1. COMPETITION RULES AND INSTRUCTIONS

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ABSTRACT

This chapter describes the competition as it was announced in 1994. To give complete information about the competition and to keep the data available for future use by other interested people, it is included in the book. It gives the information how the data can be obtained and which rules are to be applied for participating in the competition.

1.1 INTRODUCTION

This competition has been organised to help clarify the conflicting claims among many researchers who use and analyse building energy data and to foster contact among these persons and their institutions. The intent is not necessarily only to declare winners but rather to set up a format in which rigorous evaluations of techniques can be made. Because there are natural measures of performance, a rank-ordering will be given. In all cases, however, the goal is to collect and analyse quantitative results in order to understand similarities and differences among the approaches.

1.2 GENERAL INFORMATION

To participate in a proper way in the competition these are the steps to follow. The steps are:

(1) read the instructions carefully,
(2) analyse the data from one or more cases, and
(3) send in your results along with an entry form.

Instructions on submitting a return disk with the analysis of the data will be included in section 5 of this chapter.

The mailing will also include an entry form that each entrant will need to complete and submit along with the results.

Research on energy savings in buildings can be divided in three major areas: building components, test houses in real climates and occupied buildings. Three competitions are planned along this line of which this will be the first one.

The present competition concerns cases on wall components with no solar radiation involved. Simulated data have been produced for all cases.

Five different cases are provided for estimation (see Chapter 2). The accuracy of estimations and predictions is one of the criteria for judging this competition. Another criterion will be the methodology which has been applied to solve the problems.

Three cases (Cases 1 to 3) have been designed in order to test identification methods. The purpose is to test the accuracy of the parameter estimates. Two more cases been designed for prediction exercises (Cases 4 and 5).

The competition will start on July 1, 1994 and will end on December 31, 1994. Entries received after that date cannot be considered (see section 1.6). The format for the entries, described in the following sections and in the entry form supplied on the data diskette must be followed exactly, or the entry will regretfully have to be rejected.

One can participate in the competition with any number of cases, however the results of every case will be evaluated only when all required output for that case has been submitted.

The results to be produced by the competitors are in the form of estimations or predictions. These results will be submitted to the organisers on the supplied output form and in the required output format on diskette. The organisers will evaluate them using the same methods for all submissions.

Following the close of the competition, the results will be analysed and published in a book. The organisers will not participate in the competition. Selected entries will be sent to a reviewing committee, chaired by Professor T. Söderström, University of Uppsala, Sweden. This committee will invite some ten participants to write formal papers, describing the applied methodology. The overall results will be presented in a book including a presentation by participants of selected papers on the applied methodology.

There are no monetary prizes in the competition (to prevent unnecessary disagreements).

Because this is an open scientific study, entries that provide results without describing the methods used are not acceptable. On the other hand we recognise that a great deal of labour might have been applied to develop commercially useful applications and full details of those need not be revealed. Sufficient information has to be supplied so that the results can in principle be independently verified. It is not necessary to submit practical implementation details or the computer code. However, we encourage sharing the software at the end of the competition. At a minimum, each participant should supply a flow chart of their methodology together with a one page description of the method.

If the outcome of this competition is promising for a follow up, two other competition have been planned on test houses and unoccupied buildings under real climate conditions (1996) and occupied buildings (1997). If interest warrants, it is planned that a computer server will operate after the close of the competition as a central repository of interesting data, analysis programs, and the results of other comparative studies.

1.3 DEFINITIONS

Although the nomenclature below, is common in some approaches and not in others, it will provide an understandable nomenclature for this competition.

For each case you are asked to estimate parameters or to predict the heat flow. Consider the following variables as illustrated in figure 1.

$q_i(t)$ is the density of the heat flow rate at the internal surface of the wall, positive from the internal to the external side of the wall, at time *t*, in W/m^2

$q_e(t)$ is the density of the heat flow rate at the external surface of the wall, positive from the internal to the external side of the wall, at time *t*, in W/m^2

$\theta_i(t)$ is the internal surface temperature at time *t*, in $°C$

$\theta_e(t)$ is the external surface temperature at time *t*, in $°C$

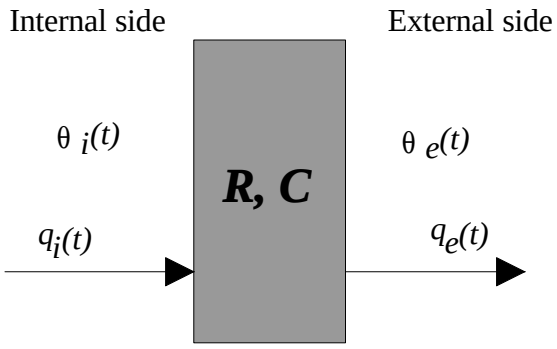

Figure 1.1 Notation for wall components

The data sets given for estimation consist of simulated measurements of the density of heat flow rate at the internal surface and the two temperature variables. The data sets given for the prediction cases consist of simulated measurements of the two temperature variables only.

