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USING THE VIRTUAL REALITY SYSTEM IN THE DEVELOPMENT OF AIRCRAFT ENGINE

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Abstract

This article analyzes the possibilities of virtual reality systems and VCOLLAB IC.IDO. These systems are used to create virtual prototypes of products and allow you to combine the results of gas dynamic calculations with CAD models of products. For these analysis capabilities VR systems have used different types of CFD data obtained by calculation using the software ESI Fastran, ACE, and ANSYS Fluent. In turn CAD models were converted from Siemens NX software and SolidWorks. Practical experience in the use of virtual reality systems showed an increase decision-making efficiency by upgrading product designs with precise geometric model of unification and calculated data.

1 Introduction

The last decade of computing showed that supercomputers used to this solely as a means to perform complex and cumbersome calculations, have been used in many related fields, high-tech market. The emergence of specialized computing platforms allowed to master new ways of working in engineering.

Among these new applications of supercomputers can select one of the most promising areas - visualization. In this context, high-performance computing systems are used to visualize the results of computational experiments (large-scale mathematical modeling), as well as to create complex "virtual reality."

Virtual reality - it is a three-dimensional artificial cybernetic world created with the help of supercomputers and perceived a man with the help of special devices. The virtual environment is usually different from the usual animated graphics, more accurate reproduction of detail and work in real time. The distinguishing factor is that this may be involved, except of other human senses, which ensures a more complete immersion in the virtual environment. Value of virtual reality research is not only the possibility of observation, but also control over created objects. Thus, the technology of virtual reality provides a complete recreation of the entire production process, from product concept to the stage of its operation, and allows you to create more complex models than with other methods of design. With the help of virtual reality technology, researchers can determine the configuration, test and optimize processes, which in turn can reduce the consumption of materials and development time required to build physical prototypes. For example, actively practiced prototyping in the making aircraft engines. This is true both for the individual

components and systems as well as for the engine as a whole. Prototyping process itself requires substantial time and cost. To reduce the overhead of creating and testing prototypes used virtual reality systems.

2. Virtual reality system ESI IC.IDO.

First studied virtual reality system, became ESI IC.IDO.
The first software package IC.IDO has limited capability to visualize CAD data. IC.IDO interface package is shown in Figure 1.

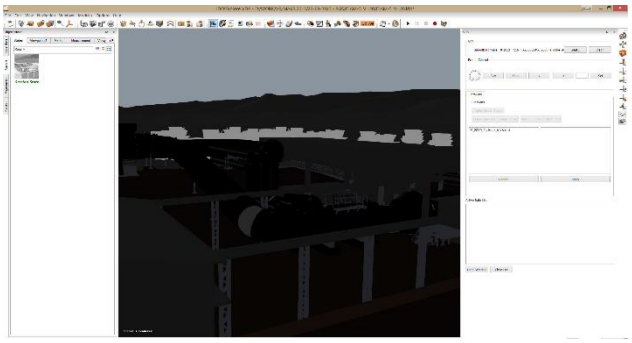

Figure 1. General view IC.IDO interface version 9.1.1 x64

As part IC.IDO integrated set of tools that allow you to completely control the boot process and manipulate 3D objects. IC.IDO modules allow direct import 3D models from formats CATIA V5, JT, PLMXML, Pro / Engineer, SolidWorks or Autodesk Maya (in some cases, additional license required), moreover, supported streaming network import objects from various OpenGL applications in which no restrictions on the editing and management model within IC.IDO. Managing the uploaded 3D models includes change of position in space, a hierarchical structure, creating the animation, change the rules and organize crossing programmable objects interact with each other, cutting, texturing. Structure of the complex IC.IDO - modular and configured depending on the scope of the system. For example, to solve problems related to the assessment of ergonomics in the field of civil aviation or automotive industry created a module IDO.ergonomics, and for solving problems of gas dynamics visualization module uses a special CFD Demonstrator, the commercial exploitation of which is not currently being due to the fact that this module is at an early stage of development. However, despite the initial stage of development, CFD Demonstrator allows you to load the gas-dynamic calculations and apply them to the geometric data - 3D models, changing positions are automatically reflected on the position of the current lines in the loaded CFD. In the imaging in dependence on the state of the system, thermal curves displayed also possible to display other parameters (pressure, temperature, etc.) for cutting the plane. Figure 2 shows an example of simulation of dynamic processes as part of a three-dimensional scene.

Figure 2. Simulation of gas dynamics in a virtual environment.

To download the correct CFD data necessary to use a freeware utility ParaView, with which the conversion is calculated data and save them in a format *. Pwsm. This ensures compatibility with many design applications, such as Fastran, ACE +, Fluent, etc.

