TRNSAIR –
THERMAL SIMULATION PROGRAM FOR
SOLAR AIR SYSTEMS

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Abstract - During the just finished international research activity - task 19 solar air systems - of the IEA - international energy agency -, a easy to use design tool for solar air systems has been developed under international collaboration. TRNSAIR uses the algorithms of TRNSYS in combination with a userfriendly interface. The program will be available for the intel based platforms like WINDOWS NT or WINDOW 95.

1. INTRODUCTION

TRNSAIR is a simulation program for solar air heating systems based on the well known dynamic simulation program TRNSYS. The nomograms in the engineering handbook have been calculated by using TRNSAIR. The program uses the algorithms of TRNSYS in combination with a user friendly interface. The program will be available for Intel based platforms with operating systems WINDOWS NT and WINDOW 95.

The program is capable to simulate 6 generic solar air heating systems in combination with a two zone building model. The user can modify the most relevant parameters of the building and the solar air system. Due to the user friendly interface, it might be used even by persons with less experience in using simulation programs.

Program features:

- full TRNSYS simulation
- changing of geometry data
- predefined 5 typical reference buildings
- predefined of building usage (dwelling; office etc.)
- selectable insulation level
- selectable construction type (heavy or light)
- selectable schedules of e.g. internal gains, occupation etc.
- most predefined values can be changed
- selectable main orientation of the facade
- big database is included and can be modified or extended
- online display of simulation results e.g. as room and air collector temperature etc.

The default settings are very helpful for the user to simulate his own building projects. The program output is:

- heating demand
- total building losses
- solar gains
- system performance
- etc.

2. BUILDING MODEL

The program has the capability to describe a building with two thermal zones. Each zone is described by length, width and height. The two zones are linked by one common wall.

As default the Task 19 reference building is included. For this building the user can choose three different insulation levels, a light or heavy construction (low or high thermal mass) and office or dwelling building type. Additional an large volume building is available (only system 1 can be attached to this building type).

This choice determines the window and wall, -types, -orientations and areas. The building type is connected to present the regime data of the zones like internal gains, heating schedules occupation and ventilation schedules, or set points for the shading device.

Figure 1: Project Initialisation window of TRNSAIR
Beyond these default settings most of the parameters can be changed by the user. The database is extendable with user defined wall types or regime data. It is also possible to define different values for each zone.

The schedules of heating, ventilation and for the use of shading devices may be controlled by time or by set points (e.g. room temperatures) to model different control strategies.

3. ZONE DESCRIPTION

The access to change the wall or window parameters can be done in the zone window which is shown in Fig 4. There, the regime data for heating, ventilation or infiltration can be set.

4. SYSTEM DESCRIPTION

After the definition of the building, it is possible to link it to one of the six different solar air systems (actually there are seven systems because system 5 does have two different applications). These different systems are represented by a logo. Further information about each system is available under the Info button.

In addition to a short description of the systems a scheme of the system and an information flow is provided with the program.
5. SIMULATION

Here the user can switch of the solar system to simulate the building without any active system as a reference case. Start time and stop time (e.g. September till May) of the simulation can be set.

The results of the running simulation may be plotted online on the screen as well the ASCII table can be imported in any spread sheet program (like EXCEL etc.). When the program is finished there will be a nice output plot for the most relevant results (e.g. heating demand, system output etc.).

6. CONCLUSION

TRNSAIR allows to design quite easily solar air heating system with less effort and a quite good result. Basic information on solar air systems and computer knowledge are necessary but easy to learn. Due to the user friendly interface and a good manual provided it doesn’t take very long to feel comfortable with the program.

The program is available at:
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