Computing the
"Holy Wisdom"

form•Z and Radiance as analytic tools for historic building research

by Oliver Hauck

The church of Saint Sophia (Holy Wisdom) in Istanbul – formerly known as Constantinople – was the cathedral of the city. This unique building with its wide cupola was built by emperor Justinian I (527-565) between 532 and 537. The first design by Anthemios of Tralles and Isidor of Milet had to be changed during the construction phase because of statical problems. During the following centuries, many windows had to be filled with brickwork because of structural collapses after several earthquakes.

For the project "The Saint Sophia of Justinian in Constantinople as a scene of profane and secular performance in late antiquity" which was funded by the Deutsche Forschungsgemeinschaft (German Research Foundation) in the framework of the priority programme "theatricality" a CAD model of the Saint Sophia in Istanbul has been generated at Technische Universität Darmstadt's faculty of architecture. This model is based on the architectural survey of the American Robert van Nice as well as on personal inspection of the actual building.

We found out very quickly that the light effects of the architectural concept do not only depend on the number and location of the windows and that common render software was not able to reproduce the original light situation. The whole building is a highly complex interaction between the occurring daylight and the window openings, the materials, and even some of the detail geometry.

The vaults which are mainly covered by gold mosaics are a major component of the light effects. The vaults reflect the daylight which occurs mostly through the openings of the aisles into the nave. This was the reason why these vaults but also all the other surfaces of the internal architecture of the building had to be reconstructed concerning their original geometry as well as light reflecting qualities.

The geometrical part has been done using **form•Z**. The light simulation has been done using Radiance and Make. To bring both programs together, we developed a special kind of workflow using **form•Z** libraries and a data management system which allowed us to work on the geometry and the materials independently.

The work has been shown in the exhibition "Insight into the virtual sky" at the Universitäts und Landesbibliothek Darmstadt. (Catalogue ISBN 978 3 8030 0691 2)
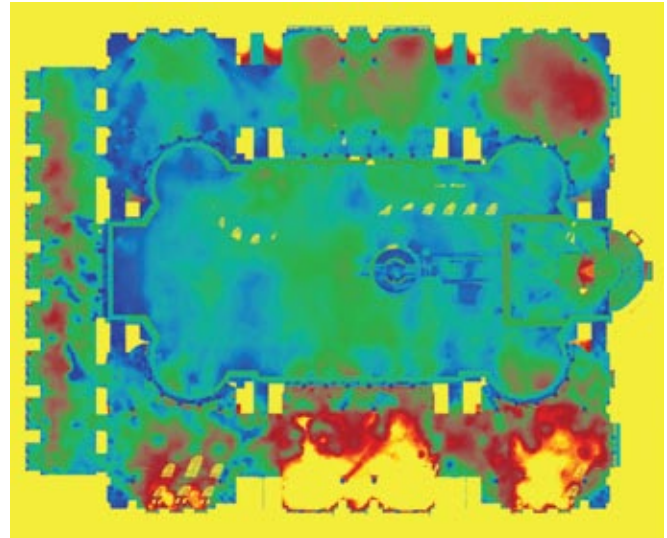
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The Project will be part of the exhibition "Byzantium, Splendour and Everyday Life" at the Art and Exhibition Hall of the Federal Republic of Germany in Bonn from February 26 – June 20, 2010.