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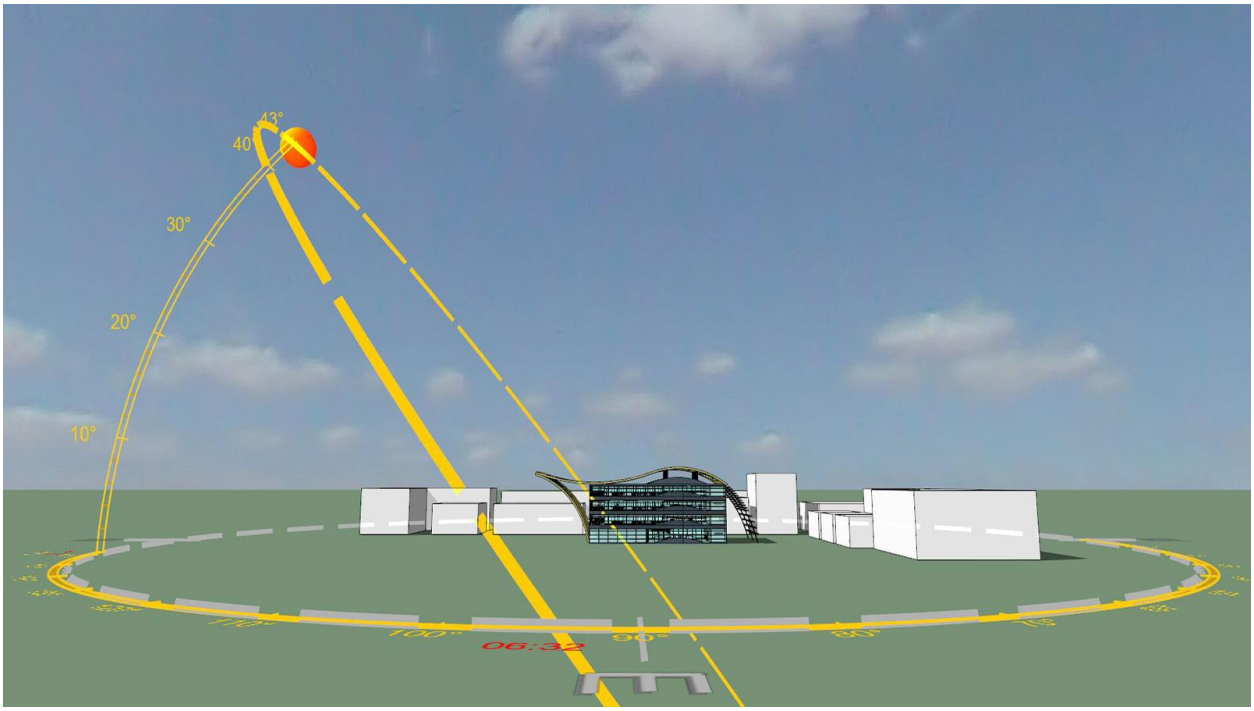
ACCOUNTING OF SUN RADIATION IN HEAT TRANSFER

Accounting Sun Radiation with Location Only

COMSOL, Energy Conversion

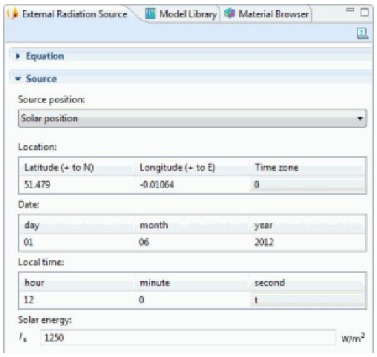
Abstract

Knowing the sun's radiation and thermal effects is very important to designers within the building industry, especially in designing "green" buildings. Heat transfer also plays a vital role in designing outdoor devices in terms of maintaining temperatures in extreme hot or cold environments. To use the words of Nicolas Huc, project leader for the Heat Transfer Module development at COMSOL in France: "it makes a huge difference if you forget to take the sun's radiation into account."



* Analyzing Solar Radiation

As of version 4.3 of the COMSOL Multiphysics® software and add-on Heat Transfer Module, external radiation sources can be defined in 3D for all physics user interfaces via the Solar Position option. You can easily define the direction and intensity of the sun's incident radiation based on the latitude and longitude position on Earth, the date, and the time with this new option (The solar position is only based on the position on Earth, not any other planet or the moon, but it is fine for airplanes and might work for a satellite orbiting close to Earth).



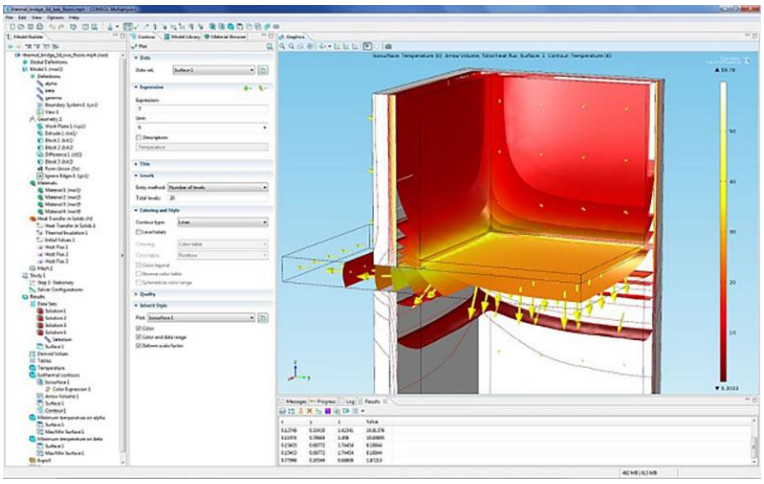
Defining an external radiation source using the Solar Position option.

The refractive index parameter has also been implemented to enable modeling of radiation through glass, water, and other media with a refractive index different than 1.0. Additionally, radiative heat transfer between thin structures is now possible when surface-to-surface radiation is used together with the Thin Conductive Shell user interface. This is great news for those involved in heat transfer projects.

So long, dense meshes! Thin walls can now be represented as interior boundaries instead of having to define a solid domain with a wall boundary condition on both sides. A wall condition can be defined between two fluid domains with the Interior Wall boundary condition, which is available in the Conjugate Heat Transfer and Non-isothermal Flow interfaces. To read about more updates to the Heat Transfer Module, check out the 4.3 Release Highlights page.

* Example: Analyzing Thermal Bridges with Heat Transfer Simulation

As an example, take a look at the following model, which represents part of a building, displaying its walls, floor, and a balcony (to the left). As you can see, the balcony creates a thermal bridge.



Analyzing heat transfer in a two-floor structure with a thermal bridge.

In ***Fanny Griesmer*** conversation with ***Nicolas***, he mentioned in passing that our software had been submitted for a benchmark some time ago for version 3.5, and COMSOL Multiphysics was the only "general-purpose software" to pass the standard EN ISO 10211 for simulations of thermal bridges in buildings. Pretty neat.

Thanks for your time!

Source: COMSOL
Author: Fanny Griesmer