BETA
SIMULATION SOLUTIONS

physics on screen

White paper

Simulation enabling technologies

Simulation and analysis current and future trends

Ian Symington, NAFEMS Technical Officer, interviews software vendors of the NAFEMS Network, on the very methods and tools engineers use every day. On behalf of BETA CAE Systems, Dimitrios Siskos, Senior Manager, Software R&D, Post- Processing Division, offers his Viewpoint.

"This white paper is an extract from an article originally featured in the October 2018 issue of NAFEMS' Benchmark Magazine": https://nafe.ms/october18

Replies by other software vendors have been omitted, and can be found in the original publication.

Simulation and analysis current and future trends

NAFEMS is a vendor-neutral organisation, recognising that it is crucial to engage with the software vendor community as they develop the very methods and tools that we all use every day. To complement this issue on interactive simulation, Ian Symington, NAFEMS Technical Officer, reached out to members of the NAFEMS Vendor Network to get thoughts on the topic.

NAFEMS
Ian Symington - Technical Officer

BETA CAE Systems
Dimitrios Siskos - Senior Manager, Software Research & Development, Post-Processing Division

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I remember sitting in my undergraduate Finite Element class back in the year 2000 and hearing how in the future meaningful simulation would take place in real time. With Reduced Order Models (ROMs) and increasing computational power, are there any areas/industries where you feel that this is currently achievable?

You used two interesting keywords: "meaningful" and "real time". This sounds like the "holy grail" for a simulation engineer. There is certainly progress in some implementation areas but we are not there yet.

In detailed component analysis Reduced Order Models (ROMs) are currently used to speed up optimization loops. In assembly, system and product level simulation we see ROMs being used to simulate different physical domains and their interactions.

In the future I think we will probably see the generation of ROMs from detailed CAE models becoming a much more common occurrence. I think we will also see the creation of surrogate models based on Deep Neural Networks becoming a more regular activity.

While FEM and CFD voxel based real-time simulation is probably fine for an initial draft simulation of simple parts and simple physics, detailed FEM & CFD models will still be relevant and will still be needed in order to simulate and analyze the behavior of complex models and phenomena.

I've been seeing some really interesting AR/VR hardware appearing in the exhibition areas at NAFEMS events. Can you describe the developments your organisation is making in this area?

The evolution in AR/VR has accelerated in recent years. Not only in the hardware but also in the enthusiasm and the acceptance from the engineers. BETA, as expected is among those who pioneer in providing solutions in this field. We support HTC Vive & Oculus Rift HMDs (Head Mounted Displays) in META post-processor. One great advantage of our solution is that you don't need to spend time translating the CAE result files to some generic format that can be read by the VR software. Design changes are too frequent and engineers simply can't wait for data translations. We also offer a full VR experience with a click of a button for all CAE disciplines. If you are analyzing NVH, Crash, CFD or Multi-Body phenomena, you just need to load the native CAE results and you are ready to go.

We have a customizable VR tablet that has many useful functions like part isolation, part explode, results selection and identification, interactive cut-planes, interactive CFD streamlines & streaklines. Another interesting feature is the VR Sketches that one can create during post-processing. With VR Sketches you can easily highlight important areas in your 3D model, assign notes in 3D and feedback your comments to the design team.

VR collaboration is another area where we are actively developing our capability. We support collaboration between desktop users, web browser users and mobile device users. We have sophisticated features like the 3D spatial audio, realistic high quality rendering with accurate lighting calculation, physical based rendering materials, textures and environment mapping. All of these features allow users to have a near natural experience when collaborating on the same VR room. We are currently working to optimize our graphics performance. Our main goal is to be able to achieve interactive frame rates in VR when animating multi-million finite element models of a car crash simulation.

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5 years ago I'd have been very sceptical about announcing the demise of the mouse and keyboard as the tools we use to interact with our simulations. I've got to admit I'm amazed by how quickly I've got used to talking to my phone to complete some basic tasks. What are your predictions for the tools we will be using to interact with our simulations in the future?

