, these shape perturbation vectors are split so that each grid, and/or a set of nearby grids, and/or a set of grids linked by a manufacturing constraint, has its own design variable. This split produces great variability in the answers. In this work, possible distortions that could happen during an optimization run are prevented with automatically generated distortion constraints and/or by mesh smoothing. To distinguish this capability from standard shape optimization, we named this capability freeform optimization. This capability could be seen as a generalization of topography optimization since it can reproduce most topography results, but it is different than topography optimization since it can be used to design any type of structure including solids and trusses whereas topography is mostly used for shell structures. Several examples that show the application of freeform are presented. One example will demonstrate that a simple perturbation vector can be used to find the optimal location of rib patterns in a solid structure as shown in Fig. 1. Another example will demonstrate that a non-uniform perturbation vector can be used to find the optimal location of bead patterns in a shell structure as shown in Fig. 2.

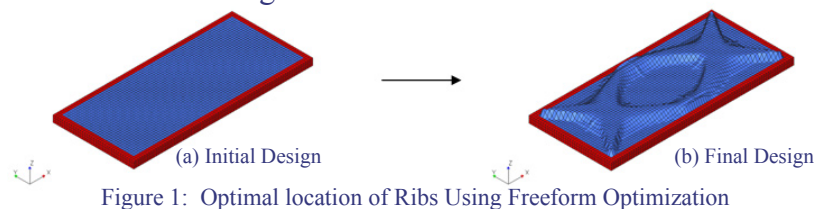


Figure 1: Optimal location of Ribs Using Freeform Optimization

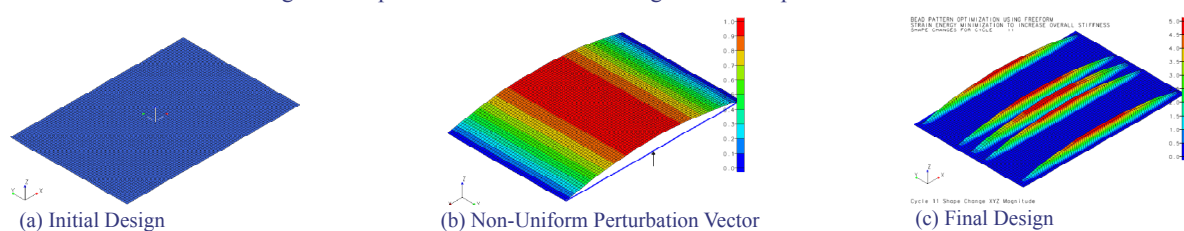


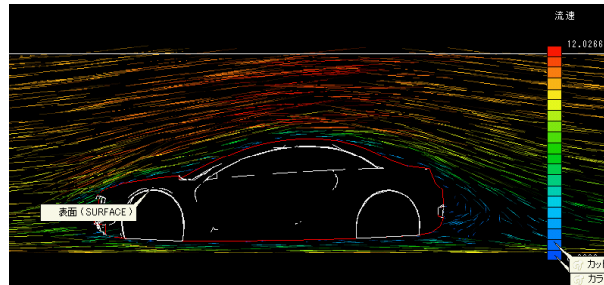
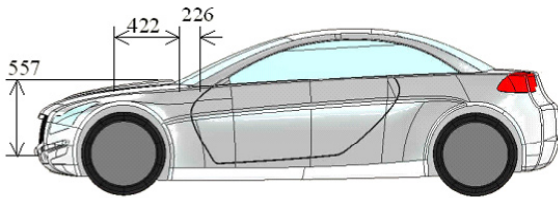
Figure 2: Optimal Location of Bead Patterns Using Freeform Optimization

## 6th China-Japan-Korea Joint Symposium on Optimization of Structural and Mechanical Systems - CJK OSM6

...continued

The second paper is entitled “*A CAD Parameter Based Design Optimization Process for CFD*” and it was written by Dr. Iku Kosaka from VR&D, Mr. Takeshi Kobiki from DI Square, Japan, and Mr. Kazuhiro Kooriyama from ADS, Japan. The abstract of this paper is as follows:

A design process to improve the coefficient of drag for vehicles analyzed by Computational Fluid Dynamics (CFD) is presented. The proposed design process involves process integration and design optimization of general-purpose optimization software, CFD software, and CAD based morphing software. Since optimizations of CFD, in general, require modification of geometry and node locations, some of the biggest challenges are parameterization and process automation of geometry changes and corresponding mesh regeneration. In addition to this, optimization results need to be incorporated into a final CAD design quickly and easily once the optimization is completed. Therefore, a CAD based morphing tool, allowing direct CAD parameter optimization, is used to re-mesh a CFD model based on the CAD parameters change. Once the process integration is completed, response values are computed at the sampling points using Design of Experiments (DOE). Then Response Surface Approximation (RSA) based optimization is performed to obtain an optimal solution. Three CAD parameters, which control the front deck of a vehicle, are used as design variables and coefficient of drag (CD) value is optimized to demonstrate the design process. Statistical tools are employed to evaluate the approximation of the response, and the approximated design space of CD value with respect to design variables is visualized in 3D plots to display the design space. The proposed process can provide valuable information and insight into a design space for designers and engineers during early conceptual design stages.

