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IRC Software for Building Designers

By John Burrows

This article highlights several NRC-IRC software programs concerned with the indoor environment.

One of the outcomes of research at the NRC Institute for Research in Construction (NRC-IRC) is software that can help building professionals design better buildings, and help material manufacturers design better products. This article outlines several software programs concerned with the indoor environment that were recently developed by NRC-IRC. Most are available free of charge.

Lighting Design
DAYSIM is a daylighting design tool used to predict the annual amount of daylight in buildings of arbitrary complex shape located anywhere in the world. It calculates the daylight factor (the relative amount of daylight inside a building compared to the daylight outside on a cloudy, overcast day) as well as the percentage of the occupied hours of the year when there is sufficient building daylight to work without the need for electric lighting. It predicts the lighting energy use of commercial buildings for a variety of lighting control systems including occupancy sensors, photocell-controlled dimming, and standard on/off switches.

DAYSIM has been designed to link to the ECOTECT building design software, allowing users to quickly set up a building model in ECOTECT, import it into DAYSIM for a daylighting analysis, and export it back into ECOTECT for a state-of-the-art graphical presentation.

SkyVision enables users to predict skylight performance for any given day, using different design variables under virtually any condition. It calculates the overall optical characteristics of various types of skylights, performance indicators of skylight/room interfaces, indoor daylight availability, and lighting energy savings (daily, monthly, and annually). This tool is useful for assessing the costs and benefits of including skylights in a building.

Daylight 1-2-3 is a sophisticated but easy-to-use daylighting design analysis tool that allows designers to take advantage of the fact that daylight is more desired by occupants than electrical illumination, and that its use can also lead to substantial energy savings. It is intended for use by anyone making daylighting-related design decisions in commercial buildings at the initial development stage. It combines the capabilities of DAYSIM, SkyVision and the ESP-r thermal simulation engine, enabling it to optimize the amount of natural light in a space together with its annual energy use. Simulations provide calculations based on climate information in virtually every country around the world.

Daylight 1-2-3 predicts the daylighting and energy performance of side-lit and top-lit private offices, open-plan offices, and classrooms. Factors taken into account include:

- glazing type
- window blinds;
- the electric lighting control system (manual, dimming, occupancy sensor);
- skylights.

Indoor Air Quality

IA-QUEST is an indoor air quality emission simulation tool that was an end product of an NRC-IRC consortium project established to develop guidelines for selecting materials and ventilation strategies to meet specific indoor air quality requirements. The software consists of two parts: a database and the simulation tool. The database stores test emission data ("off-gassing") for 90 "target" volatile organic compounds (VOCs), "abundant" VOCs and TVOCs (total VOCs) for 69 building materials commonly used in Canada. It also provides information about specimen details and test conditions involved in measuring the emissions. The simulation part predicts the indoor air contaminant concentrations in a room for which specific materials (from the database) and ventilation conditions/strategies are selected.

Insulating Buildings from Aircraft Noise

The **IBANA-Calc** software calculates indoor sound levels from aircraft noise for both residential and commercial building envelope designs. It enables users to view comparisons of designs, refer to printed reports, and listen to simulated aircraft noise as it would be heard indoors. It is intended to resolve the difficulty of relating decibel ratings to what one actually hears—a frequent challenge for architects and interior designers. It allows designers to compare various designs.

Summary

These software packages reflect the fact that design tools are an important element of the NRC-IRC strategy for transferring knowledge to the construction industry. Several of the tools described here continue to be enhanced as new information becomes available. Further details about these software packages and purchase/download instructions can be found at:
http://irc.nrc-cnrc.gc.ca/software_e.html

This Web site link also provides access to NRC-IRC software on subjects other than the indoor environment, such as fire safety, heat, air and moisture transfer in walls, and infrastructure.

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