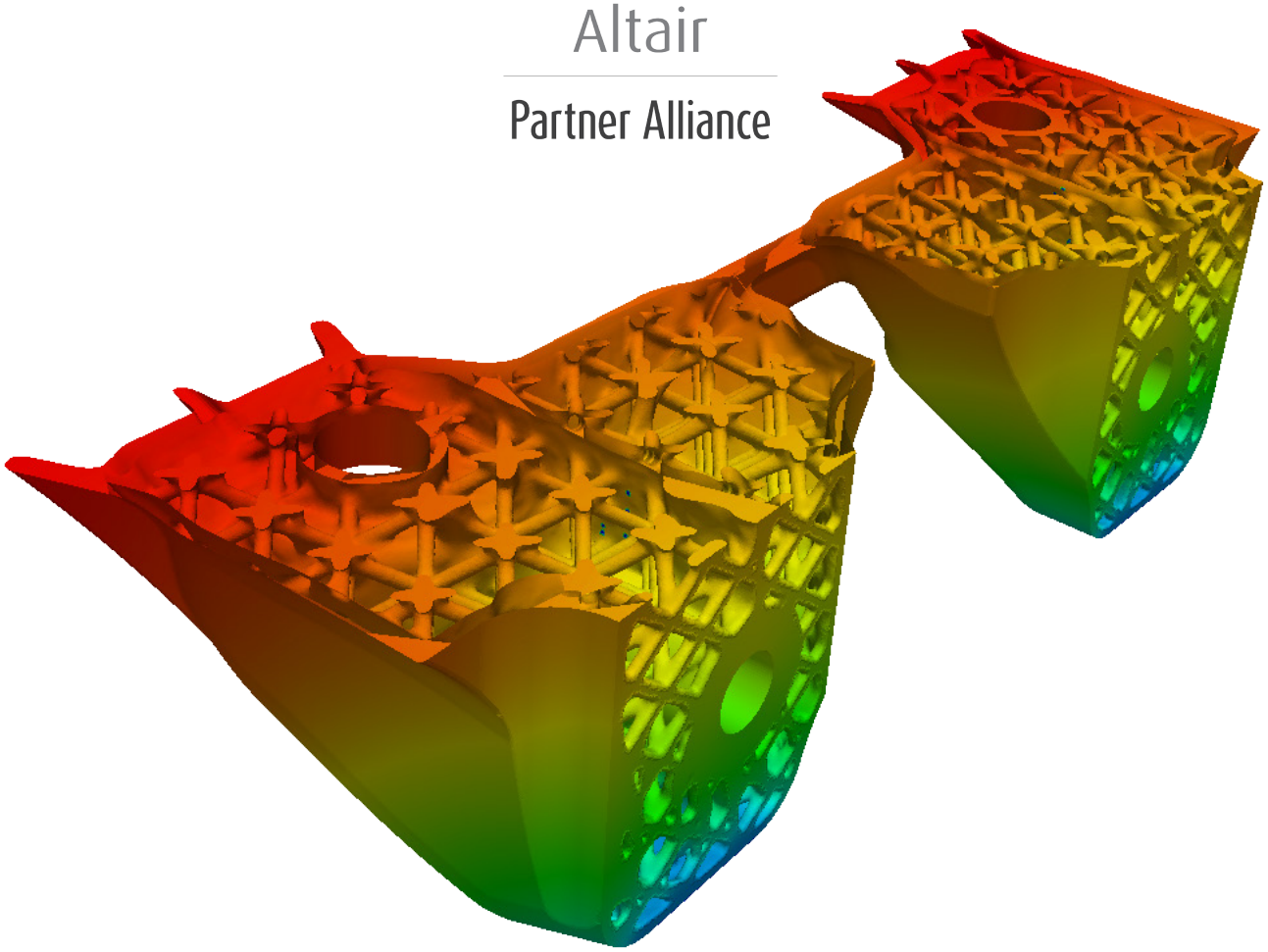
