flixo

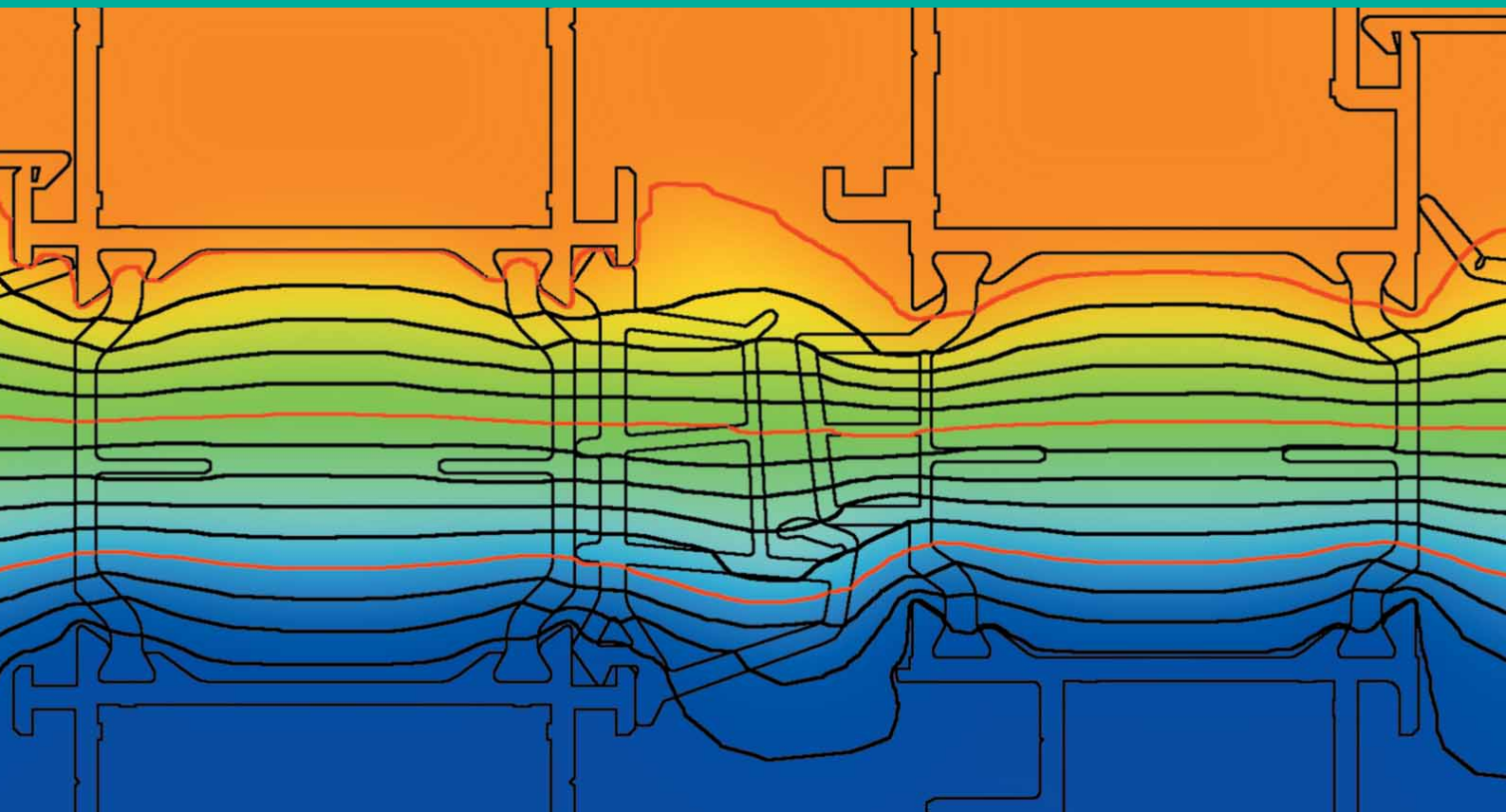## The thermal analysis and reporting program

flixo produces thermal-hygro analyses of the component and facade cross-sections. It has been developed by architects, computer scientists and physicists for architects, planners, energy consultants and building physicists.

With flixo thermal bridges, for example, can be detected at the planning stage and eliminated through changes in design. Consequently, building failures can be prevented and heating energy can also be saved.

A further application is relevant to hygro-analysis, with which, for example, temperature minima on the internal surfaces of a cross-section can be determined in order to avoid the formation of condensed water or mildew.

flixo analyzes two-dimensional component nodes for stationary boundary conditions (room temperatures and thermal transfer coefficients).

Interface ATHENA-flixo

Detail drawings produced in ATHENA can be integrated into flixo with a little effort. Areas and materials (where known) are transferred automatically and calculations become a child´s play. The usual time of 1.5 hrs. taken for the transfer of a detail drawing produced in CAD programs (plus the same time for modifications to the detail) is now reduced to a few minutes - because ATHENA tranferres the detail perfectly prepared into flixo.