For example, the one dimensional solution of the Fourier equation for a homogeneous single layer wall as given by

$$Q(s) = \frac{\sqrt{st}}{R\sinh\sqrt{st}}\cosh\sqrt{st}\,q_i(s) - \frac{\sqrt{st}}{R\sinh\sqrt{st}}\,q_e(s)$$

where $s = iw$, $i = \sqrt{-1}$ and w is the angle velocity has been used for simulation of the heat flow in case 1.

Definitions of the parameters R and C, may be found in chapter 2.1.

1.4 DATA SETS

The data sets provided on a high density diskette, are compressed DOS-readable ASCII text files. Each diskette is numbered and reference is made to the subscriber. In this chapter we describe the general features of the data sets. The order of the signals as they appear in columns in the data file are respectively T_e (external temperature), T_i (internal temperature) and q (heat flow density). In all cases the time interval of the data is one hour.

1.4.1 Test on the data series

When starting the analysis of the data sets it is advised to first check the data. For that purpose one file *DATASTAT.TXT* with statistical information for all the data series is given on the diskette too. For every signal in the data set the following statistical information is given :

Maximum, Mean, Minimum and Variance for each signal and Length for the data file

These statistical information is given in chapter 2.3. When submitting the predicted data series for cases 4 or 5, you should give the same statistical information on the output format sheet as has been provided.

1.5 SUBMITTALS

Completed entries (only a diskette with results plus completed entry form will be accepted) should be mailed to the address given below. The diskette (3.5" size of any density) must be in ASCII format readable by an MS-DOS machine. It is strongly advised to deliver a hardcopy of the output too. Hard copy alone or non-conforming entries cannot be accepted.

The minimum required submittal to the organisers consists of :

1. A general description sheet/file. A dummy can be found in section 1.8. Part of the entry form will include your name and address and describe the machine type, operating system and software used.
2. The result format sheet/file. A dummy can be found in section 1.9
3. Method description text sheet/file. To be made for every method applied!!!!
4. A hardcopy of a flow chart describing the method.
5. Graphical outputs for illustrative purposes are optional. At maximum one A4 sheet per case.

All output should be given to four significant digits.

The predicted data series for the cases 4 and 5, should be put as an additional column added to the right of the two columns in the supplied data files, respectively Data42.txt and Data52.txt. That is, for cases 4 and 5 submit data files that are three columns wide, the rightmost column being the heat flow prediction that corresponds to the temperature values in columns 1 and 2. Supply the data on diskette in ASCII format, readable for DOS machines.

1.6 DEADLINE AND EXTENSIONS

The competition ends at midnight on December 31, 1994; to be fair, we cannot accept entries after this time. We will allow two weeks after this deadline (until January 15th 1995) for only the following two exceptions:

- Because of computer difficulty you were unable to submit the data in time. Send the data before January 15th, along with an explanation of the difficulty. The organisers must be notified of your need to have this extension by December 31, 1994. You may use E-mail for that purpose.

- You just found out about the competition or just received the data. Submit your entry form before December 31st, along with an explanation why this extension is needed.

1.7 ACCESSING THE DATA

The competition does not require advanced registration; there are two ways to enter:

1. by normal mail. Simply request the data by sending in the participation form. The data are available on diskettes (3.5" size) in ASCII, IBM-PC format. (there is no charge for the data diskette). To receive the data, send the attached application form together with a self-addressed rigid envelope to :

Joint Research Centre
Institute of System Engineering and Informatics
J.J. BLOEM, Building 45
I - 21020 Ispra (VA), ITALY

2. by E-mail. In that case just send an request for participation by E-mail to J. Kreider at the University of Colorado, Boulder, CO 80309-0428, U.S. at the following E-mail address:

kreider@bechtel.colorado.edu
or
hans.bloem@jrc.it

Information how to obtain the necessary instructions and the required data series, using FTP, are forwarded to you by E-mail.

Instructions on submitting a return disk with the analysis of the cases will be included in a README file. The disk will also include an entry form that each participant will need to complete and submit along with the results.

1.8 DESCRIB.TXT

Format of general description sheet/file "DESCRIB.TXT"
Give general information about your name, etc. in a file with the following format (already provided on the diskette, or on FTP, named "DESCRIB.TXT").