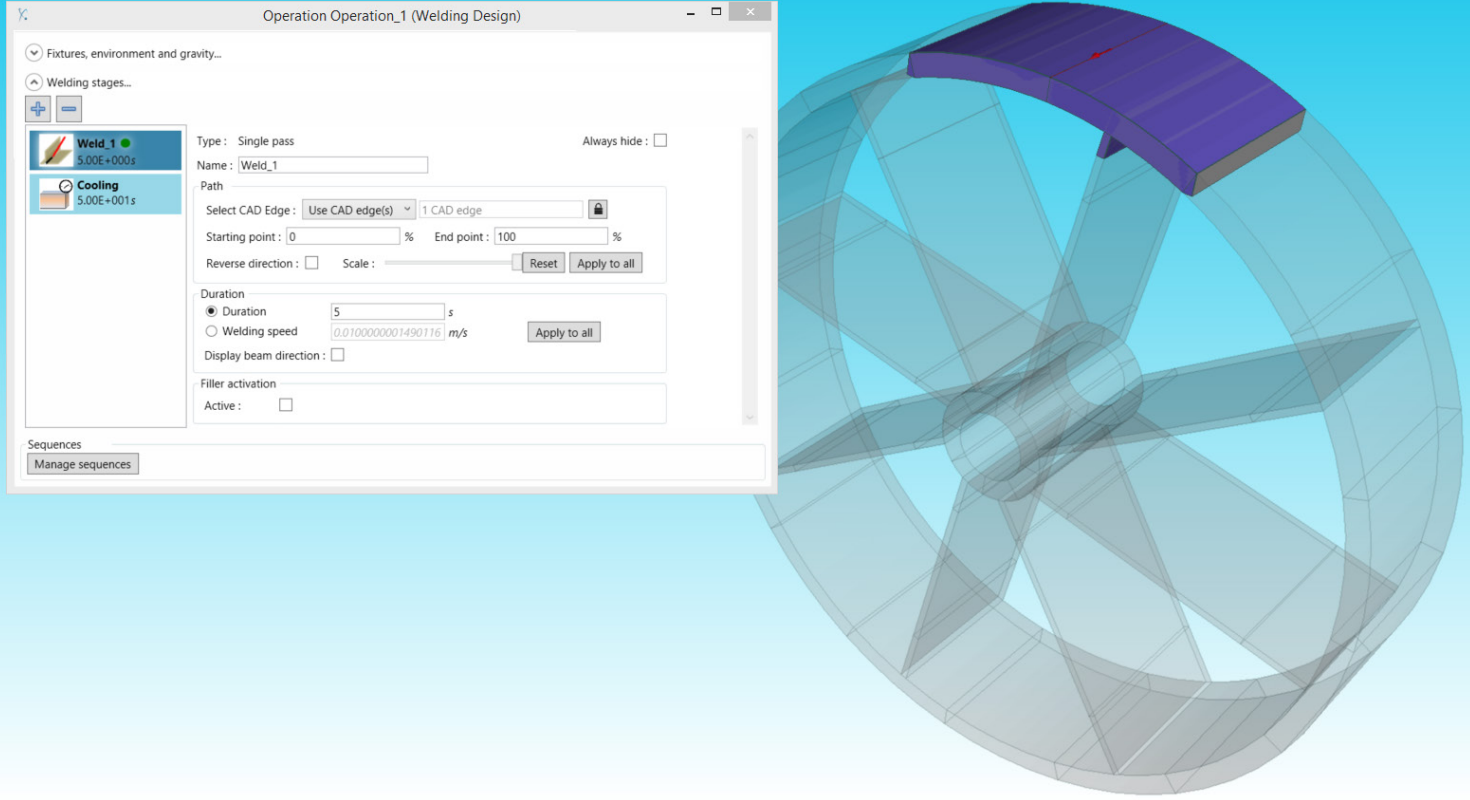
Altair

