

Novus Nexus, Inc. Simulate Better with US

FEANexus™

Efficient FEA Processes Through "Abstract Modeling"

Overview

FEANexus[™] is an advanced FEA pre-processor implementing **"Abstract Modeling"** technology, which promotes consistent FEA processes and generates comparable results that can be initiated by non-FEA experts. Users of **FEANexus** significantly accelerate product innovation through efficient **Simulation Based Design (SBD)** methodology. Being able to invoke FEA simulations early and repeatedly during the full product development cycle is the key to creating products that perform better and reducing development time and cost . Traditional FEA pre-processors used in today's development processes do not foster SBD and often lead to simulations only being used as a virtual test during final design stages — when changes are relatively costly. A major problem is the existing disconnect between CAD and FEA spaces which requires re-importing product geometries after each change and then repeating the FEA workflow (i.e. meshing, simulation eat-up). These tasks are time consuming without adding any value, but hard to avoid because the FEA simulation can only be defined after the CAD model becomes available. By using **Abstract Modeling concepts, FEANexus** allows users to overcome these limitations and facilitates FEA simulation processes that are automated by means of geometry independent, re-usable abstract models, thus supporting design decisions through comparable, consistent and high quality results.

Automated Creation of FEA Solver Input

FEANexus' **"Abstract Model**" captures all necessary information to perform a FEA simulation without being tied to a specific product shape. Through the combination of a CAD model with an abstract model, **FEANexus** automatically creates the 3D/2D solid mesh as well as the solver input files. Because abstract models are fully independent from a specific CAD model or geometric shape, they can be re-used, ensure <u>comparable</u> results and capture valuable simulation knowhow. This combination ensures "best practices" for reliable FEA simulations creating comparable results for decision making. **FEANexus** uses the CAD system for all geometry work and reliable automatic mesh generation, thereby avoiding geometry data conversion which can save significant amounts of time often spent on this non-value added task. Finally facilitating simulations by users who are non-experts, **FEANexus** makes early and frequent tests of product performance throughout all phases of the emerging design possible.

Models and Workflow in FEANexus

FEANexus uses or generates the following models or file formats to create the solver input files:

CAD Model – Derived from the regular CAD model with text string attributes added for the synchronization with Abstract Models.

Abstract Model – Contains all information relevant for a FEA simulation like mesh specifications, steps, load, constraints, materials, needed solver output, etc. Simulation set-ups are defined through classes, relations and attributes in an object oriented approach avoiding issues encountered with history based strategies. Abstract Models are shape and CAD system independent but partly FEA solver specific.

Simulation Model – Automatically created by **FEANexus** through the synchronization of an Abstract Model with a CAD Model. The parameters contained in the Abstract Model are applied to the targeted geometric entities.

Mesh Model – Automatically created by **FEANexus** applying the mesh parameters contained in the Abstract Model to the CAD Model. The internal format of a Mesh Model as well as the mesh strategy depends on the FEA solver for which the mesh is generated.

Solver Input Files – Automatically created by **FEANexus** applying the information contained in the Simulation Model for the solver specified in the Abstract Model and ready to perform a simulation.



Capabilities:

• Automation of FEA Simulation Process:

FEANexus is ideally suited to implement efficient, highly automated and reliable Simulation Based Design processes for FEA. The reliability comes from two key factors: reusable data templates (i.e. abstract models) for the simulation set-up and exploitation of the CAD system for all geometry manipulations.

• Geometry Independent Abstract Models:

All FEA simulation settings are defined in geometry independent abstract models. Abstract models apply object-oriented principles, which makes them re-usable while always creating comparable results and conserving valuable simulation know-how.

• Automatic Creation of 3D and 2D FEA Meshes:

FEANexus features comprehensive automatic mesh generation capabilities for surfaces and volumes. Different mesh strategies allow the creation of meshes optimized for finite element based solvers. All necessary geometry Interrogations are done through the CAD system, thereby avoiding any geometry translation problems.

• Automatic Creation of FEA Solver Input:

Shape independent abstract models containing all Information to perform a FEA simulation in combination with a specific CAD model are all that is needed to automatically create meshes and FEA solver input files.

• Fully Automatic Production Mode:

FEANexus' production mode allows any person involved in the development process to initiate FEA simulations creating quality results. A user, e.g. a CAD designer, only selects a CAD model and an appropriate abstract model to automatically create the FEA mesh and solver input files.



FEANexus System Overview

A FEA simulation process based on **FEANexus** can be executed in two modes, authoring and production.

Authoring mode involves the creation, editing, testing and debugging of an abstract model during initial setup of the workflow. Authoring of abstract models is usually performed by FEA specialists. Production mode means the automatic generation of a 3D/2D FEA mesh and solver input files by simply selecting a CAD model and corresponding abstract model.



