Modification for the mechanical analysis

The name of the .TSH or .TEM files that describe the sections heated by the HASEMI fire is, for each section type, the name of ONE of the relevant .TSH or .TEM file. For example, "`b0017_2.tem`" or "`s0156_3.tsh`".

The information about the torsion properties (for .TEM files) or about the re-bar layers (for the .TSH files) has to be present only in this file, not in the other .TSH or .TEM files of the same section type that describe the temperature at the other points of integration.

As a consequence, all the beam elements of one section type have the same torsion stiffness.

Modification for the thermal analyses

- The command "`MAKE.TEM`" is replaced by the command "`MAKE.TEMHA`" if the temperatures are determined in beam sections, and the command "`MAKE.TSH`" is replaced by the command "`MAKE.TSHHA`" if the temperatures are determined in shell elements shell elements.
- After this command "`MAKE.TXXHA`, the complete name "*filename.in*" of the input file of the mechanical analysis is given (maximum 20 characters) on the next line.

  Note: the input file describing the mechanical analysis must be present when the thermal analysis is run. If the mechanical analysis is 2D, gravity must be pointing downward the Y axis (i.e. Y is vertical upward). If the mechanical analysis is 3D, gravity must be pointing downward the Z axis (i.e. Z is vertical upward).
- The command "`BEAM_TYPE`" ielemtype
  or the command "`SHELL_TYPE`" ielemtype
  is given on the next line, where "ielemtype" is the number in the mechanical input file of the section type (beam or shell) analysed in this thermal analysis.
- The command giving the name of the TEM file is omitted (SAFIR will create the files with the appropriate names such as "b001_1.tem", "b001_2.tem", "b002_1.tem", etc.
- Each surface of the section heated by the HASEMI fire must have a FLUX command and the text "`HASEMI`" where appropriate. For example:

  ```
  FLUX    NO    NO    HASEMI    NO
  ```
  ! Do not use "`HASEMI`" in a "`FRONTIER`" command. There is no need to add a frontier "`F20`" on the same surface (for reemitted energy); it will be automatically added by SAFIR. "`F20`" frontiers can be added on other surfaces, e.g. on the upper unheated side of a slab.

A file called "*hasemi.txt*" must be present in the folder as the other input files. This file describes the local Hasemi fire(s). It's format is:

SERIES 1: comments

Any number of lines, followed by a blank line.

SERIES 2: number of fires

"NFIRE", nfire

where "nfire" is the number of localised Hasemi fires.

The following series have to be written "nfire" times

SERIES 3: position of the fire(s)

"FIRE_POS", posx, posy, [posz]

where posx, posy and posz give the position of the Hasemi fire in the system of coordinates of the mechanical analysis.

SERIES 4: ceiling height

"HEIGHT", hc

where "hc" is the vertical distance from the fire source to the ceiling.

> Note: only this value will influence the severity of the fire on the structure. The vertical position of the fire given in Series 3 is in fact not used in the model

SERIES 5: diameter

"DIAMETER"
time(1), diameter(1)
time(2), diameter(2)
.
.
time(j), diameter(j)
"END_DIAM"

where "j" cannot be bigger than "IDIMTIMSTEP" (at the moment = 20)

SERIES 6: Rate of Heat Release

"RHR"
time(1), RHR(1)
time(2), RHR(2)
.
.
time(i), RHR(i)
"END_RHR"

where "i" cannot be bigger than "IDIMTIMSTEP" (at the moment = 20)

Example of such a file:

```
Description of the local fire by the Hasemi method.

     NFIRE    2           ! Number of localised fires

  FIRE_POS   0.   0.  0.5
    HEIGHT  2.5           ! Distance between the fire and the ceiling
  DIAMETER
             0.        0.  ! Time (s) - Fire source diameter (m)
           300.        3.
           600.        4.
  END_DIAM
       RHR
             0.        0.  ! Time (s) - Rate of heat release (W)
           600.   900000.
   END_RHR

  FIRE_POS  1.5   0.  0.5
    HEIGHT  2.5
  DIAMETER
             0.        0.
           100.        0.
           400.        3.
           600.        4.
  END_DIAM
       RHR
             0.        0.
           100.        0.
           500.   900000.
           600.   900000.
   END_RHR
```

New variables used

`diamhasemi(idimtimstep,2,nfire)`

diamhasemi(i,1,nf): time "`i`" where the diameter is defined for the fire "`nf`"

diamhasemi(i,2,nf): diameter at this time "`i`" for the fire "`nf`"

`hceiling(nfire)`

Distances between the fire source and the ceiling in the Hasemi fire(s)

`ieh`

Index for the loop on the "`ielemhas`" F.E.

`ielemhas`

Number of elements that have the type "`ielemtype"`

`ielemtype`

The number in the mechanical input file of the section type (beam or shell) where the temperatures will be calculated.

`ingb`

Index for the loop on the number of Gauss points

`inumelemhas(nbeammec)`

Vector giving the numbers of the elements (from 1 to ielemhas) that have the type `"ielemtype"`

`lfirsthasemi`

Is TRUE if the temperatures have not yet been calculated in the first Hasemi section

`lhasemi`

Is TRUE if a mechanical calculation is performed under Hasemi fires(s), i.e. if "STATIC_H" or "DYNAMIC_H" have been declared.

`lmatemhasemi`

Is TRUE if a thermal analysis is made in beam sections subjected to Hasemi fire(s).

`lmaketshhasemi`

Is TRUE if a thermal analysis is made in shell thickness subjected to Hasemi fire(s).

`nbeammec`

The number of beam finite elements in the mechanical analysis

`ndimmec`

The number of dimensions in the mechanical analysis

`nfire`

`The` number `of Hasemi fire(s)`

`ngaussbeammec`

The number of gaussian points in the beams of the mechanical analysis

`ngshellthickmec`

The number of gaussian points on the thickness of the shell F.E. in the mechanical analysis

`nnodemec`

The number of nodes in the mechanical analysis

`nodesofFEmec(4,nFEmec)`

Nodes of the relevant F.E. (beam or shell) in the mechanical analysis

`nshellmec`

The number of shell finite elements in the mechanical analysis

`rcoordgausshas(ielemhas,ngaussbeammec,ndimmec)`

rccordgausshas(ih,ng,ndi) is the "nd^{ith}" coordinate, in the mechanical analysis, of the "ng^{th}" point of Gauss in the F.E. that has the Hasemi number "`ih`".

`rcoordgmec(ndimmec,nnodemec)`

Coordinates of the nodes in the mechanical analysis

`rfirepos(nfire,ndimmec)`

Positions of the Hasemi fire(s) in the mechanical analysis

`rhasemiactu(nfire)`

Horizontal distance in the system of coordinates of the mechanical analysis between the Gauss point where the temperatures are calculated and the fire "`nf`".

`rhrhasemi(idimtimestep,2,nfire)`

rhrhasemi(i,1,nf): time "`i`" where the RHR is defined for the fire "`nf`"

rhrhasemi(i,2,nf): RHR at this time "`i`" for the fire "`nf`"