Partner Alliance



GeonX

PARTNER SPOTLIGHT



Partner Spotlight: GeonX

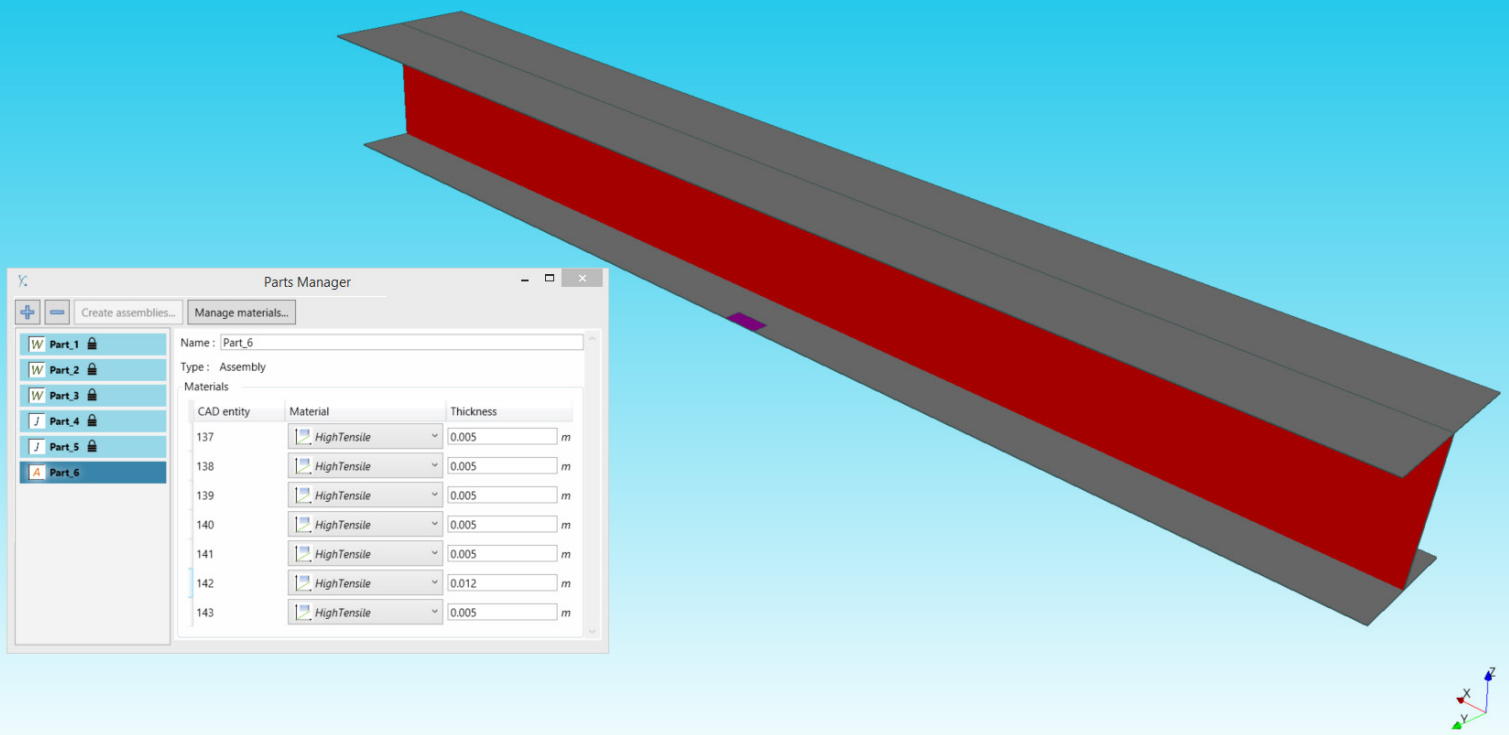
Dr. Laurent D'Alvise, CEO and Co-founder, discusses manufacturing process simulation software, Virfac®, available through the Altair Partner Alliance.

APA: What prompted the development of your software?

Laurent: The development of Virfac was prompted by the need of the industry to optimize costs and to increase the "Return on Investment" when doing numerical simulation of processes. After nine years developing the FE solver, Morfeo, on a massively parallel basis, GeonX was then founded with the ambition to make this powerful software accessible within a demanding and challenging industrial environment. Virfac was indeed developed to shorten the time to market when designing new processes or parts to manufacture. After a little more than three years of incorporation, Virfac encapsulates not only one but three FE solvers; Morfeo, Barracuda (GPGPU-based) and JWELD (JSOL). This converges to the development of a Virtual Factory as close as possible to the real manufacturing chain.

