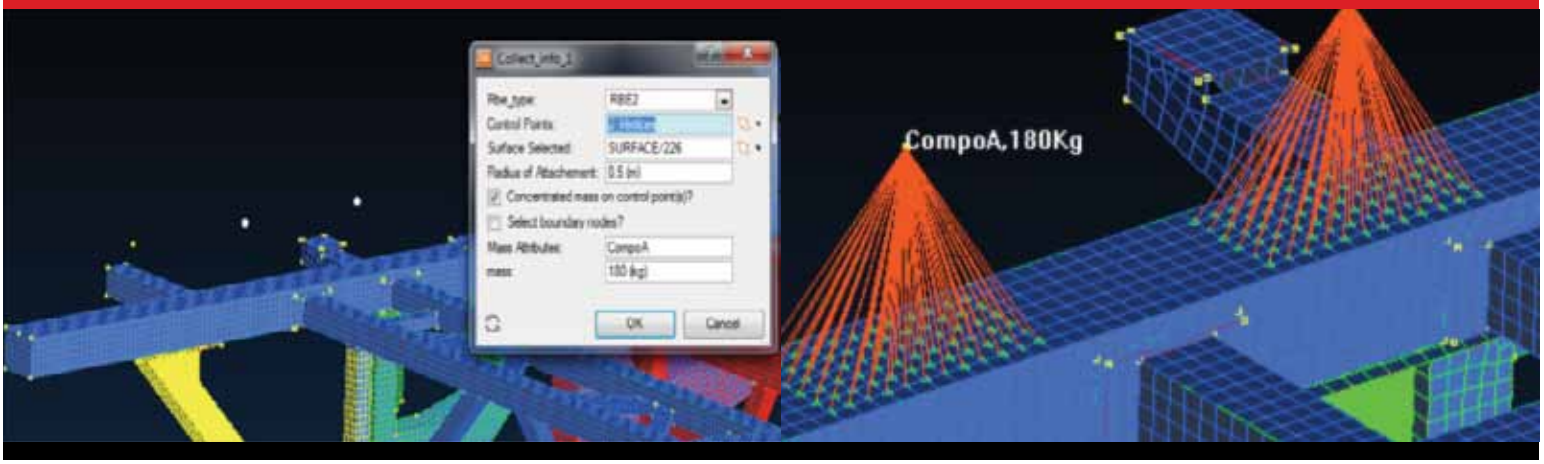
MSC Software: Case Study - Optimec Consultants

Optimec Consultants Automates Modeling and Analysis with MSC SimXpert



Based in the Greater Montreal area in Quebec, Canada, Optimec Consultants is an advanced engineering consulting firm offering Computer Assisted Engineering (CAE) services and complete Finite Element Analysis (FEA) solutions, and is a certified reseller of the MSC Software product line.

For the past year, major efforts have been directed towards maximizing the potential uses of templates for building and analyzing FEA models. Templates are powerful macros that allow automation and improve productivity. Template building is a very promising capability within the MSC SimXpert multidisciplinary simulation environment. The goal of developing templates is to use them internally and to offer personalized simulation solutions to existing clients and new industries looking to implement the Finite Element Method in their design process. This case study presents four key templates that have been developed specifically for the large machinery industry and for work in future developments.

The SimXpert template building capability permits the creation of templates aimed at automating repetitive processes. Building templates can be done using actions library or via macro recording. Specific scripts can also be coded using Python programming language. SimXpert's main advantage over its competitors is its ease of use and straightforward interface (prior to this project, the author had no previous experience with either Python programming or automating). Developing templates that address specific FEA needs thus became the best and simplest way to implement best practices and proven methods across a company.

Key Highlights:

Industry

Machinery
Engineering Services

Challenge

Automating the modeling and analysis of large FEA models

MSC Software Solutions

MSC SimXpert

Benefits

- Quick verification of results
- Shorter analysis time
- Ease of use

"SimXpert's main advantage over its competitors is its ease of use and straightforward interface. Developing templates that address specific FEA needs thus became the best and simplest way to implement best practices and proven methods across a company."

Mathieu Lussier, Optimec Consultants

Large Machinery Models

2D Properties Creation Template

Some machinery industries require the analysis of large models comprised of a mix of steel frames and beams assembled together. Each component is a welded assembly of sheet metal plates of different thicknesses. The plates are modeled as 2D shell elements with a property for each thickness. While simple, the creation of these properties is repetitive and error prone. A template was developed to automate the creation of the 2D properties with a CVS input file of the thicknesses.

