

CERBSim provides simulation services

Created for the development and design of machines and components with complex physical characteristics, and based on NGSolve

Computer simulations are becoming increasingly important in product development and product design - think of crash tests or the design of machines and components with regard to their mechanical, electromagnetic, fluidic, acoustic or nano-optical properties, as well as their optimization. Simulations enable the properties of the product to be studied in a model before prototypes are produced. This saves on time and costs. However, conventional simulation software often reaches its limits in the case of complicated geometries or couplings of diverse physical phenomena. A reliable simulation is then only possible in an unreasonable amount of computing time, or not at all.

Current mathematical research often provides approaches to solve such problems efficiently, for example by new discretizations, variable polynomial degrees, use of automated code generation, or parallelization of algorithms in order to better leverage modern computing architectures.

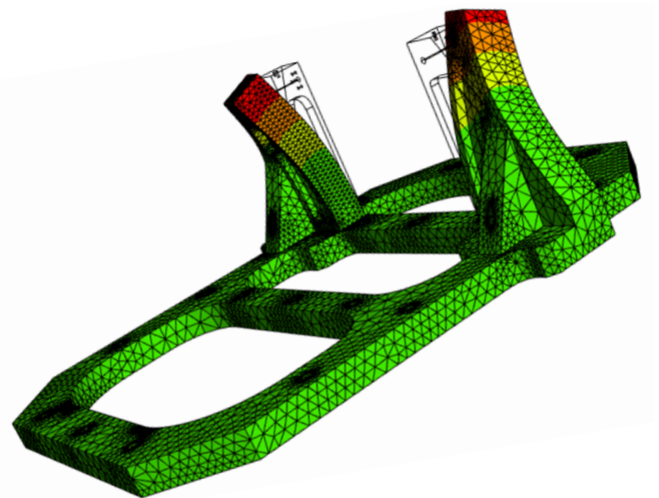
Objectives

The established goal of TU Wien's spin-off, [CERBSim](#), is to make state of the art science available to industry. Industry partners from highly diverse production sectors will gain access to flexible, efficient and inexpensive software tools.

Essential Solutions

Dr. Joachim Schöberl, from the Research Unit Scientific Computing and Modelling of TU Wien, and his team of colleagues have been developing the software packages [Netgen](#) and [NGSolve](#) over the past 25 years. The packages are structured in modular form and represent the state of the art in each corresponding area of science.

The software packages were released with a free license. In 2019, Joachim Schöberl, Matthias Hochsteger and Christopher Lackner founded the spin-off [CERBSim](#) in order to offer professional support and individual



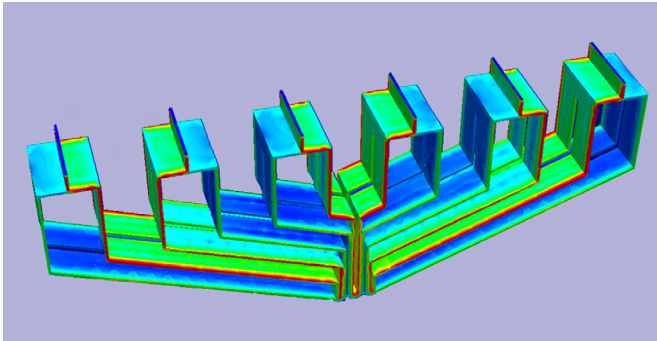
development as additional services to supplement these open source packages. [CERBSim's](#) offer spans a wide range, from the integration of internal company application modules into workflows, to larger revisions of [NGSolve's](#) core software, and customer-specific extensions for it.

Special Features

[Netgen](#) is a network generator that has become widespread since its inception. It is particularly well-suited to applications requiring special geometries, such as thin layers or elongated structures. [Netgen](#) impresses with its special meshing techniques, which require only a small number of elements and therefore little computational effort.

Due to its efficiency and robust qualities, [Netgen](#) is also used in many commercial simulation programs.

[NGSolve](#) is a finite element package used to solve differential equations based on geometries meshed with [Netgen](#). Both packages are programmed in modern C++. Shared-memory (C++11 Threads) as well as distributed-memory (MPI), are parallelized and optimized for contemporary hardware structures.



Loss density in a busbar –
due to induced eddy currents in the outermost layers

Applications To Date

Netgen has been integrated by several software companies as a network generator in their modeling and simulation tools - for example in Salome, FreeCAD, Z88 or in Cenos. **NGSolve** is being successfully used by those industrial companies in which the coupling of very different physical phenomena is often required. Some of its users include:

- Siemens Energy (transformers)
- AC2T research (bearings, tribological simulations)
- Schlumberger (borehole sensors)
- Endress+Hauser (flow sensors)
- Toyota (shape optimization)

This is where the programs' features shine – with **NGSolve** for example, the penetration depth of the fields in the thin shields around the transformer can be very highly resolved, or elongated boreholes can be meshed using only a small number of elements via **Netgen**. Algorithms specially developed for electrodynamics, acoustics or fluid mechanics in **NGSolve** are then applied to these meshes. Through the interaction of the mesh generator with the finite element package, even highly complex problems can be solved on conventional desktop PCs in a few minutes. Automatic optimization and parameter studies are also possible.

CERBSim enables industrial and research users to quickly and accurately simulate their components and systems. **Netgen** and **NGSolve** can be used intuitively, through their graphical user interface, and can be easily customized for specific applications. Their Python interface makes it easy to integrate them into the user's existing workflows - due to the fact that other software often offers a Python interface itself, or is controllable by Python. Both packages can be implemented by the user independent of one another and can be linked to existing programs.

What CERBSim Offers its Customers

If the performance of your own applications for simulation reaches its limits, **CERBSim** offers professional solutions: Almost any physical problem can be efficiently solved by adapting the features of the underlying essential programmes to the problem at hand.

Tasks in development and construction can be performed intuitively and quickly due to the professional and customer-friendly design of its user interface. Browser-based 3D visualization developed by **CERBSim** enables clients to develop cloud-based simulation applications and make them directly accessible to a select group of users

Your advantages

- no license costs due to free open source software (LGPLv2 license)
- platform-independent (Windows, MacOSX, Linux)
- downloads on www.ngsolve.org
- **CERBSim** offers flexible, rapid adaptation to your changing needs and integration into your existing workflows
- free access to updates that stay at the cutting edge of mathematical science

Contact

Christopher Lackner
 CERBSim GmbH
 cerbsim.com
 +43 664 2135896
 clackner@cerbsim.com, rema@tuwien.ac.at