



LS CAD

Z88 ARION®

APRIL 25th, 2016

Dear readers,

TOPICS IN THIS EDITION:

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Although this is the Z88Aurora® newsletter, we would like to introduce another new development of our chair: Z88Arion®.

Z88Arion® is a software for topology optimization and of course it is for free. It is being developed under the leadership of my long time employee Dr.-Ing. Michael Frisch.

With this, the presented product spectrum of the Z88-family

It is the aim of the software - analogous to Z88Aurora® - to provide a tool without any acquisition or license costs for both small and medium-sized enterprises and education institutions, so that they can take another step towards virtual product development.

The development of Z88Arion® would not be possible without financial support. Therefore, I would like to give thanks to



Prof. Dr.-Ing. Frank Rieg
Head of the Chair of Engineering Design and CAD of the University of Bayreuth



is expanded. Z88Arion® covers a brand new area of application, but is also based on the Finite-Element-Analysis.

As you already know of Z88Aurora®, Z88Arion® is developed under the premise to have a highly user-friendly graphical interface, which promises a short training period as well as fast optimization simulations.

the Oberfrankenstiftung for the support. Z88Arion® would not exist otherwise.

We do hope that you have enjoyed this entirely new program and are very excited about your feedback.

If there is - contrary to our expectation - any teething trouble, please do not hesitate to tell us.

Best regards,

Your Professor Frank Rieg

VISIT US ONLINE 

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What is optimization good for?

Optimization within the product development process

A high productivity within the product development and manufacturing process are vital competitive factors for many companies. Often, these factors are requirements for cost savings and for reducing development time. Aspects in the development of a new product, which are state of the art nowadays, are the construction via CAD-tools (Computer Aided Design) as well as subsequent numerical simulation. Usually, these new products are not 'optimal'. This leads to the question what optimal means regarding the product development? For this, the optimization offers a solution ap-

proach. As a simulation tool, the topology optimization looks for the best possible structure regarding a predefined aim, for example a component which is as rigid or as light as possible. Furthermore, with the help of topology optimization in the product development process, the number of iteration cycles of virtual and real prototypes can be reduced. In order to exhaust the saving potential of this method, the components have to - as already mentioned - be designed in a weight reducing way, whereas the loads have to be compensated at the same time. Not experience is crucial for this, but analytical approaches of engineering mechanics and bionics are the basis. Especially the topology optimization, as a subsection of the so called structural optimization can be integrated in the concept phase of the product development process. Through this method, optimal design proposals arise, which have to be assessed and refined by the user, but which would not in the first place exist



Learn more about **Z88Aurora®**, **Z88Arion®** and the research fields of the **Chair of Engineering Design and CAD in the social networks:**

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- Faster product development
- Production of new, innovative products and extension of existing product ranges
- Resource efficient



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Furthermore, with the help of topology optimization in the product development process, the number of iteration cycles of virtual and real prototypes can be reduced. In order to exhaust

without software support. These kind of programs use mathematical optimization methods to improve the component to the extend that the optimum is reached.

The optimization algorithms which are involved and used in the software, are supposed to find the optimal solution fast and reliably.

To sum it up, the optimization simulation pursues the following goals:

use of materials and tools

Now, a freeware called Z88Arion® is offered in a German version for Windows 64bit which exactly meets these opportunities. From now on, Z88Arion® is ready for download on our well known website www.z88.de.

Please see the next pages of this newsletter to learn more about how Z88Arion® works in detail.



Z88Arion® at a glance

How does topology optimization work?

Z88Arion® is a software which improves components via different topology optimization algorithms with regard to diverse optimization goals. Therefore, optimization algorithms and Finite-Element-Analysis (FEA) go hand in hand.

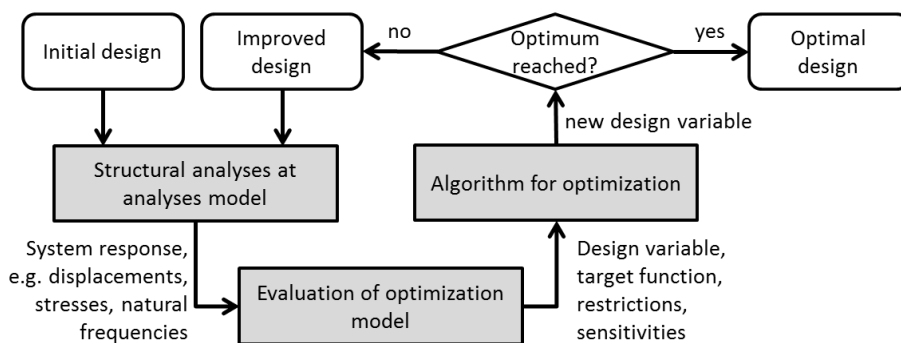
Depending on which method is used and which target is pursued, the optimization solver uses the correspond-

tion. Here, the meaning of the proceeding appears. An element with a low value of the Young's modulus shows a very soft behavior and does not improve the strength or the stiffness of the component - just as a hole acts.

Simplified, it could be said: at the beginning of the optimization, finite elements are removed out of the struc-

In some methods the Young's modulus is calculated indirectly via another property. All variables which are varied through the optimization algorithm are referred to as design variables.

In this version Z88Arion® optimizes within static mechanical analyses. This means that only the Young's modulus of the



ing data of a Finite-Element-Analysis it needs for further processing. This can be displacement of nodes as well as stresses, which occur as a result of the load.