Figure 1 shows a typical model that requires thirty (30) different properties. A CVS input file of the different thicknesses is used and the shell properties are created automatically with the corresponding material and in the right unit system.

Automated Paper Rolls Creation for the Pulp & Paper Industry

Rolls are used in the Pulp & Paper (P&P) industry for drying, pressing and transporting paper or felt throughout the manufacturing cycle. These rolls tend to be heavy and long and need to be accounted for. A typical P&P model has between 15 and 20 rolls. Each roll is different in cross-section, weight and length. Also, each roll sustains loads from the nipping of the paper between two rolls or the tension created by transporting the paper or the felt. Different 1D properties are necessary to model each roll appropriately. Moreover, the application region of the load is roll specific. The creation of the different properties, the application of the load and the proper location of the roll can take up to 30 minutes for each roll. A template was developed that allows the creation of each roll with simple inputs. The roll is then created within seconds (figure 2).

General Purpose Non-Structural Component (Concentrated Masses) Modeling Template

Not all components of a large machinery model are modeled in detail. Non-structural components (such as gears, brackets, electronic boxes) are usually added as concentrated masses (CONM2). These masses are connected to the rest of the model via Rigid Body Elements (RBE2 or RBE3). One hundred masses can be added for a typical model. The creation of these elements as well as the connection to their corresponding area of attachment is tedious. Also, the verification of each mass is extremely time consuming. The process of creation and verification of all the generated masses can take 8 to 10 hours. The risk of human error is also apparent. A template was developed to quickly create the non-structural masses and practically eliminate the need for in depth verification. The process creates the concentrated mass element and attaches it to the nodes of a selected surface within a certain inputted radius. Custom attributes added to the mass element allow quick visual verification of the component's name and weight (figure 3 & 4).

2D Shell Thickness Modification Template

Certain machinery operates in high humidity levels (P&P, mining, etc.). Over the years, important rust accumulation on the metal plates will require a revision of the stress levels of the machinery. Rust level is usually provided as a percentage of thickness loss from on-site measurements and varies for different locations on a large machine. With the typical thirty different thicknesses of a large machinery model and about five to ten rust levels to be taken into account, a 'rusted' model can require about 120 different shell properties with each specific application region. This process is extremely long and error prone. Twenty-four hours are usually necessary to update a model to its rusted

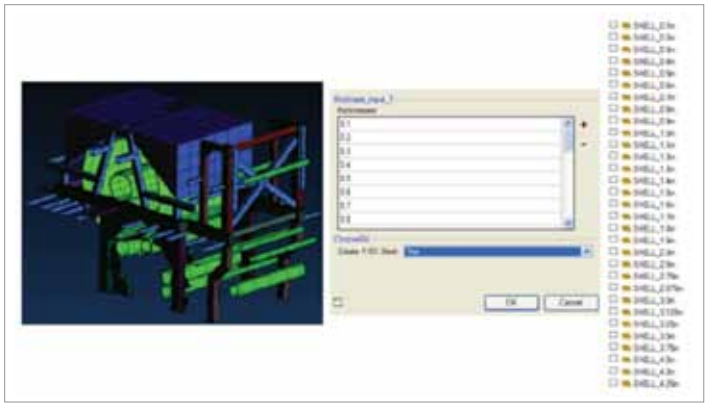


Figure 1 A typical large machinery model with thirty (30) different 2D properties.

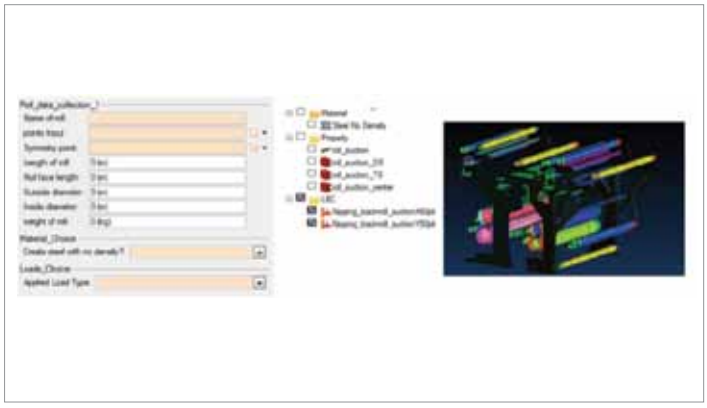


Figure 2 A few inputs are needed to create all the required information to generate a P&P roll at the right location with its corresponding loadings

state. A template was developed that requires the selection of elements and the rust percentage to be applied. With this information, it automatically calculates new thicknesses, creates the new shell properties and applies the new properties to the selected elements (figure 5 & 6).

