



1 *Stainless steel blinds s_enn® at Fraunhofer ISE in Freiburg.*

2 *Venetian blind system mounted in the Köln Triangle building in Cologne.*

INTEGRATED SIMULATION OF COMPLEX FENESTRATION SYSTEMS

Windows and façades play a crucial role in the overall energy performance of buildings with respect to daylight, solar heat gains and thermal losses. The optimal use of daylight to achieve low energy costs and visual comfort is one R&D focus at the Fraunhofer Institute for Solar Energy Systems ISE.

To comply with new and more demanding building regulations – such as the 2020 EU Energy Performance of Buildings Directive – innovative, cost-optimized building products have to be developed. Often, a trade-off between different building functions has to be found, for which complex simulation and optimization tools are required.

Complex fenestration systems (CFS) refer to any window technology that incorporates a non-clear or switchable layer. Examples include translucent insulating panels and shading devices, such as venetian and roller blinds. CFS systems combined with suitable control strategies have the potential to improve the thermal and visual comfort of indoor spaces as well as to save lighting, cooling and heating energy.

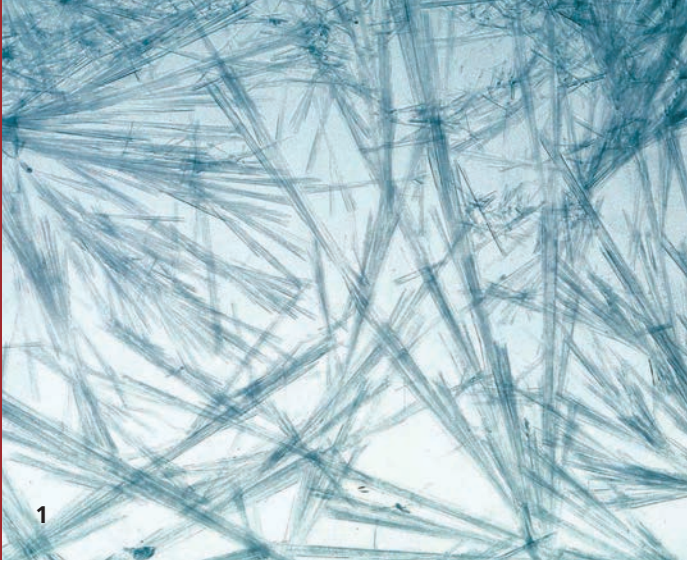
Fraunhofer ISE has extensive experience in solar control and daylighting research. We specialize in the mathematical and physical modeling of thermal and optical processes in sunlit façades and in analyzing their effect on building energy performance. The Institute's competence also includes calorimeter measurements with on-site indoor and outdoor accredited test facilities as well as studies on user preferences and visual comfort, carried out in the rotatable daylighting test facility on the roof.

Fraunhofer Institute for Solar Energy Systems

Heidenhofstrasse 2
79110 Freiburg
Germany
Phone +49 761 4588-0
Fax +49 761 4588-9000
www.ise.fraunhofer.de

Energy Efficient Buildings – Lighting Technology

Dr Bruno Bueno
Phone +49 761 4588-5377
building.light@ise.fraunhofer.de



Characterization of New Technologies

In our TestLab Solar Façades (accredited according to DIN EN ISO / IEC 17025), we determine the thermal and optical properties of new façade technologies.

The characterization of complex fenestration systems (CFS) often requires detailed optical measurements. To measure the light scattering properties of complex materials, researchers at Fraunhofer ISE use a modern scanning photogoniometer commissioned in 2014. With this facility, we are able to measure the angle-dependent transmission and reflection of light, which are saved as a bidirectional scattering distribution function (BSDF) data set. This data can be used as input in daylight simulation programs.

Web Tool for Simulating CFS

Fraunhofer ISE offers industry partners access to the web-based simulation platform "Fener". Here accurate and computationally efficient methods for thermal and daylighting simulations of office spaces installed with CFS are presented.

Based on the use of BSDF, "Fener" includes simulation tools such as "EnergyPlus" and "Radiance", as well as our own models, specifically designed to represent the daylighting and solar-control properties of CFS.

Self-Evaluation of Design Alternatives

Access to "Fener" allows our clients to evaluate different design alternatives in a fast and cost-effective fashion. "Fener" can help industry in the development of new façade products and assist building planners in the integration of commercially available technologies.

Engineering Consulting

Fraunhofer ISE has broad experience in national and international projects in the fields of energy efficiency, energy savings and renewable energy integration for residential and non-residential buildings. The projects specifically focus on the development of new components and energy concepts as well as their monitoring, evaluation and optimization through building automation strategies.

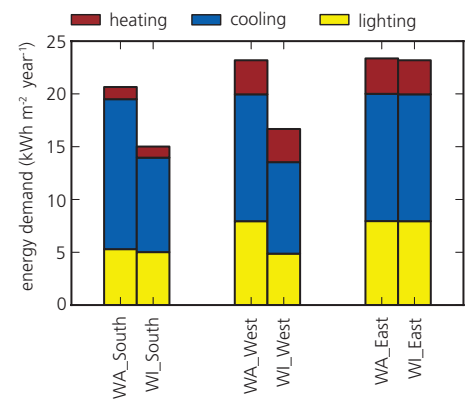
Industry Participation

We welcome our industry partners to participate in the development of "Fener" by including their products in our database. We also offer customized versions of the program to meet their needs.

1 Example of a complex fenestration material:

GLASSX® Crystal. © GLASSX AG

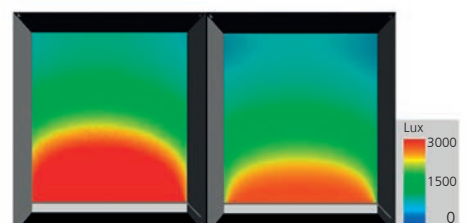
2 Goniophotometer lab at Fraunhofer ISE.



3 Composition of annual energy demand for

two different solar control systems (WA/WI)

as calculated by the web-based simulation platform "Fener".



4 Comparison of the daylighting distribution

in an office space between two different shading systems as calculated by "Fener".