

## Mechanical Optimization of Customer Designed Products

### Contact

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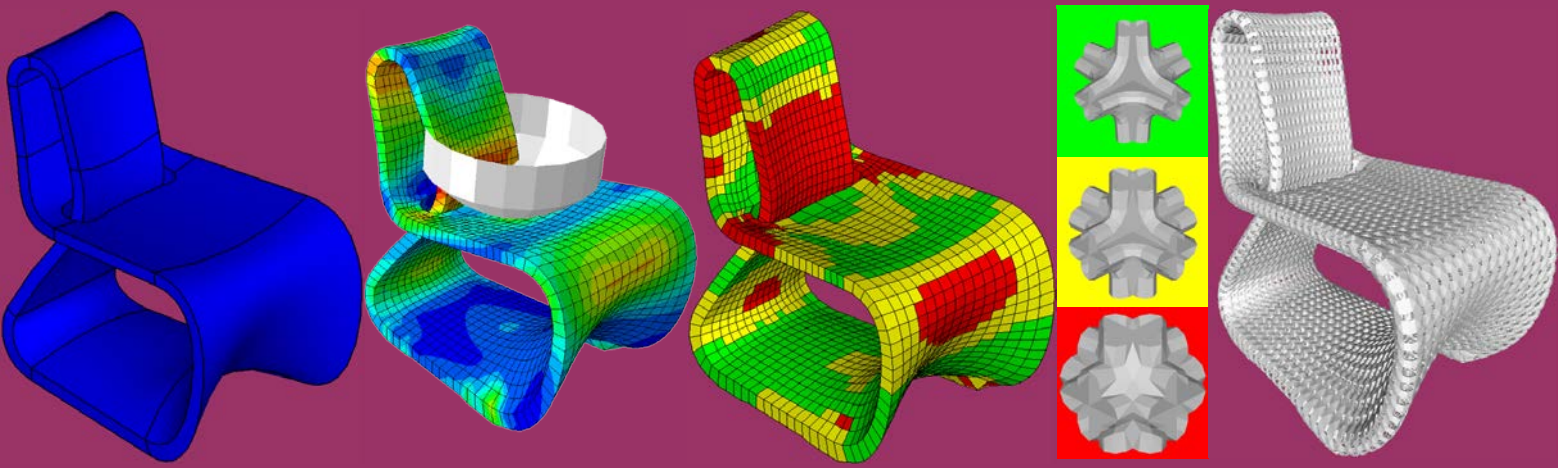
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»Mass customization« describes the trend that consumers individualize mass-produced goods. The customization expresses ultimately an »emotional bond« of the consumer with goods he or she uses in daily life. Cars are personalized by numerous extras, a cell phone is individualized by personal ring tones or fancy cases. Customers who appreciate their products will use them for a long time; thus, mass customization can contribute to a sustainable economy. Additive manufacturing techniques and communication via the internet offer to the consumer new ways to participate in the production of individualized goods. Consumers can design their own products by CAD software and send the design for additive manufacturing to a »fablab«.

Since the average customer is not necessarily a gifted designer and a skillful engineer, a dedicated user interface needs to guide the customers through the innovation and production process:

- The design software should provide the user with a suitable number of options: too many options will exhaust, too few will limit the user.
- The customer should get an instant feed-back whether or not his or her design meets the technical requirements (i.e. whether its is mechanically stable and fabricable by additive manufacturing techniques)

An appropriate choice of options for the design process and an instant feed-back regarding the technical quality of the design will give the customer a feeling of accomplishment.



### Our Expertise for Your Benefit

#### • Automated Micro-Structuring of Bulk Designs

We developed a software tool for light weight construction which internally structures bulk CAE designs. The resulting cellular structures are suitable for digital manufacturing. The internal structure is based on a trabecular structure similar to the structure found in cancellous bone.

#### • Prediction of Mechanical Properties

An assessment of the mechanical properties without having to build spare samples for testing is essential if one aims at the cost efficient additive manufacturing of small lot sizes. Due to its regular structure, our microstructure allows a beforehand calculation of mechanical properties like strength and stiffness. Tests on only a few representative specimens are necessary for the parameterization of finite element calculations and the assessment of the material used in the additive manufacturing process. The procedure can be applied to any material used in rapid prototyping and any process available.

#### • Optimization of the Microstructure

In order to optimize the mechanical performance of the entire component, the microstructure of the trabecular cells can be adapted in response to a pre-determined load. This adaptation involves by local, anisotropic increase of the diameter of selected trabeculae. Thus, a minimal investment in material and production time is needed to enhance the load bearing capacity of the product significantly.

#### • Online Tool for Customer Designed Products

The structuring process can be integrated in an online-tool that enables customers to design their own products. The customer designed products will be automatically evaluated for mechanical stability, micro-structured and a geometry file created that can be used in additive manufacturing processes.

#### Services

- Automated micro-structuring of bulk designs:
  - STL File
  - Small File Size
  - Enclosed Mesh
- Prediction of mechanical properties
  - Stiffness
  - Strength
  - Experiments to determine material properties
- Optimization of the microstructure

- TOP LEFT TO RIGHT:
- BULK DESIGN OF A CANTILEVER CHAIR
  - FE RESULTS OF STRESSES IN THE CHAIR
  - CLASSIFICATION OF ELEMENTS ACCORDING TO STRESSES
  - DIFFERENT TYPE OF CELLS ARE USED ACCORDING TO THE CLASSIFICATION
  - RESULTING GEOMETRY