With the help of the FEA-data, the structure of the component is adjusted by varying the Young's modulus of the finite elements, for example.

Here, a low value of the Young's modulus shall represent a hole in the structure, whereas a high value of the Young's modulus should be a rigid structure. After that, a new FEA is carried out using this Young's modulus distribu-

ture. After that, a FEA is carried out. This process is repeated as long as necessary to receive an optimal result.

In case another physical aspect would be the focus of

elements represents the value which is varied.

In which way the Young's modulus is adapted, is dependent of the method which is used. The existing

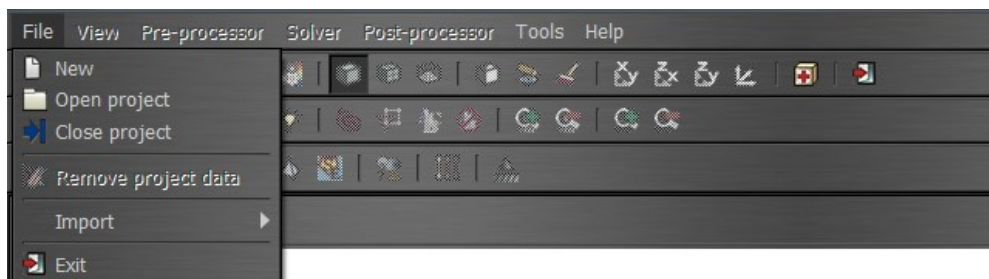


which leads to an optimum in the end.

Empirical methods change the design variable on the basis of a law, which assumes optimality. Usually, these methods deliver good results with less computing effort.

Within Z88Arion®, both methods are realized: the so called OC-method as agent for the mathematical group and the TOSS-algorithm, which is based on a mixture of mathematical and empirical processes.

Further information on the respective method is given



the optimization (e.g. heat flow, flow velocity), not the Young's modulus but another physical property has to be varied, for example the conductivity.

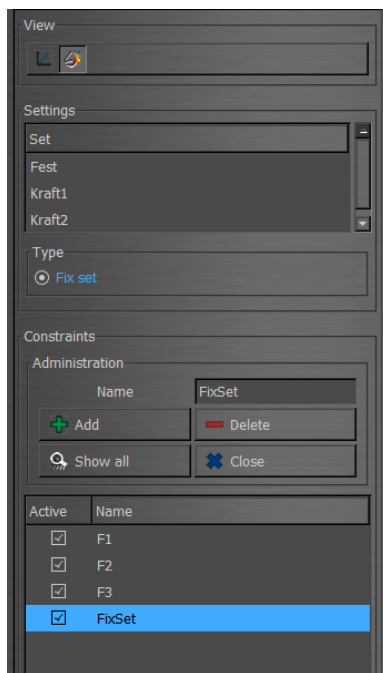
methods can be divided into mathematical and empirical proceedings. The mathematical methods adjust the design variable using a mathematical founded law

in detail in the user manual of Z88Arion®.

The graphical user interface of Z88Arion® may seem familiar to you, as it looks



similar to the GUI of Z88Aurora®. In this way, we hope to guarantee a short and fast training period for Z88Arion®. All functions which are not necessary for



the optimization are removed.

Furthermore, the GUI of Z88Arion® is significantly darker to build a clear und visible contrast to Z88Aurora®.

In everyday engineering life

a component is subject to several circumstances. Components can not be optimized in any possible way. Special areas may not be adjusted, maybe because these areas interact with another component in reality.

For sure, it makes no sense to remove a smooth surface, if another part should lie on it.

Because of this, so called fix-sets can be defined within the boundary condition menu of Z88Arion®. These are special element sets which may not be adjusted during the iterations of the optimization process.

Only in this way it can be guaranteed that the optimized component can be used later on.

So, how does an optimization with Z88Arion® work?

Well, at first a component is imported to Z88Arion®, just like in a normal FEA. After

that, the part is meshed. For this, linear hexahedrons and linear tetrahedrons are available in Z88Arion®.

Subsequently, as known of Z88Aurora®, sets can be created in order to define material or boundary conditions.

Here, only mechanical boundary conditions such as pressure, displacement or forces are meant. Because numerous Finite-Element-Analyses are carried out in the scope of an optimization, the component has to be statically determinate.

The mentioned fix-sets can be defined in the boundary condition menu if desired.

In the end, an algorithm has to be chosen in the solver menu which controls the optimization process. Numerous parameters can be changed, which should be used by experienced users only. All available parameters are explained in the user manual. Moreover, Z88Arion® offers a context-sensitive help which indi-

cates the definition range of each solver parameter.

Then, you will have to wait a little bit until the final design proposal is calculated and visualized.

Besides this, every single iteration which leads to the final result can be displayed.

Z88 AT HANNOVER TRADE FAIR 2016

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We are proud to be again part of the Hannover Trade Fair 2016. Of course, Z88Arion® is the main focus of interest this year. But also Z88Aurora® is presented and can be tested extensively on site at our stand.

From April 25th to April 29th you can visit our Z88 team members at the joint stand of Bayern Innovativ in hall 2,

stand number A52 and learn more about Z88, Z88Arion® and Z88Aurora® at first hand.

Using the following link, you can secure your free tickets now: [Free ticket Hannover Trade Fair](#)

Please note that you have to register yourself on the website of Hannover Trade Fair due to the fact that each ticket is personalized. After successful registration you will get your free ticket via e-mail.

We are looking forward to meet you!

