EVDS 683.99 | H (3-0)
Building Performance Simulation
Instructor: Salman KHALILI ARAGHI, skhalil@ucalgary.ca
Monday & Wednesday @ 9:30 – 10:50, PF 2165

Introduction
This course explores building performance simulation in the design, operation and management of buildings. The information captured through building performance simulation not only becomes resources for engineers to analyze particular performative features of buildings but also would aid architects in terms of the decision making through conceptual design phases. The intention of this course is to teach students what performative architecture is, the definitions of performance-based design, essential concepts and methods associated with various analytical techniques used in the simulation of building performance, its implications for the relationships between architectural design and the various engineering disciplines as well as its applications in design conceptualization associated with generative design approach.

Teaching Approach
The class meetings will consist of two parts; first, lectures devoted to learning the concept and implications of performance-based design, and second, demonstrations of performance analysis and simulation techniques in various software programs used for performance simulation. Architectural students will be asked to develop models from their comprehensive design studio projects for simulation and analysis purposes in regard to environmental, structural and air flow performances in software tools made by Autodesk including Vasari (whole building energy simulation), Ecotect (solar radiation, daylight and thermal analysis), Robot (structural modeling and analysis) and simulation CFD (air flow and heat transfer). The intention is to learn the simulation and evaluation techniques, but not modify the design.

Means of Evaluation
The evaluation is based on class participation, assignment projects and a two-page paper:

- Class Participation   10%

- Assignments (class presentation):

  - Assignment #1: Whole Building Energy Analysis (Autodesk Vasari)   15%
  - Assignment #2: Energy Analysis (Autodesk Ecotect)   25%
  - Assignment #3: Structural Modeling and Analysis (Autodesk Robot)   25%
  - Assignment #4: Air Flow and Heat Transfer (Autodesk CFD)   15%

- Term Paper (2 pages)   10%

Schedule

01/12	Performative Architecture	03/02	Detailed Energy Analysis
01/14	Performance vs. Form Making	03/04	Detailed Energy Analysis
01/19	Guest Lecturer (Axel Kilian)	03/09	Project 2 Consultations
01/21	Guest Lecture (Rudi Stouffs)	03/11	Project 2 Presentations
01/26	Guest Lecturer (Patrick Teuffel)	03/16	Project 2 Presentations
01/28	Guest Lecturer (Bige Tuncer)	03/18	Structural Modeling/Analysis
02/02	Critical Discussion	03/23	Structural Modeling/Analysis
02/04	Guest Lecturer (Branko Kolarevic)	03/25	Project 3 Consultations
02/09	Whole Building Energy Simulation	03/30	Project 3 Presentations
02/11	Project 1 Consultation	04/01	Project 3 Presentations
02/16	Block Week (no lectures)	04/06	Computational Fluid Dynamics
02/18	Block Week (no lectures)	04/08	Project 4 consultations
02/23	Project 1 Presentations	04/13	Project 4 Presentations
02/25	Project 1 Presentations	04/15	Project 4 Presentations

Note: Please note the schedule is subject to change depending on the progress of the class.

References:

Chaszar, André. *Blurring the Lines: Computer-Aided Design and Manufacturing in Contemporary Architecture (Architecture in Practice)*. Academy Press, 2006.

Corser, Robert, ed. *Fabricating Architecture: Selected Readings in Digital Design and Manufacturing*. Chronicle Books, 2006.

Grobman, Yasha J., and Eran Neuman, eds. *Performalism: Form and Performance in Digital Architecture*. Routledge, 2013.

Kolarevic, Branko, ed. *Architecture in the Digital Age: Design and Manufacturing*. Taylor & Francis, 2004.

Kolarevic, Branko, and Ali Malkawi, eds. *Performative Architecture*. Routledge, 2005.

Kolarevic, Branko, and Kevin Klinger, eds. *Manufacturing Material Effects: Rethinking Design and Making in Architecture*. Routledge, 2013.

Ng, Rashida, and Sneha Patel, eds. *Performative Materials in Architecture and Design*. Intellect, 2013.

Grading Scale

Letter Grade	4-Point Scale	4-Point Range	Percent	Description
A+	4.00	4.00	95-100	Outstanding – evaluated by instructor
A	4.00	3.85-4.00	90-94.99	Excellent – comprehensive understanding of the subject
A-	3.70	3.50-3.84	85-89.99	Very good performance
B+	3.30	3.15-3.49	80-84.99	Good performance
B	3.00	2.85-3.14	75-79.99	Satisfactory performance
B-	2.70	2.50-2.84	70-74.99	Min pass for students in the Faculty of Graduate Studies
C+	2.30	2.15-2.49	65-69.99	All final grades below B- are indicative of failure at the graduate level and cannot be counted toward Faculty of Graduate Studies course requirements
C	2.00	1.85-2.14	60-64.99	
C-	1.70	1.50-1.84	55-59.99	
D+	1.30	1.15-1.49	50-54.99	
D	1.00	0.50-1.14	45-49.99	
F	0.00	0-0.49	0-44.99	

A student who receives a "C+" or lower in any one course will be required to withdraw regardless of their grade point average (GPA) unless the program recommends otherwise. If the program permits the student to retake a failed course, the second grade will replace the initial grade in the calculation of the GPA, and both grades will appear on the transcript.

Notes:

1. Written work, term assignments and other course related work may only be submitted by e-mail if prior permission to do so has been obtained from the course instructor. Submissions must come from an official University of Calgary (ucalgary) email account.
2. It is the student's responsibility to request academic accommodations. If you are a student with a documented disability who may require academic accommodation and have not registered with the Student Accessibility Services, please contact their office at 220-8237. (http://www.ucalgary.ca/access). Students who have not registered with the Student Accessibility Services are not eligible for formal academic accommodation. You are also required to discuss your needs with your instructor no later than fourteen (14) days after the start of this course.
3. Plagiarism - Plagiarism involves submitting or presenting work in a course as if it were the student's own work done expressly for that particular course when, in fact, it is not. Most commonly plagiarism exists when:(a) the work submitted or presented was done, in whole or in part, by an individual other than the one submitting or presenting the work (this includes having another impersonate the student or otherwise substituting the work of another for one's own in an examination or test),(b) parts of the work are taken from

another source without reference to the original author,(c) the whole work (e.g., an essay) is copied from another source, and/or,(d) a student submits or presents work in one course which has also been submitted in another course(although it may be completely original with that student) without the knowledge of or prior agreement of the instructor involved. While it is recognized that scholarly work often involves reference to the ideas, data and conclusions of other scholars, intellectual honesty requires that such references be explicitly and clearly noted. Plagiarism is an extremely serious academic offence. It is recognized that clause (d) does not prevent a graduate student incorporating work previously done by him or her in a thesis. Any suspicion of plagiarism will be reported to the Dean, and dealt with as per the regulations in the University of Calgary Graduate Calendar.

4. Information regarding the Freedom of Information and Protection of Privacy Act (http://www.ucalgary.ca/secretariat/privacy) and how this impacts the receipt and delivery of course Material.

5. Emergency Evacuation/Assembly Points (http://www.ucalgary.ca/emergencyplan/assemblypoints).

6. Safewalk information (http://www.ucalgary.ca/security/safewalk).

7. Contact Info for: Student Union (http://www.su.ucalgary.ca/page/affordability-accessibility/contact); Graduate Student representative (http://www.ucalgary.ca/gsa/) and Student Ombudsman's Office (http://www.su.ucalgary.ca/page/quality-education/academic-services/student-rights).