Future Projects

Templates are currently being developed for nonlinear analysis modeling (drop testing, top loading, and plastic and rubber projects) in response to specific customer interests. SimXpert's ability to access different software and create different files and formats is also being studied for reducing post-processing and report building time.

With the implementation of the Finite Element Method in new industries that have limited or developing FEA knowledge, the need to offer customized and 'client-oriented' software solutions becomes crucial. Templating right and proven methods will not only benefit the everyday stress engineer but will also permit the use of FEA by the larger engineering community.

The author would like to thank the MSC team for their great support and continuous help throughout the development of these and future projects. Specifically, we thank immensely our local friendly Application Engineer and SimXpert Template Aficionado, M. Dominick Lauzon. He offered valuable help, support and training. We thank also all the MSC Forum members for their input.

If you have any questions or comments, feel free to contact us.

Optimec Consultants inc.
2994, Boul Dagenais O.,Laval (Qc) Can, H7P 1T1
Tel: 450.937.1974 • Fax: 450.937.1874
ael-rez@optimec.ca
www.optimec.ca

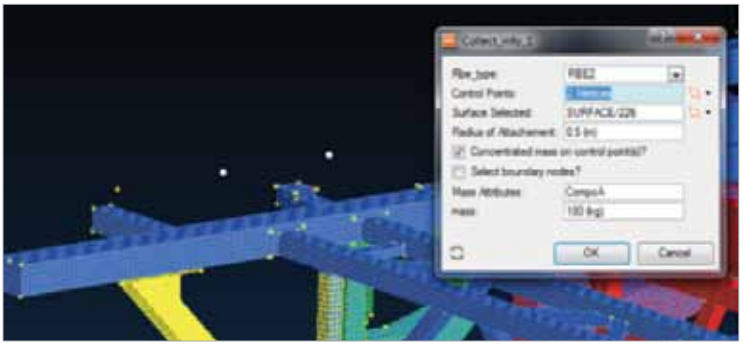


Figure 3: Two non-structural masses are created quickly by simply inputting the locations (points), the surface and the radius of attachment as well as the mass attributes and its corresponding weight.

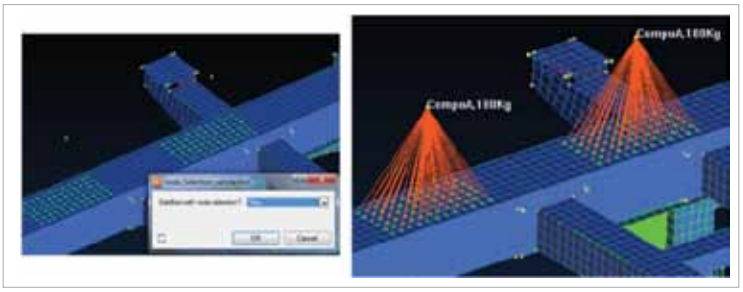


Figure 4: The template can be repeated until the radius of attachment is represented. Custom attributes added to the mass element allow quick visual verification of each element.

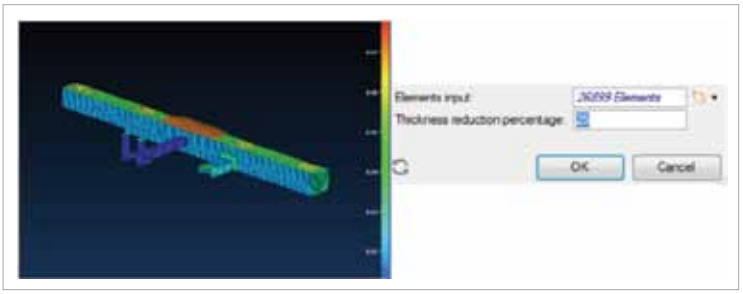


Figure 5: Typical beam has fourteen different thicknesses. High humidity levels caused a general 25% of thickness reduction over the years.