Shape and CAD System Independence

The following example demonstrates how an abstract model in **FEANexus** can be used with products of greatly different topology and coming from different CAD systems. The image below gives an example of two CAD models with vastly different topology using the same abstract model. Both models are created in Creo[™]. However, a user can work with different CAD systems to create CAD models supported by FEANexus. The models can differ in shape and overall functionality. An abstract model covering the functionality of both products is used to automatically create the mesh and solver input files for both products. This principle of a versatile abstract model can be applied for example to use the same abstract model with a full assembly, subassemblies or single parts.

Benefits:

Automation of FEA Simulation Process:

An automated simulation process assures consistency in results, reduces the potential for human error, eases the demands on scarce simulation resources and accelerates the simulation cycle.

• Geometry-Independent Abstract Models:

Because abstract models are fully independent of shapes, they become truly reusable. They not only capture valuable simulation know-how, but also ensure that results are comparable and best practices are followed.

• Model Authoring and Use Separable:

While it is recommended that FEA specialists author and test abstract models, the utilization of abstract models does not require any FEA competence. This makes it possible for all engineers throughout an engineering enterprise to initiate FEA simulations creating quality simulation results when needed for decision making.

• Maximum Leverage of Simulation Resources:

When reliable simulations don't always require the direct involvement of simulation specialists, these valuable resources are freed from performing non-value adding tasks, allowing them instead to generate higher simulation throughput and/or optimize simulation methods for more accurate results.

• Assured Simulation Quality:

Always applying the same abstract model for a specific type of simulation assures that the results are of a constant quality which is necessary to make the right design decisions.

Frequently Asked Questions:

• What is the distinction between traditional FEA processes and FEANexus?

Traditional FEA involves a lot of non-value added but compulsory tasks (which consume an engineer's valuable time) like geometry cleanup, repetitive meshing and solver setup.

FEANexus automates the FEA workflow using abstract model templates, SBD CAD models and automated meshing algorithms. This reduces job preparation time, improves consistency of simulation results independent of where and by whom they are created. This allows companies to run more simulations in early product development without the need to grow existing teams.



Abstract Model Reusability

About Novus Nexus, Inc

Novus NexusTM, Inc. provides products and services based on <u>Abstract Modeling</u> approach which enable manufacturing companies to do large number of virtual studies in early stages of product design. The product is based on Simmetrix' Simulation Based Technology which automate meshing and simulation process.

Novus is Latin for **new** and **Nexus** is Latin for **connection**. The graphical design for our Logo has **us** in a distinct color to underscore our core principle **us**. **Us** is our ecosystem of customers, clients and partners. We approach all that we do to make **us** successful. **Us** is our mission. The connected spheres in the Logo symbolize **connection** or **nexus** and illustrate the abstract modeling principle applied to CAE including the important many to one capability.

Novus Nexus, Inc. is founded by <u>Dr. Bruce Webster</u> who has more than 25+ years of experience in CAE. Dr. Bruce Webster along with staff of Novus Nexus, Inc. are available to assist clients in expert FEA and CAE automation projects.

Contact us:

India

Novus Nexus India Pvt. Ltd. Flat No 1 Tejonodhi Apartment Near Mitcon, Balewardi, Pune 411045, Phone: +91-20-65240582

United States

Novus Nexus, Inc. 143 Cadycentre # 351, Northville, MI 48167 United States Phone: +1-734-637-2424

Email : <u>info@novusnexus.com_support@novusnexus.com</u> Website : <u>www.novusnexus.com</u>

Novus Nexus, Inc. Simulate Better with US

• Does FEANexus[™] have its own FEA solver?

FEANexus is a FEA preprocessor which can write simulation ready solver input files for commercial FEA solvers.

• Which FEA solvers are supported in FEANexus?

FEANexus currently supports **Abaqus**, **Ansys Mechanical** and **MSC Nastran**.

• Which CAD systems are supported in FEANexus?

FFANexus supports SBD CAD models prepared in **Pro/Engineer, Creo, Catia, SolidWorks** and **SpaceClaim**.

• Can FEANexus do geometry clean up?

FEANexus does not have any geometry cleanup tools. It utilizes SBD CAD models created for FEA simulation (i.e. not manufacturing CAD model). Although, cleaned up manufacturing CAD models can be used, Novus Nexus encourages parametric CAD models to take maximum advantage of abstract modeling technology.

• Can FEANexus do post processing?

FEANexus does not have capability of post processing.

• Who is using FEANexus/FluidNexus?

As an example, John Deere, Hanon Systems, Whirlpool and PAX Inc have successfully automated their FEA/CFD workflows using FEANexus/FluidNexus.

• What is difference between FEANexus and your other product, FluidNexus?

As name suggests, FEANexus supports FEA structural solvers like Abaqus, Ansys Mechanical etc and FluidNexus supports CFD solvers such as Fluent, OpenFOAM, Acusolve etc.