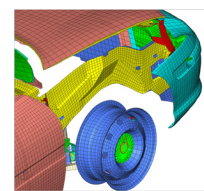
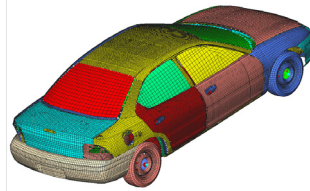


### 3.5

## 11th International LS-Dyna Users' Conference

VR&D attended the 11th International LS-DYNA Users' Conference that was held June 6-8, 2010 in Dearborn, Michigan. Iku Kosaka, one of our engineers, presented the paper entitled "*Improvement of Energy Absorption for the Side Member Using Topography Optimization*". The abstract of the paper is as follows:

This paper describes a design system to optimize the non-linear responses computed from LS-DYNA® using various optimization techniques, especially with large-scale (large number of design variables) optimization, and demonstrates the system as it improves the energy absorption for the side member of the vehicle. The proposed design system uses the equivalent static load (ESL) method, which requires the iterative process of non-linear structural analysis (LS-DYNA) and linear structural optimization (GENESIS®). Unlike general-purpose optimization software packages, it does not require many analysis calls when large numbers of design variables are used to design a structure. Therefore, non-parametric techniques, such as Topology, Topometry, and Topography Optimizations, which often require thousands of design variables, can be easily employed. To demonstrate this, the side member of the Dodge Neon was optimized to improve its energy absorption using Topography Optimization. *To obtain a copy of this paper you can contact us using the following email: [genesis.support@vrand.com](mailto:genesis.support@vrand.com).*



## 4.

# Upcoming Events

4.1

### 13th AIAA/ISSMO MAO Conference

VR&D will attend the 13th AIAA/ISSMO MAO Conference to be held September 13th - 15th, 2010. We are presenting three papers at the conference.

The first paper is entitled ***“VisualDOC: New Capabilities for Concurrent and Integrated Simulation and Design”***. This paper will give a preview of the new features in VisualDOC 7.0. This paper will be presented by Dr. Santosh Tiwari.

The second paper is entitled ***“Full Automobile Topology Design Optimized to Maximize Structural Stiffness Subject to Multiple Static Load Cases Including Inertial Relief ”***. This paper shows and compares Body in White topology optimization results with and without inertial relief static loading. This paper will be presented by Mr. Gary Quinn.

The third paper is entitled ***“Fifty Years of Structural Synthesis: Some Musings From a Disciple of Schmit”***. The purpose of the paper is to offer a brief overview of the structural synthesis field and related developments since its inception 50 years ago, focusing on the career of Professor Lucien Schmit and his influence in the industry. This paper will be presented by Dr. Gary Vanderplaats.

Dr. Vanderplaats will also participate in a keynote panel discussion on Wednesday, September 15, 2010. The panel will focus on the Past, Present, and Future of MDO.

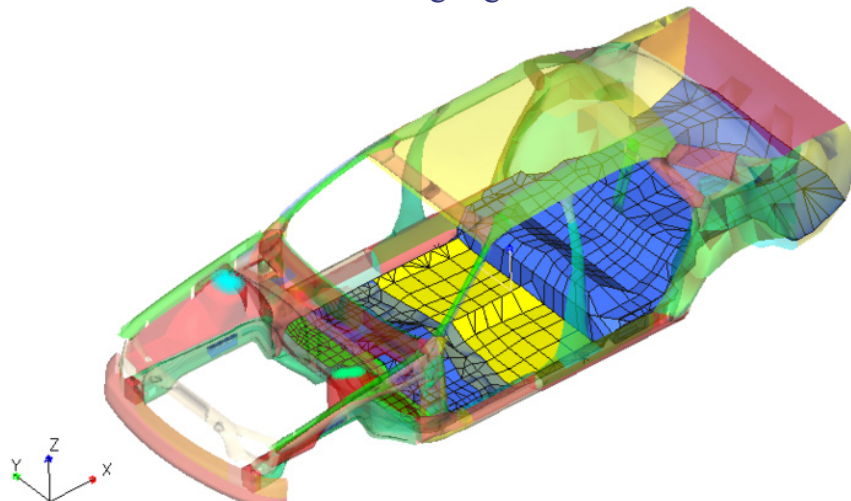
We hope to see you at the conference. Please feel free to contact us if you need more information about the papers.

