Arch 4050/6050 Daylighting

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Credit Hours: 3

Prerequisites: ARCH 4050/6050-T01

Premise

Good daylighting design helps create healthy, vibrant, and humane built environments. In addition, daylight is a renewable resource with significant potential to help solve our ecological, environmental, and resource scarcity problems. Electric lighting, the primary source of illumination in our nation's buildings, composes approximately 30% of a commercial/institutional building's total electricity use and is a significant source of internal heat gain. In most buildings, the creative and intelligent admission of daylight can eliminate nearly all electric lighting needs during daylight hours. Unfortunately, our profession's knowledge of daylighting design principles has diminished over the last century. This course will rediscover those lost skills and teach contemporary daylighting analysis methods and design strategies through the use of state-of-the-art metrics and simulation tools.

Objectives and Content

- To give students the resources and analytical skills needed to design, justify, and represent creative, intelligent, and integrated daylighting solutions in their current design projects and future practice.
- This course will first address the relevance of daylighting to our nation's infrastructure and environmental systems.
- The primary focus of this course is to teach advanced daylighting performance analysis methods and design strategies built upon qualitative daylighting concepts.
    - The use of new materials, products, and metrics, which compose a new daylighting design vocabulary, will be addressed.
    - Simple metrics, such as USGBC's LEED daylighting credit (EQ 8.1), will be analyzed and critiqued followed by a comparative survey of state-of-the-art climate-based metrics (such as Useful Daylight Illuminance and Daylight Autonomy) and analysis methods.

Method

- No previous daylighting or energy simulation experience is needed for this course.
- In general, each week there will be a seminar followed by a related simulation lab.
- Students will build confidence and skills with simulation software by first working through standard analysis techniques on simple models provided by the instructor.
- These skills will then be used to iteratively analyze and improved more complex design problems.
- Simulation software will likely include *DIVA-for-Rhino* (Design Iterate Validate Adapt), a plugin for *Rhinoceros* developed by Harvard's Graduate Design of School). *DIVA* will be used to interface *Radiance* and *DAYSIM* for dynamic climate-based simulations and for data visualization.

Evaluation

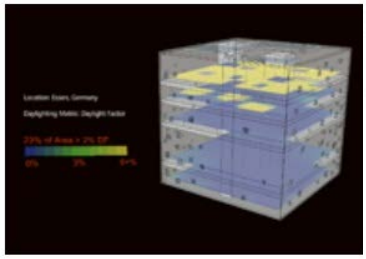
20% class participation and attendance
30% assignments
50% final analysis project

References

C.F. Reinhart, J Mardaljevic, Z. Rogers, "Dynamic daylight performance metrics for sustainable building design", *National Research Council Canada* 3 (1) p. 1-25, 2006 < http://www.nrc-cnrc.gc.ca/obj/irc/doc/pubs/nrcc48669/nrcc48669.pdf>

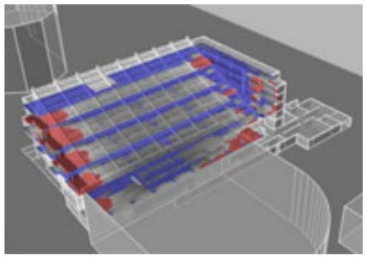
DIVA-for-Rhino, <http://www.diva-for-rhino.com/>

K Lagios, J Niemasz and C F Reinhart, "Animated Building Performance Simulation (ABPS) - Linking Rhinoceros/Grasshopper with Radiance/Daysim", *SimBuild 2010*, New York City, August 2010
<http://www.gsd.harvard.edu/research/gsdsquare/Publications/DaylightingAnalysisInRhinoAndGrasshopper.pdf>



www.diva-for-rhino.com

Climate-Based Metrics
(Radiance/Daysim)



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LEED IEQ Credit 8.1 Compliance
(Radiance)

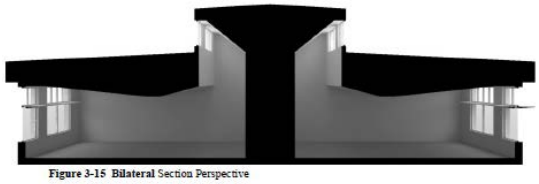

Figure 3-15 Bilateral Section Perspective

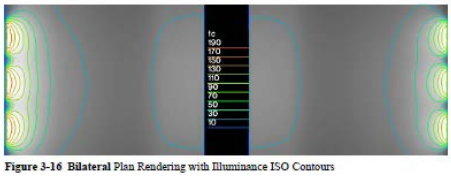

Figure 3-16 Bilateral Plan Rendering with Illuminance ISO Contours