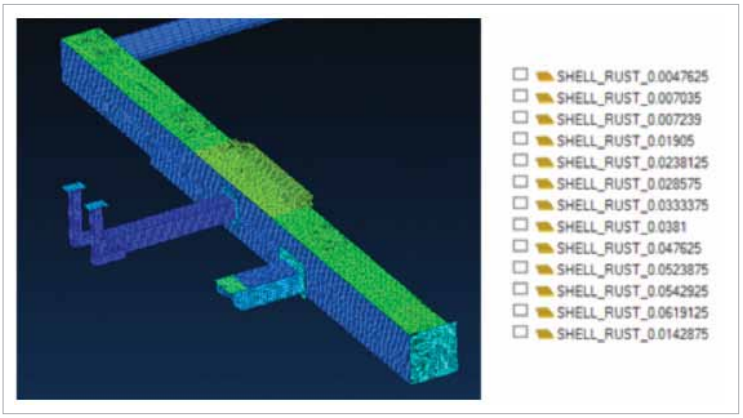


Figure 6: The selected elements are updated with their new 'rusted' properties without affecting the rest of the model

About MSC Software

MSC Software is one of the ten original software companies and the worldwide leader in multidiscipline simulation. As a trusted partner, MSC Software helps companies improve quality, save time and reduce costs associated with design and test of manufactured products. Academic institutions, researchers, and students employ MSC technology to expand individual knowledge as well as expand the horizon of simulation. MSC Software employs 1,000 professionals in 20 countries. For additional information about MSC Software's products and services, please visit www.mscsoftware.com.

Please visit www.mscsoftware.com for more case studies

About MSC SimXpert

SimXpert is a next generation CAE application for modeling and analysis using FEA and multibody dynamics (MBD). Integrated with MSC's advanced multidiscipline (MD) solver technologies, SimXpert provides an efficient "end-to-end" solution that takes you from CAD to analysis report in a single easy-to-use application.

"Doing more with less" is a common theme in most companies today, but designers, engineers and CAE analysts spend most of their time and effort on manual, labor intensive tasks. Translating and fixing CAD data, meshing, reworking models, creating the same plots and charts over and over – all of these mean that engineers are spending more time developing expertise in using tools rather than on evaluating and understanding their products. SimXpert changes that by providing native access to CAD data and easy to use tools to automate their simulation jobs and get results fast. SimXpert's unified user environment also enables teams to share data, models, results and best practices across time zones, geographic boundaries, and CAE disciplines, so that they can approach problems more consistently and get reliable results faster. Complete teams of engineers can now work in a modern and easy to use interface to run multi-body dynamics, structural analysis, thermal simulations, crash tests, drop testing, and more.

Industry Uses:

- Automotive: Powertrain, Seals and gaskets, Brakes, Suspension, Gear contact, Multi-body dynamics
- Aerospace and Defense: Landing gear, Composites, Wing structures, Fuselage, Seals and hoses, Sheet metal forming
- Heavy Equipment: Gears, Steering yokes, Belts, Hoses, Manufacturing
- Medical: Stents, Catheters, Pacemakers, Dental and knee implants, Prosthetics, Muscle and tissue, Hospital equipment like beds, wheel chairs
- Packaging: Bottle forming, Bottle top load tests, Snap-on caps, Child safety lids
- Oil and Gas: Packers, blow out preventers, Seals and gaskets, Pipes and casings, Weldments, Drill bits
- Wind Energy: Composite blade analysis, Composite failure, Gears and bearings

Corporate
MSC Software Corporation
2 MacArthur Place
Santa Ana, California 92707
Telephone 714.540.8900
www.mscsoftware.com

Europe, Middle East, Africa
MSC Software GmbH
Am Moosfeld 13
81829 Munich, Germany
Telephone 49.89.431.98.70

Asia-Pacific
MSC Software Japan LTD.
Shinjuku First West 8F
23-7 Nishi Shinjuku
1-Chome, Shinjuku-Ku
Tokyo, Japan 160-0023
Telephone 81.3.6911.1200

Asia-Pacific
MSC Software (S) Pte. Ltd.
100 Beach Road
#16-05 Shaw Tower
Singapore 189702
Telephone 65.6272.0082

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