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ENHANCEMENTS IN THE DEROB-IUA 1,0 BUILDING THERMAL SIMULATION CODING TO IMPROVE THE PRODUCTIVITY OF VALIDATION EXERCISES

by

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A series of enhancements to the DEROB-IUA 1,0 building thermal simulation system coding which aid the advanced user of the system in validation exercises is described.

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ABSTRACT

A series of enhancements to the DEROB-IUA 1,0 building thermal simulation system coding which aid the advanced user of the system in validation exercises is described.

KEYWORDS·

Building; thermal; simulation; validation; convergence.

BACKGROUND

While the effort put into the development of building thermal simulation programs over the past decade has been intense, a similar effort does not appear to have been made to validate these programs. Of the simulation systems produced during this period the DEROB family has received more attention than most other similar programs[1].

When the DEROB International Users' Association (IUA) was formed in 1983 a commitment was made to develop a set of validation exercises which could be reapplied to successive versions of DEROB. Attempts to acquire such data bases have foundered because of the unfortunate tendency for scientists involved in validation exercises to make little or no effort to preserve their data bases[2,3].

ASSOCIATING EXPERIMENTAL DATA BASES WITH DEROB

The association of files of hourly experimental data with the DEROB simulation run is quite straightforward. The user specifies the data file, its format, the number of columns of variables and the start and end times. The user can also specify the variables to be retrieved and used in the simulation, by time. Although it would be useful to be able to start using different variables during the progress of the simulation run such an enhancement has not yet been implemented.

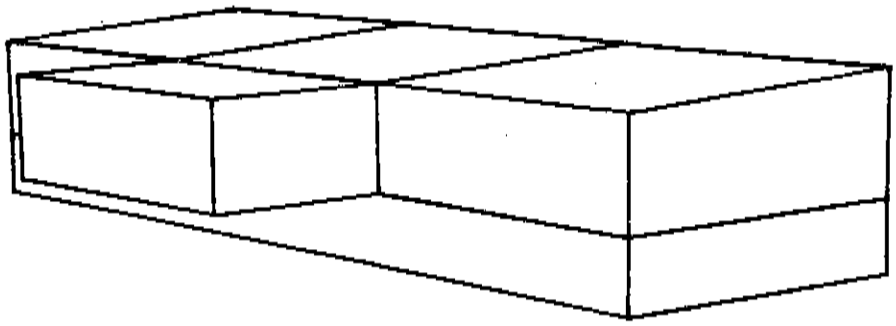

Fig. 1. Bird's eye view of the classroom module model from the southeast. Note that the ground plane is not shown in the digital representation of the model and the utility crawl space under the classroom is clearly visible.

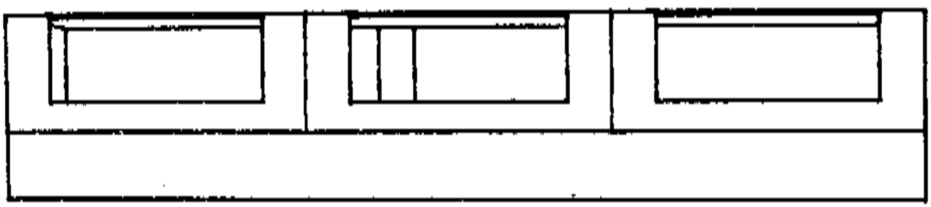

Fig. 2. Approximately eye level view of the classroom module from several degrees west of true north. Again note the bulk of the crawl space below the unseen ground level.

simulation run and associated on an hourly basis with the analogous nodes in the R-C network. DEROB would then accept these temperatures as fixed for the purpose of obtaining a solution.

An additional set of commands allows the user to simply ignore any nodes lying beyond these fixed boundaries. In this way the R-C network may be trimmed to a size not much larger than was the case with more primitive programs.

DIAGNOSING CONVERGENCE PROBLEMS

It is not difficult to see how this flexibility plus the additional complication of allowing advection connections between volumes to be controlled thermostatically, or on a time schedule, could lead to the unwary user creating a situation in which DEROB could not converge on a solution. To aid the user in these messy situations the enhanced version of DEROB-IUA 1,0a provides a set of diagnostic aids which are activated when the network will not converge.

A command to fix an experimentally acquired air temperature to its analogous nodal location in a simulation model would take the form:

SET VOLUME (col vol type m b)

where:

- col = column in the special input file in which the value is to be found;
- vol = volume number to which the value retrieved is to be set;
- type = type of variable to be associated with the volumetric air node where:
  - 1 = air temperature;
  - 2 = heating load applied to the air node;
  - 3 = cooling load applied to the air node.

A command to trim a certain node from the network can take the form:

CHOP WALL (counter node)

where:

- counter = the bookkeeping counter for the wall in the model;
- node = the node in the one-dimensional array which is to be trimmed from the R-C network.

CONCLUSIONS

These enhancements are in varying states of completion. A version of DEROB-IUA 1,0a which has a fully debugged specialised output file has been in regular use at the National Building Research Institute for nearly a year now. It has proved to be an excellent time saving facility in that mode. The other facilities described are being brought to testing (not distribution) standard in order to provide a discussion resource for the next meeting of the DEROB International Users' Association Conference which is tentatively scheduled for the end of 1985. It is hoped that most of these facilities will be incorporated in the DEROB-IUA 2,0 version which will be adopted by IUA members at that time.

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