3. Software package VCollab Pro.

Unlike IC.IDO, software capabilities of VCollab initially calculated for combining geometric data and the results of calculations performed using various CAE applications. For exploration has been used a professional version of this package consists of three utilities - VMoveCAD, VMoveCAE and VCollab Pro. Before we start with the CAD data and CFD model must undergo pre-deployment training - conversion from the source format to a format

VCollab. To prepare the geometry module is used VMoveCAD (Figure 3)

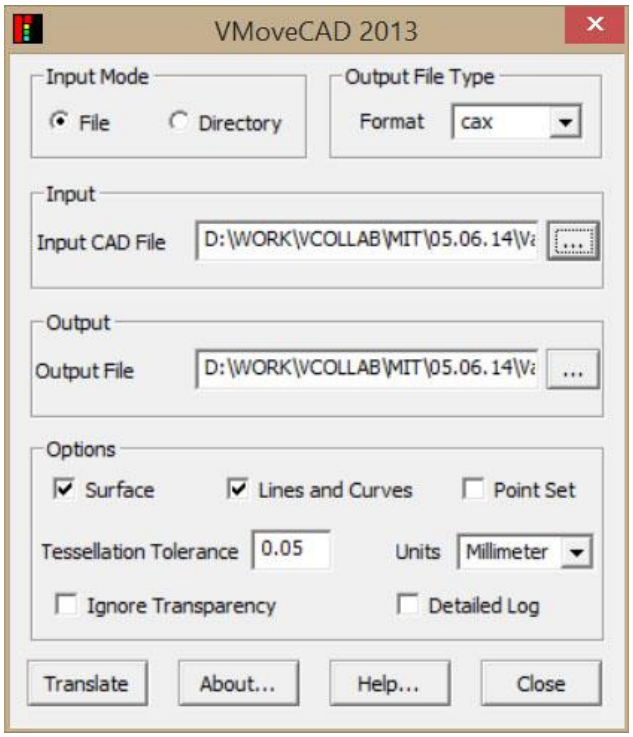

Figure 3 Interface VCollab-module VMoveCAD.

A similar module is designed for CAE applications. (Figure 4)

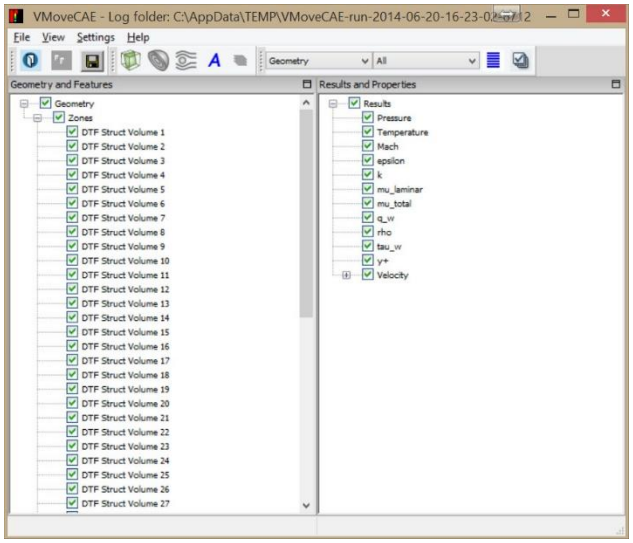

Figure 4 Interface VCollab-module VMoveCAE.

After parameterization features downloadable data is to convert them into an internal format VCollab, a distinctive feature of which is occupied by a small amount (a few times smaller than the original).

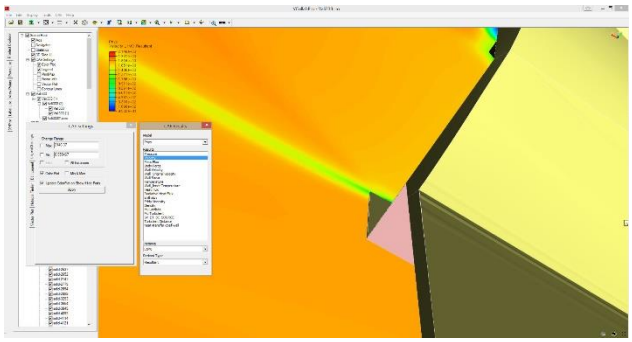

Figure 5 Interface of VCollab Pro.

Combining the data produced using VCollab Pro. The program allows you to customize the output as CAD, CAE and data, special attention should be paid to visualize the results of the unsteady calculation and animation playback. Also there is the ability to install the cutting plane and its movement in the real time scale, cueing, including measurement, creating presentation spans, and so forth. Moreover, in the scene rendering possible lump several geometric models superimposed with the calculated data.

4. Specific requirements for hardware.

The hardware part with which the system works IC.IDO, can be constructed using different hardware configurations ranging from simple workstations with one monitor without 3D support and finishing cluster systems that display the three-dimensional stereo 6 working surfaces simultaneously (so-called CAVE system) .