APA: What problem is Virfac meant to solve?

Laurent: Virfac is meant to allow companies to improve the quality of their product by optimizing their manufacturing processes at the preliminary phase of design. For complex manufacturing processes at the preliminary phase of design. For complex manufacturing processes and expensive parts, the possibility to simulate *what-if* scenarios offered by Virfac gives the ability to cut the expenses and shorten the time to market. Moreover, Virfac allows users to evaluate, modify and



optimize the design before making it. This open-innovation is particularly important today when one observes the quick expansion of the additive manufacturing technology which is already well present within Virfac.

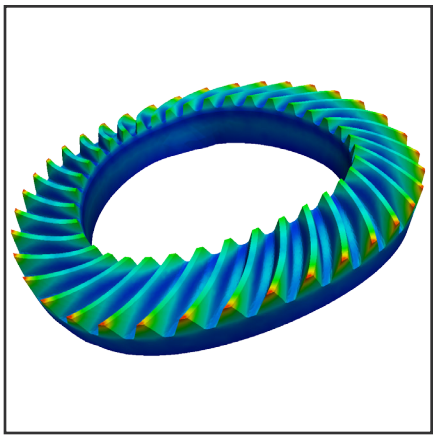
APA: What are the benefits of using Virfac for manufacturing process simulation?

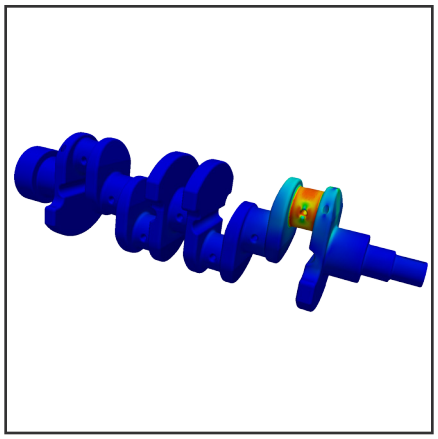
Laurent: Virfac can be used for the simulation of welding (fusion and friction), additive manufacturing, machining, heat treatment, surface heat treatment and fatigue damage tolerance (crack propagation based on the XFEM). Providing the operating conditions, doing a minimum of simplifications thanks to the powerful embedded FE solver. Virfac predicts the metallurgical quality as well as the residual distortions and stresses. Automatic optimization can be run to minimize distortions by finding out the best sequence of welding or verifying the influence of a heat treatment on the complete chain of manufacturing.

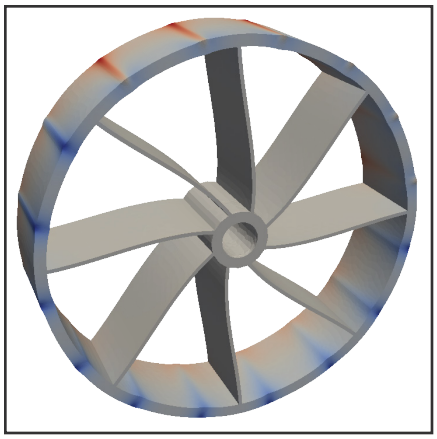
The main benefit in using Virfac is the highly specialized features that were tailor-made to address industrial requirements in terms of (i) quick learning curve, (ii) short setup time, (iii) short computation time and last but not least, (iv) high fidelity in accuracy.

APA: Are there any unique applications that Virfac works for that your competition cannot?