Name:
University/Company:
Address:
City:
Country:
Telephone:
Fax:
E-mail:
Type of computer:
Operating system:
Applied software: (give here the name and origin of the program)
Case1 submitted results? (give yes or no)
Case1 method? (if yes, give some keywords on this line)
Case2 submitted results? (give yes or no)
Case2 method? (if yes, give some keywords on this line)
Case3 submitted results? (give yes or no)
Case3 method? (if yes, give some keywords on this line)
Case4 submitted results? (give yes or no)
Case4 method? (if yes, give some keywords on this line)
Case5 submitted results? (give yes or no)
Case5 method? (if yes, give some keywords on this line)
Additional comments ! (up to 20 lines will be read, including this one)

Example of the complete filled sheet "describ.txt". Do not use tab's (only space) and do not add lines. Our software will read this file as 21 lines with an additional text block for comments of at maximum 20 lines!

Name: Hans Bloem
University/Company: Joint Research Centre
Address: Building 45
City: I-21020 Ispra
Country: Italy
Telephone: +39.332.789842
Fax: +39.332.789992
E-mail: hans.bloem@jrc.it
Type of computer: PC 486 DX
Operating system: MS-DOS
Applied software: MATLAB, SIT
Case1 submitted results? yes
Case1 method? prediction error method
Case2 submitted results? yes
Case2 method? prediction error method
Case3 submitted results? no
Case3 method? (if yes, give some keywords on this line)
Case4 submitted results? no
Case4 method? (if yes, give some keywords on this line)
Case5 submitted results? yes
Case5 method? neural network
Additional comments ! (up to 20 lines will be read, including this one)
I don't have any comments

1.9 RESULT.TXT

Format of result sheet/file "RESULT.TXT"
Give your results in a file with the following format (already provided on the diskette, or on FTP, named "RESULT.TXT"). Use a 'space' as separator of the values and no tabs. Do not add lines. The file should exist of 46 lines, not more and not less. The program that will be used to read this file reads these 46 lines in the order given below. All output should be given to four significant digits.

Data11 (give R C and optional: sR sC, in this order)
Data12 (give data point of sensor failure)
Data201 (give R C sR sC, in this order)
Data202 etc.
Data203
Data204
Data205
Data206
Data207
Data208
Data209
Data210
Data211
Data212
Data213
Data214
Data215
Data216
Data217
Data218
Data219
Data220
Data301 (give H1 H2 H3 G1 G2 sH1 sH2 sH3 sG1 sG2 in this order)
Data302 etc.
Data303
Data304
Data305
Data306
Data307
Data308
Data309
Data310
Data311
Data312
Data313
Data314
Data315
Data316
Data317
Data318
Data319
Data320
Data41 (optional: give R C sR sC, in this order)
Data42 (give length maximum mean minimum variance)
Data51 (optional: give R C sR sC, in this order)
Data52 (give length maximum mean minimum variance)

As an example a partially filled "RESULT.TXT" file is given here.

Data11 11.11 112.3 0.1234 30.30
Data12 1501
Data201 11.11 112.3 0.1234 30.30
Data202 11.11 112.3 0.1234 30.30
Data203 11.11 112.3 0.1234 30.30
Data204 11.11 112.3 0.1234 30.30
Data205 11.11 112.3 0.1234 30.30
Data206 11.11 112.3 0.1234 30.30
Data207 etc.
Data208
Data209
Data210
Data211
Data212
Data213
Data214
Data215
Data216
Data217
Data218
Data219
Data220
Data301 54.54 54.54 54.54 100.89 100.89 1.234 1.234 1.234 20.56 20.56
Data302 54.54 54.54 54.54 100.89 100.89 1.234 1.234 1.234 20.56 20.56
Data303 54.54 54.54 54.54 100.89 100.89 1.234 1.234 1.234 20.56 20.56
Data304 54.54 54.54 54.54 100.89 100.89 1.234 1.234 1.234 20.56 20.56
Data305 54.54 54.54 54.54 100.89 100.89 1.234 1.234 1.234 20.56 20.56
Data306 54.54 54.54 54.54 100.89 100.89 1.234 1.234 1.234 20.56 20.56
Data307 etc.
Data308
Data309
Data310
Data311
Data312
Data313
Data314
Data315
Data316
Data317
Data318
Data319
Data320
Data41 11.11 112.3 0.1234 30.30
Data42 600 12.33 8.45 3.89 4.56
Data51 11.11 112.3 0.1234 30.30
Data52 600 12.33 8.45 3.89 4.56