This approach allows engineers to most accurately simulate the interaction with the model being machined, as well as detailed review and evaluate internal and external gas-dynamic processes. Testing of the system showed that in order to render scenes require the use of modern graphics cards series models NVIDIA Quadro. Using alternative graphics solutions based on AMD FirePro not recommended as used 3D API fully optimized

solutions for NVIDIA, as well as a subsystem responsible for displaying 3D monitor or projector. When loading CFD data is a sharp jump in the use of RAM, so the best would be the amount of 32 GB.

Software package supports the management IC.IDO objects using different types of manipulators, simultaneous number can reach 6 pieces (when using multiple motion sensors). It also supports the tracking of the user's head and "reflection" real tools in virtual space. In our laboratory was investigated mobile hardware and software package that includes the web for 3D projector, the projector itself, two identical laptop with a processor Core i7 (4 cores), 32 GB of RAM, a graphics accelerator NVIDIA Quadro 4000 and the storage capacity of 1TB. To control the movements researchers used a set consisting of TRACKPACK2 extended, standard Controller;, Flystick2 (Target 4), incl. Accessory, and NVIDIA 3DVision Pro glasses mounted with motion sensors. As advantages of this solution is worth noting its portability and compactness, ease of deployment and the availability of suitable manipulators for rapidly penetrate objects, make cuts, etc. The disadvantage is poor performance when loading large data, as well as increased quality requirements blackout workroom.

With regard to the VCollab Pro, in contrast to the product IC.IDO This software is not so demanding on system resources, but because for its full use quite powerful workstation with the volume of the local memory of the order of 16-32 GB. (Which does not preclude the use of graphical clusters, if necessary). Restrictions on the use of the graphics accelerator also have been reported, the use of AMD Radeon HD AMD FirePro or no effect on the quality of visualization of data downloaded and fully complies onomu the GeForce or Quadro. VCollab Pro supports both passive and active 3D systems from different vendors, developers do not impose special restrictions on the type of equipment used. As disadvantages VCollab system is the absence of support special manipulators of joysticks, gloves, etc.

5. Practical application of virtual reality systems.

Unlike two-dimensional visualizer, a virtual reality system allows real-time three-dimensional building sections to demonstrate the flow fields. In addition, VR system allows demonstrate the streamlines in 3D with the ability to organize them in the study area without having to change additional settings, scenes, all actions are performed in real time using the manipulator.

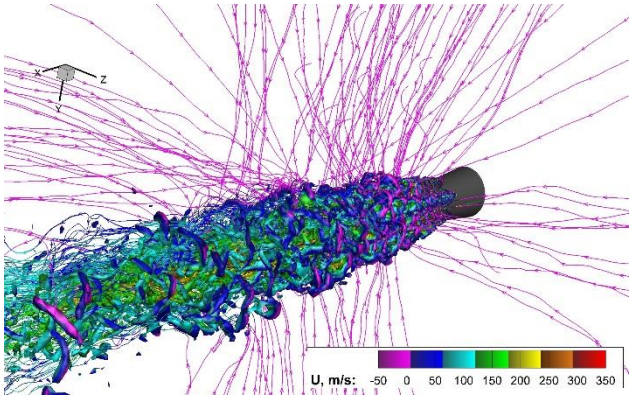

Figure 6. Streamlines. Chevron nozzle.

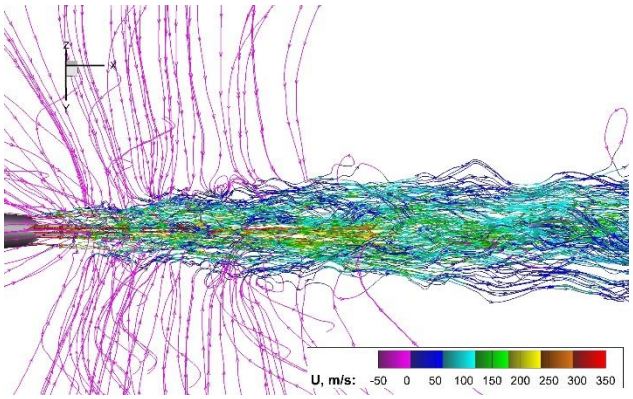

Figure 6. Streamlines. Chevron nozzle.

To investigate the capabilities and applicability of virtual reality system was taken IC.IDO publication devoted to the oral cavity flow. On an example of this problem, the researchers noted

6. Conclusion

Practical feasibility study of virtual reality IC.IDO showed good applicability of this type of software, along with other applications involved in creating a virtual prototype of the product. With the ability to merge into a single three-dimensional scene results of gas dynamic calculations and CAD models, you can quickly and accurately make decisions about making changes in product design. Creating virtual prototypes does not require additional investments, by contrast, lets you save funds going to the creation of intermediate natural models. In addition, this type of software allows not only to analyze the physical processes occurring within the product, but also strictly control all the design features, solving a lot of engineering problems without having to create additional physical models.

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Literature

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