Laurent: Our strength lies in the fact that we propose a common user-friendly interface for all our modules, based on the virtual factory paradigm. It means that it is very easy to chain and combine multiple process simulations in one analysis. For example, it is possible to perform a welding operation followed by heat treatment, machining and eventually, the fatigue in-service behavior with a crack growth analysis based on the upwind evolution of the workpiece in terms of stresses, strains and metallurgical transformations. The user does not need to care about the transfer and compatibility of data from







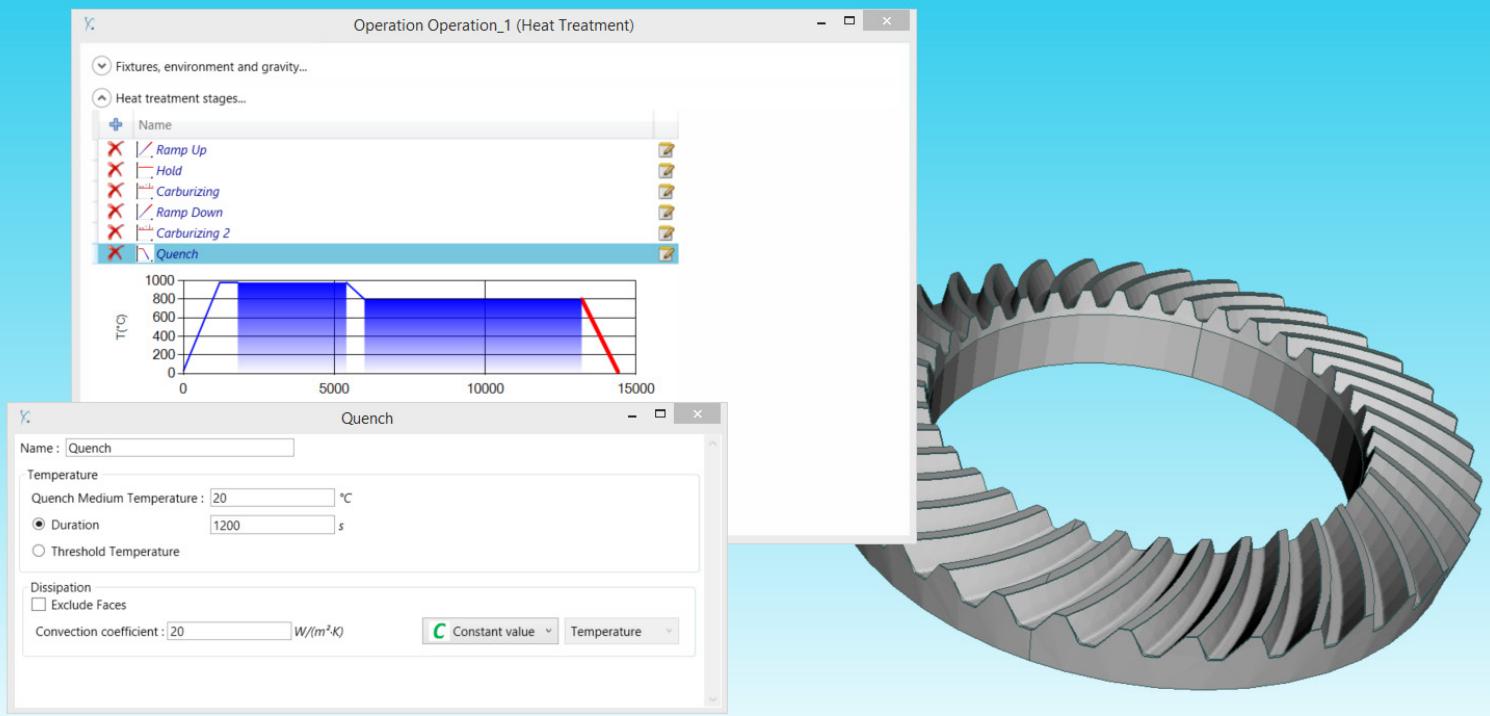
one software to another, it is all performed in the same environment as Virfac.

Another differentiator lies in the CAD-based model setup. No need to mesh manually before starting preparation of your model. You build your process model and finish by the meshing step which is handled automatically. If you feel that you need to modify the parameters, every parameter can be tuned. Finally, if you prefer using an external mesh generator (e.g. HyperMesh), Virfac offers a powerful feature which imports your mesh and automatically fits your CAD-based setup.

