Sirona cuts development costs of dental X-Ray equipment with the aid of 3D EM Simulation

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Sirona products are to be found in all fields of treatment and activities in a modern dental practice. These include, in addition to treatment equipment and instrumentation, the business division CAD/CAM Systems (production of ceramic inlays, onlays, partial crowns etc) and imaging systems with its products for X-Ray diagnosis. Sirona, as a system manufacturer, has the ability to combine products from the various business divisions – an example being CAD/CAM-Systems with 3D X-ray tube devices. The Imaging Systems products range from intra-oral x-ray devices such as the Heliodent Plus range as shown in Figure 1, panorama x-ray devices (Orthopos range) to 3D devices (Galileos range).

Figure 1: Intraoral X-Ray Device Heliodent Plus and a typical X-Ray Scan

The main task in the development of an x-ray device is the placement of the high voltage components in a predetermined volume with an efficient usage of material. Since the components are embedded in highly insulated oil, measurements during the operation of the devices are limited or impossible. Time-consuming and expensive iteration steps are required if the positions of individual components in the device are to be optimized. CST EMS allows the placement of these components to be checked and optimized during the initial design phases. In addition, the effects of the dielectric properties of the various materials on the overall construction can be carried out in this manner. The results of the long-term tests on the first design prototypes have shown that they are functionally very reliable.

Creating the geometry is generally the most costly stage of any FE simulation process. However, an X-ray device such as that shown in Figure 2, is easily and efficiently imported as an assembly via the CST EMS Pro/E import interface.

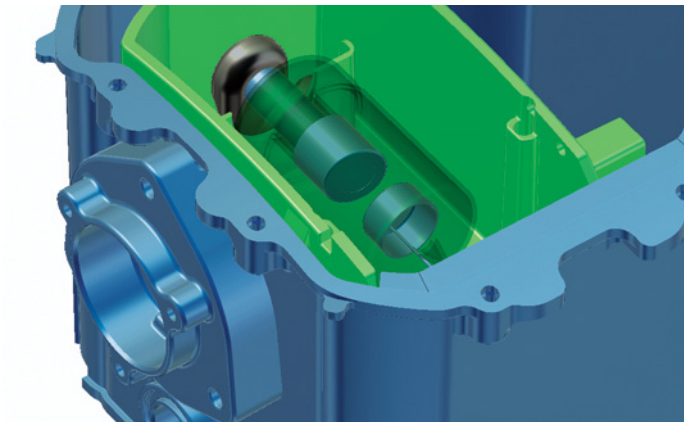

Figure 2: Imported Pro/E Assembly of a Heliodent Plus

Simplifications may be carried out at the discretion of the user who has the additional advantage of being able to easily apply modifications and attribute user-defined parameters. This allows virtual experiments to be performed such as the repositioning and resizing of components. Parameterization can also be used for what-if testing on, for example, material properties. Such parametric tools as well as optimization capabilities are fully integrated in CST EMS.

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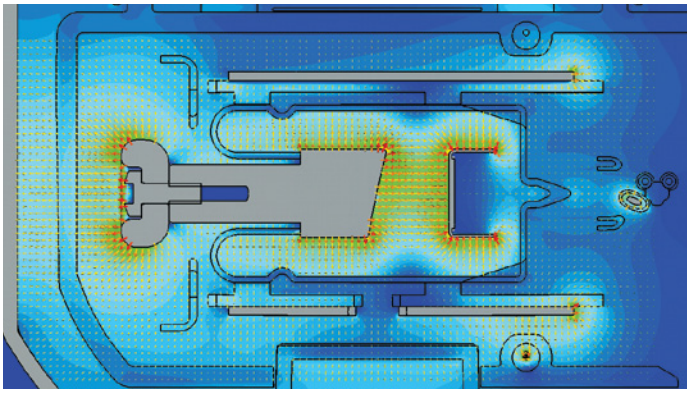

Figure 3: Electric Field Distribution in the Heliodent Plus

As an example, a typical parameterization would entail the variation of the voltages on electrodes. The effect of voltage and component positions on the electric field distribution in the x-ray device can be visualized [Figure 3] and quantified i.e. the electric field at any location in the model can be extracted for use in the optimizer. In practice, this was used to obtain the optimal geometry of the radiation screens. This, importantly, could be performed prior to the production of the first prototypes.

The workflow circle can be completed by exporting the modified geometry back in to CAD Software (Pro/E). As a result, the iterative design process can be reduced even further. For us at Sirona, this has proven to be a vital part of the simulation and development process.

The advantages of simulation are two-fold. Firstly, a reduction in the number of prototype cycles, development time and costs can be achieved. Secondly, by targeting material usage, component expenses and the ensuing manufacturing costs could also be minimized.

„Electromagnetic simulation using CST EMS is now established at the heart of these significant improvements to the development and manufacturing processes. The software is extremely reliable, robust and efficient. The CST EMS development team reacts swiftly to our needs and feature requests and is always receptive to new ideas and suggestions. As a consequence, we believe that product support, in addition to the software's powerful features, has contributed to the success of EM simulation at Sirona“ .

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