

Seminar „ Thermal Protection of Buildings“

Task list

All tasks shall be finalized by reports including summaries and calculation reports.

Task no. 1: Assemblies of building constructions

- a) Design assemblies of wall and roof for a low-energy family house
- b) Calculate U-value of both constructions including effects of thermal bridges (in an approximate way)
- d) Calculate the risk of interstitial water vapor condensation (1D Glaser model)
- e) Compare results with requirements and eventually change the design. The requirements are:
 - U-value is lower than $0.2 \text{ W/(m}^2\text{K)}$
 - final amount (at the end of the year) of accumulated moisture is 0 kg/m^2 , max. amount of accumulated moisture is 0.1 kg/m^2 with the exception of wooden constructions where the condensation is not accepted at all.
- f) Create a short presentation about your design and results of calculation in MS PowerPoint.

Task no. 2: Advanced model of building construction (WUFI model)

- a) Choose one of the envelope constructions (from task no. 1)
- b) Assume a higher amount of built-in water content in the thermal insulation
- c) Calculate probable changes in water content in this construction during next 10 years
- d) Create a short presentation about your results in MS PowerPoint.

Task no. 3: Energy performance of a low-energy family house

- a) Find an architectural study of a simple low-e family house (source: technical literature, architectural journals, web sites)
- b) Complete basic documentation for the house: ground plans, 1 section, elevations and situation
- c) Prepare 3 types of possible heat sources for the house including their efficiencies.
- d) Define heated part of the house. Prepare two variants of glazing area (minimum, maximum) on S and/or SE and/or SW facades. Calculate areas of building constructions on the envelope of heated part of the house for both variants.
- e) Calculate energy need for heating for both variants and choose the optimal one.
- f) Calculate primary energy connected with the performance of the house for all heat sources and choose the optimal variant.

g) Create a short presentation about your family house and results of calculation in MS PowerPoint.

Common assumptions:

- forced ventilation with heat recovery (efficiency 50-70%)
- opaque constructions: taken from task no. 1
- thermal transmittances of windows: $1,0 \text{ W/(m}^2\cdot\text{K)}$ and less
- solar factor of windows: 0,5.

Task no. 4: 2D heat conduction in thermal bridges

a) Draw a detailed plan of a selected thermal bridge or joint (e.g. wall-roof, wall-ceiling connection)

b) Create its 2D thermal model and calculate steady-state temperature field

c) Calculate minimum internal surface temperature for this thermal bridge/joint and compare it with dew-point temperature for given boundary conditions

d) Create a short presentation about your calculation in MS PowerPoint.