I was also sceptical when we started developing VR support. All my concerns were addressed after wearing the HMD and started navigating and interacting naturally with the 3D model in 3D space. VR 3D navigation is much faster than mouse and keyboard navigation and also much more engaging! Our CFD colleagues stay inside VR for hours, generating streamlines, interactively editing cut-planes, viewing vortex cores and oil-flow results.VR is the new mouse, and speech recognition and voice commands will soon become the new keyboard!

While researching this issue of Benchmark, we have been finding out about the 'Caves' and 'Simulators' which allow people to really experience how a product is going to operate virtually. From my point of view a huge benefit of these sorts of facilities is that they take simulation from the computer screen and make it accessible to the non-analyst. Where do you think the true value of these facilities lie? Can you tell us about any of these facilities that your organization has been involved with?

For me the biggest benefit is the collaboration of different mindsets in product development. The technology allows various domain experts from design and simulation, physical testing and manufacturing to come together and interact with the product. They can communicate their ideas much better, even if they speak a different language they all understand the product. With VR, the feedback and collaboration between these different mindsets is greatly improved. VR adds the missing "physical" engagement to the product.

Recently Airbus announced they were shifting 130,000 staff from Microsoft Office to Google's Suite of cloud-based tools. One of the major drivers behind this appears to be a desire to encourage collaboration. Do you feel that organisations will make similar moves with their CAE capability? If so what technology needs to exist to allow this to happen?

CAE collaboration will happen in the future. As a company we already have various solutions that allow collaboration of CAE users around the globe. We also plan to release a new Collaboration Platform, that will organize team work activities in desktop, web & VR. For more details you can refer to our CAASE18 presentation: "A Unified Environment for Collaborative CAE and Immersive Simulation Results' Processing" nafe.ms/2xvkXJN

Network bandwidth & latency is an issue, especially when collaborating between different continents. In our tools we try to minimize the network latency effect by controlling the synchronization points between collaborators. Also, our powerful

"we already offer solutions that allow the collaboration of CAE users around the globe and we also plan to release a brand new Collaboration Platform"

CAE compression technology helps in cases of limited network bandwidth. For more details you can refer to our CAASE18 presentation: "Advanced Results Compression Combined with a Sophisticated and Out-of-the-Box Simulation Data Management System: A Case Implemented at Honda" nafe.ms/2xu5PfZ.

Finally, have you come across any novel use application of VR/AR technology that you would like to share with our readers? Would you like to make any predictions about how CAE and in particular simulation technology, will evolve in the next decade?

Our users have been using META photorealism to correlate between test and simulation. An example featuring a Volvo XC60 can be found at nafe.ms/2xsZ1zg

We have also been using photorealistic rendering to help CAE engineers at Volvo evaluate the impact of permanent deformation brought about by misuse. This approach allows engineers to assess their simulation results by visual inspection as they would with a physical test instead of processing contour plots. More information can be found in the presentation "Evaluation of CAE Simulation Results using Photorealism in Processing" nafe.ms/2xsldbn, made in the plenary session of the 2018 NAFEMS Nordic conference.

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In the future it is likely that we will see efforts being made to solve complex CAE models in real time. Machine Learning and Deep Neural Networks will certainly play an important role in this. We will also see more ways to interact and collaborate with the virtual product. Direct Modeler technology (in VR), voice recognition and voice commands, hand tracking, AR and Haptic feedback technology will become mainstream. Interactive raytracing will become standard in CAE allowing models to have a near physical visual quality.

About BETA CAE Systems International AG

BETA is a simulation solutions provider, dedicated to the development of state of the art software systems for CAE. For almost 30 years, we have been developing tools and delivering services for the front-runners in numerous sectors by listening to their needs and taking up even the most demanding challenges. For more information on BETA CAE systems, our products, and our services, visit www.beta-cae.com

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