## 5. GENESIS and Design Studio: Tips and Tricks

5.1

### Display Styles of Different Groups

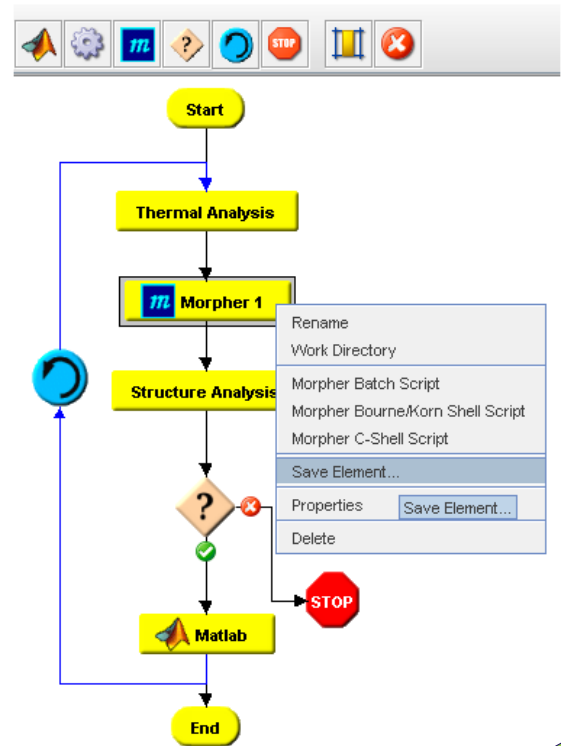
For presentation purposes, one might need to enhance/highlight a specific part/parts in the finite element model. Using Design Studio, one can create a picture/animation using different display styles for different parts. To do so, in the Display tab pick a display style. Then hide the groups that you want with the selected styling and select "Change Visible Groups Only" radio button. Then select a different display style and push the Show All button to show all the groups. For example, as shown in the figure below, the floor of the car model is highlighted.



## 6. *VisualDOC: Tips and Tricks*

### 6.1 Save Element Option in VisualScript

**Reusing VisualScript Components:** Do you know that you can save individual elements (components) of your workflow in VisualScript as separate VisualScript models and use them in a different VisualScript model? To export an element, right-click on it, and choose "Save Element" option from the pop-up menu. After you have saved the element (component), you can import it into another VisualScript model by using the "Load Element" menu item from the File menu. The imported component is added to the current VisualScript model and becomes part of the workflow. It can then be connected to the rest of the workflow.



## 7. *VR&D Workshops*

### 7.1 VR&D Free Optimization Workshops

Starting in 2009, VR&D has been offering free one-day workshops that are designed to give attendees a brief overview about the software capabilities and features. We started with two offerings:

**Structural Optimization** (*GENESIS and Design Studio*) - This workshop is designed to demonstrate the ease of running optimization using GENESIS and Design Studio. The workshop covers topology, sizing, shape, topography, topometry, and freeform optimization problems.

**General Optimization** (*VisualDOC*) - This workshop is designed to highlight how VisualDOC can be used to add design optimization capabilities to an existing analysis. An overview of the features present in the software along with several analysis integration techniques are presented.

Based on the success of these workshops, we are offering workshops targeting specific capabilities and features. We now offer two new classes:

**Automobile Body Optimization** - This workshop will provide an overview of important capabilities of GENESIS for optimizing car bodies. Attendees will solve examples that demonstrate the ease of use of the software in optimizing entire automobile bodies.

