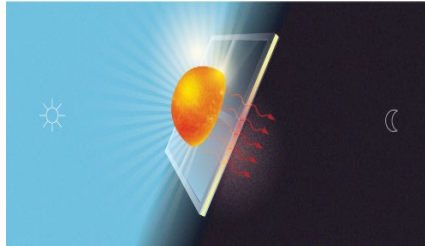




Kandidatarbete

Examenskod ACEX10



## Performance of smart window glazing Part 2: numerical modelling and simulations

Windows are essential parts of building envelopes because they provide daylight and fresh air to the indoor environment, as well as a visual and sound connection with the surrounding. At the same time, due to their functional requirements, windows are the least energy efficient parts in buildings. There are various techniques to reduce heat losses through windows such as multiple glazing, insulated, airtight window frames, and low emissive coatings. Thermochromic coatings, PCMs (phase change materials), and photoswitches molecules are examples of novel systems for changing the solar radiation properties of window glazing in response to the ambient temperature and/or solar exposure. Since these systems operate without a human-aided control, they are called smart solutions.

This project aims at studying the thermal and visual performance of smart windows (thermochromic coatings, PCM layers, and molecular photo-switches). It is composed of two parts. While Part 1 is about experimentation, Part 2 is focused on numerical modeling and simulation. The two parts can be executed separately.

### Specific goals of Part 2 are:

- Review of existing performance indicators for window glazing and their applicability to smart glazing
- Build up numerical models with which it is possible to study thermal and visual performance of window glazing
- Develop calculation benchmarks that show the performance difference between ordinary and smart glazing

### Target group of students

TKSAM

### Group size

3-4

### Special requirements

Students interested in learning or improving numerical modelling skills

### Suggestion from

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### Can the project be duplicated?

No

## Methods

Literature review; numerical simulations in Comsol and/or Matlab. Manuals for Comsol are available.

## Literature recommendation

- [1] Grynning S, Goia F, Time B. Dynamic thermal performance of a PCM window system: Characterization using large scale measurements. *Energy Procedia* 2015;78:85–90. doi:10.1016/j.egypro.2015.11.119.
- [2] Cornaro C, Bucci F, Pierro M, Bonadonna ME, Siniscalco G. A new method for the thermal characterization of transparent and semi-transparent materials using outdoor measurements and dynamic simulation. *Energy Build* 2015;104:57–64. doi:10.1016/j.enbuild.2015.06.081.