Our third strength is the recent release of the Virfac Additive Manufacturing Module. Virfac is based on a fully transient thermo-mechanical-metallurgical coupling, providing the user with highly accurate distortions and residual stresses after additive manufacturing. This module possesses advanced slicing features wherein the user can automatically generate macro-layers from the CAD geometry. With the help of this module, the user can optimize the build-up orientation, the support configuration and verify the influence of operating conditions on the distortions, plastic strains and residual stresses.

APA: How much time does it take to learn and start using your software?

Laurent: Virfac was developed with the user in mind. Our interface is intuitive and guides the user through the different steps of their analysis making the setup of the project very simple and efficient. We typically perform one day trainings for our customers and of course, after their training our users can count on our support team to assist them with their projects. Our team includes experts in numerical simulations but also experts in materials and manufacturing processes. Our people



are one of our strongest assets.

APA: What are the biggest challenges or problems that customers in your target market face and how do you address their needs?

Laurent: Simulating manufacturing processes on industrial workpieces with large dimensions and complex shapes usually involves a very long computation time, it can easily span several months. The Virfac FE solver, Morfeo, has been developed from 2003 with the capability to handle massively parallel computations. This makes the computation much faster.

Classical FEM solutions have some limitations in terms of computation time and results accuracy. Thanks to the use of Extended FEM technology on which some modules of Virfac (especially Virfac Crack Propagation and Machining (level set)) are based, the computation time and resources are reduced for an improved precision.

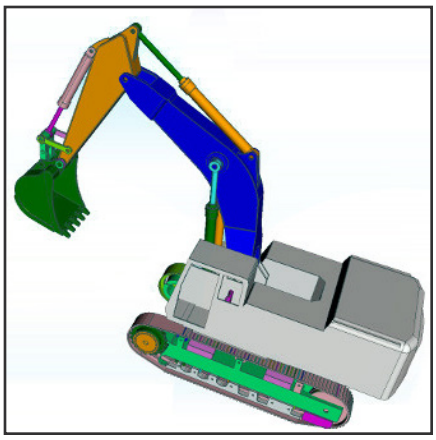
APA: Describe a typical work-flow of Virfac.

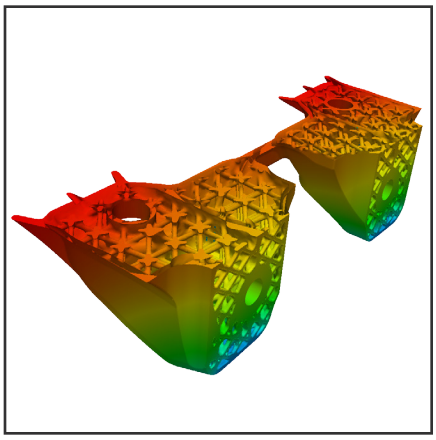
Laurent: Virfac is designed to be straightforward and user-oriented without being a black box for experts. Here is a typical work-flow for the Virfac Welding Designer Module:

a) Model setup is quickly performed on its different modules with the help of the different automated tools available within Virfac. A typical work-flow starts with the creation of a new project where the user chooses the modules and the unit system.

b) Then, one or more CAD geometries (solid or shell) or a mesh (done with HyperMesh for example) have to be uploaded into the project. Virfac also offers a large panel of tools that help the user clean and modify the imported CAD models.

c) The second step consists of creating parts as workpieces or jigs, group them into one or more assemblies and





assign the materials to each volume of each assembly. Materials can be defined through various constitutive laws. It is also possible to perform strong or weak metallurgical coupling and define the micro-structure of the material, which is especially important in welding simulation and heat treatment modules. Also, access to a material characteristics generator has recently been added to Virfac.

d) In the next step, the user selects the boundary conditions and defines the process parameters with an intuitive and fully-automated interface. At the end of this third step, lies an interactive sequence manager to easily set up and try different welding sequences for the Virfac Welding Designer Module.

e) After that, comes the numerical models manager which automatically creates an optimized mesh from the CAD model that takes into account the different complex shapes and singularity of the geometry. The user simply has to click on the generate button. Of course, the meshing parameters remain editable by the user.

f) Once all these steps are done, it is time to generate the run package and launch the computation either on a local computer or a HPC.

For more information about Virfac, visit the solution page.