CAD-PLAN
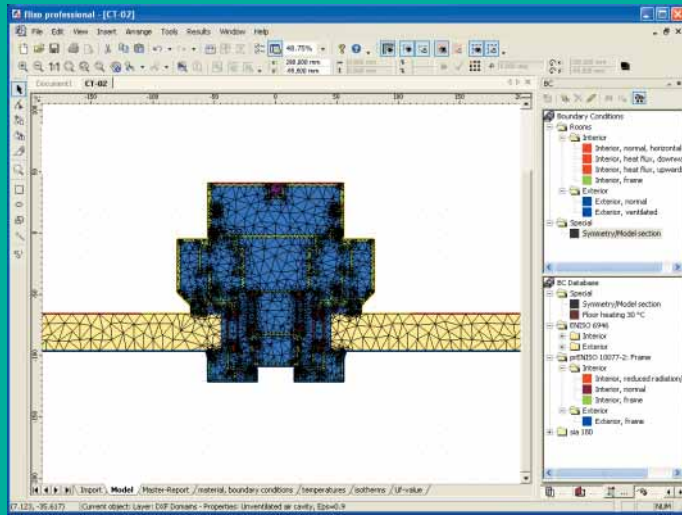
Features

- Computation of temperatures according to the finite element method (triangular elements); iterative solution of the arising system of linear equations using an optimized, conjugated gradient technique.
- Automatic grid pitch reduction at critical points.
- Computation of equivalent thermal conduction coefficients for air cavities and automatic subdivision of air cavities according to EN ISO 10077-2.
- Certification as a thermal bridge program according to EN ISO 10211-1 and EN ISO 10077-2.
- Unrestricted number of nodal temperatures (depending on the hardware used).
- Consideration of materials with orthotropic material properties.
- Intelligent cursor with tooltips for the explanation of workflows.
- User interface in Englisch, German, French and Italian.

Results

- Isothermals and false-color images of any building detail for qualitative thermal assessment and optimization.
- Temperatures at freely determined design points.
- Heat flux density at freely determined design points.
- Minimum and maximum surface temperatures at freely determined design boundaries and critical room humidities for the assessment of possible mildew formation and condensation problems.
- Heat flow at freely determined boundary lines.
- Thermal transmission coefficients for quantyfying thermal bridging effects: "U-value" (with various boundary conditions to also analyze the critical surface temperature) and the length-related "Psi value" (also for models with more than two room temperatures).
- Heat flow lines for highlighting thermal bridges.
- Automatic computation of framework k values.
- Optionally the fRsi factor including the surface and the critical room humidity can be shown for any surface point.

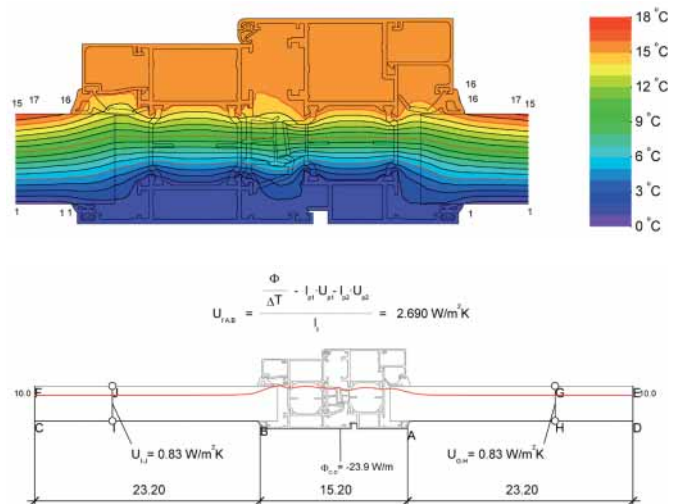## Integration into the MS-Windows® environment

- Well-known operation and concepts from the MS Office products:
  - Cut/Paste and Insert as well as Undo/Restore of the last actions.
  - Different flixo documents can be edited in parallel.
  - Interchange of flixo data (design details, results) via the clipboard or using drag & drop. For example, results can be integrated directly in a MS Word® Excel® document or copied or moved from one design to another.

System requirements

flixo does not make high demands on the hardware. However, the more powerful the computer is, the faster complex computations can be carried out. As an operating system, Windows XP® or Windows Vista® can be used.

Inputs

- flixo is subdivided into a design section and a report section. The physical situation (geometry, boundary conditions, materials) is defined in the design part. The results can be interactively combined in the reports. Elements which arise in all reports can be defined in a master report.
- The physical situation can either be imported via DXF files or be directly entered and processed with the integrated CAD editor.
- Direct import of DXF files from Macintosh systems is also possible, taking the layout data into account. Finding of smallest two dimensional elements with assignment of materials. Scaling of construction based on the default size of a freely selected dimension.
- Import and export via the Building-SVG Interface. When importing additional information (e.g. material properties) is considered beside the geometry. The output is adjustable (e.g. for direct displaying in a web browser).
- The CAD editor/layout editor supports the following familiar concepts:
  - Layers: Objects can be arranged on various layers and the layers can be selectively superimposed, masked out, printed and frozen.
  - Snapping aids: Objects can be aligned with various auxiliary objects such as auxiliary lines, grids and special points on adjacent objects. Rotating an object can be done with an angle snap (multiple of a user-defined base angle).
  - Associative elements such as local results and isothermals.
  - Mouse and keyboard-controlled input.
  - Geometrical operations such as grouping, merging, cutting, differences between objects.
- The integrated and expandable component library of flixo enables components to be simply transferred using the mouse (drag & drop) into the current design.
- A material data base with more than 1000 materials from various standards (EN ISO 12524, EN ISO 10077-2, EN ISO 673, EN 6946, DIN 4108-4) is available

$$U_{FAE} = \frac{\frac{\Phi}{\Delta T} - l_{a1} U_{a1} - l_{a2} U_{a2}}{l_i} = 2.690 \ W/m^2 K$$

CAD-PLAN