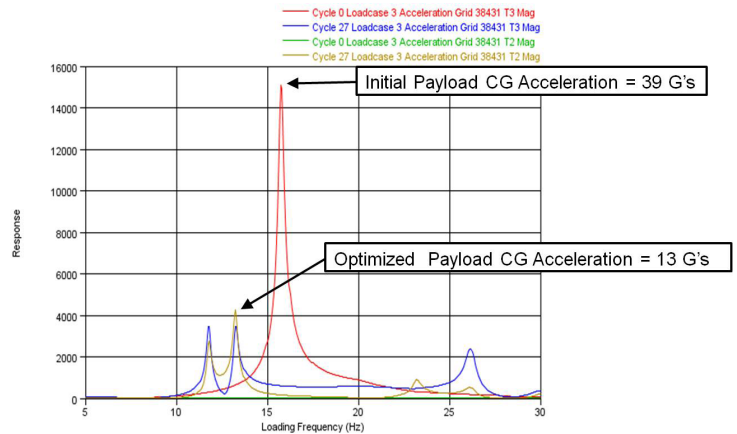
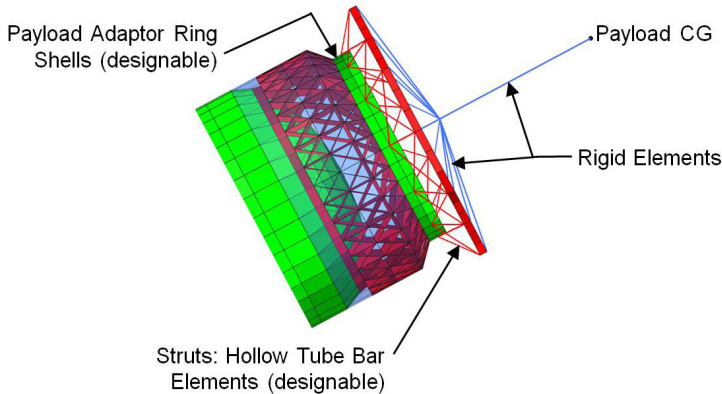
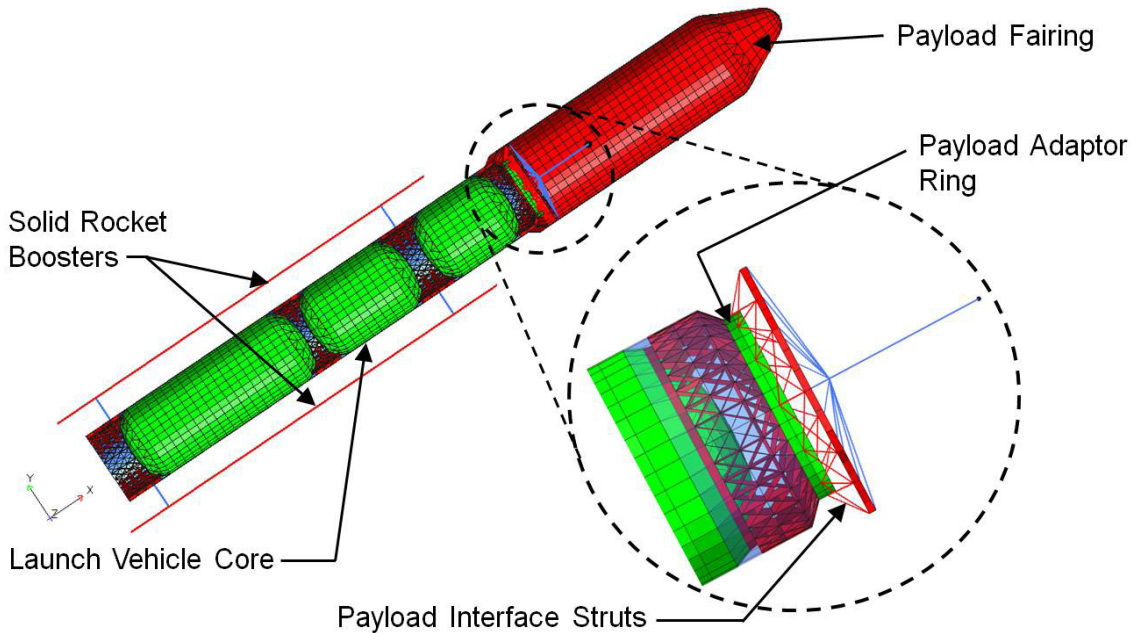
**Freeform and Composite Optimization** - This workshop will provide an in-depth look at freeform and composite optimization using GENESIS and Design Studio. In this workshop we look at the capabilities of GENESIS to optimize laminated composites. We explore Freeform Optimization and a new shape optimization capability. This special shape optimization capability allows the user to find the best location and shape of rib patterns that stiffen solid structures. It can also be used to find the best location of grids in any type of structure.

*We will continue offering on-site and custom classes. Please contact us (email: [training@vrand.com](mailto:training@vrand.com) or 1-248-596-1611 x101) for more information or go to our website for more information: [www.vrand.com](http://www.vrand.com).*

# 8. VR&D Consulting Services

## 8.1 Consulting Services Offered

VR&D can provide the technology and manpower for project specific design optimization tasks. We are expert at applied design optimization using topology, topometry, topography, shape, and sizing techniques. If your company is interested in discussing how VR&D engineering services can help with your project, please contact one of our offices (contact information on following page).



## 8.2 Launch Vehicle Payload Interface Design Using GENESIS Topometry Optimization

GENESIS Topometry Optimization is an element by element sizing optimization capability. It finds an optimal distribution of any property that can be size optimized. Optimizing the interface elements (plates and bars) allows the structure to be tuned such that the 38G lateral CG acceleration is reduced. The GENESIS optimized structure has reduced the lateral Z acceleration from 39 G's to 13 G's.

*Step-by-step instructions to set up and run this example are in the Design Studio for GENESIS examples manual (Example FRDSG006.dat)*



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