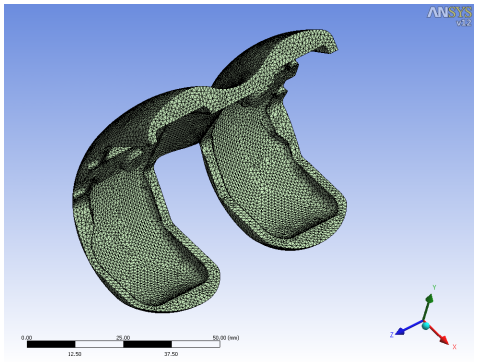
Need to improve your time to market? Numerical simulation is the right solution!

Newsletter No 08/09

Testing every single design of a product is generally highly time consuming and cost intensive: specimens first need to be manufactured then tested with an appropriate set-up. Furthermore, samples are often destroyed during testing. Short-cutting these steps is possibly leading to a substantial reduction of the time to market and to enhanced cost control: numerical simulations and more particularly structural finite element analysis (FEA) allow the evaluation of, among other, the structural performance of single element or complex multi-component products.

Structural FEA belongs to a broad family of numerical algorithms enabling to solve partial differential equations as present in solid mechanics. To solve these equations, in other words to compute (out of material properties and boundary conditions) displacement, strain and stress fields, the FEA requests to divide the component being analyzed into small regions called «finite elements». This technique allows the computation of global and local structural efficiency of single components or multipart assemblies.



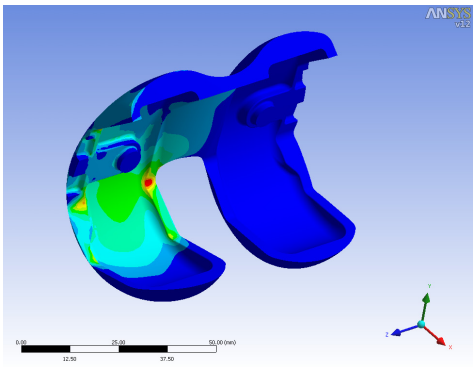
Mesh of a prosthetic knee component made of tetrahedrons and based on the CAD geometry.

FEA at RMS

RMS is using ANSYS® release 12.0 especially the «Structural Mechanics Solution» to investigate a wide range of problems: from static analyses (displacements, strains, stresses, that result from static loading) to transient issues (time dependent answers of systems subject to static loading) with geometric (large deformations), material (viscosity, plasticity) nonlinearities and/or contact problems (from glued to frictional). Other profitable features are the parameters study/optimization algorithms allowing a rapid oriented investigation of different design variations.

Case report: femoral component portfolio extension

To encompass a wider part of the population, a larger size of the balanSys total knee replacement implant (Mathys Ltd Bettlach) was virtually developed via computer aided design (CAD) tools. Before the experimental testing phase, a finite element analysis was performed to evaluate the structural performances of the novel implant under similar loading and boundary conditions as the experimental ones. Furthermore, FEA enabled a comparison with already successfully implanted prostheses.



A finite element analysis output: Three dimension representation of the equivalent stress distribution (von Mises) calculated for the femoral component of a knee prosthesis.

Computations confirmed expectations concerning the weak point locations and allowed comparing the maximal stresses between all implant sizes. Based on the FEA outcomes a further version of the implant was designed with targeted modifications. The new version performed better (lower stresses) than the established designs, which strongly suggests that this design should successfully undergo dynamic tests and certainly should provide enough mechanical stability.

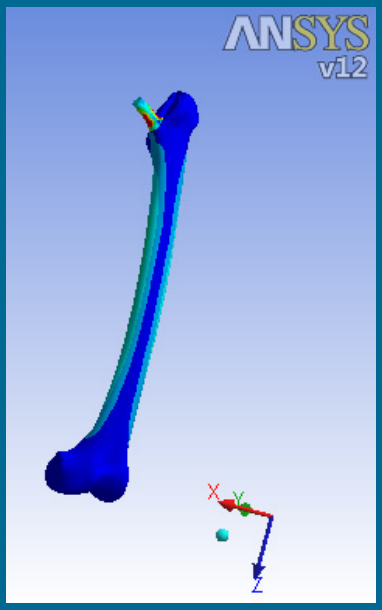
This example shows how FEA can efficiently be integrated into the development of novel products by reducing the development time and costs (only a single design needs to be mechanically tested).

The most important points

FEA offers a wide range of investigations concerning the detail level of the model (estimation or in depth analyses), the type of load application, and the boundary conditions as well as the presentation of outcome data. All this has to be discussed and specified according to the needs of the customer.

Examples of result presentations:

- deformed states
- coloured stress or strain plots
- graphs
- tables



Femoral stem prosthesis implanted into bone. Representation of the equivalent stress distribution in bone and implant.

Please discuss your questions with us! We will be happy to advise you.

Or ask for our service catalogue. You will find this and other information on our website as well.

The RMS has been certified according to ISO 9001:2008. Selected services have been accredited according to ISO/IEC 17025.

RMS Foundation • Dr. h. c. Robert Mathys Stiftung
Bischmattstrasse 12 • P.O. Box 203 • CH-2544 Bettlach
Phone +41 (0)32 644 20 00 • Fax +41 (0)32 644 20 90 • www.rms-foundation.ch

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