UsingView3D.doc

Using the View3D Program **– Draft! For review only**
George N. Walton
Building Environment Division
National Institute of Standards and Technology
Gaithersburg, MD 20899-8633
gwalton@nist.gov
December 2002

View3D is a computer program for calculating view factors between simple polygons. It has been developed more to test view factor calculations than as a user-friendly production tool. The methods it uses and its performance are described in NISTIR-6925. This note briefly describes how to use View3D and several auxiliary programs.

Program	Function
View3D.exe	compute view factors from surface geometry data
ViewGr.exe	graphic display the surface geometry
ViewEm.exe	convert "black" view factors to "gray" view factors
ViewHT.exe	compute radiant fluxes for a set of view factors and temperatures
VS3fix.exe	fix non-planar surfaces
VFbintxt.exe	convert binary view factor file to text

All of these programs operate from an MS-DOS window within the MS Windows operating system. It is assumed that the user is familiar with the use of directories in this mode so that programs are properly available for execution.

View3D is an MS Windows console application. It uses a command line interface to define the input and output files.

> View3D VS3file VFfile

The VS3file (3D Vertex & Surface data file) describes the geometry of the surfaces and controls the calculation of the view factors and the format of the output file. The format of the VS3file is described in VS3file.doc. The VFfile (View Factor file) includes the computed view factors, surfaces areas and emisivities, and some control data. The formats, text and binary, are described in VFfile.doc. The calculation process is summarized in View3D.log text file.

ViewGr is an MS DOS program to display the VSfile geometry. This display can be critical in confirming the correctness or finding errors in a manually generated geometric description.

> ViewGr VS3file

The interactive display allows the user to select the coordinates of a viewpoint and the speed at which the surfaces are displayed. The surfaces are projected onto a plane perpendicular to the line from the viewpoint to the origin. When a surface is displayed as black it is facing away from the viewer. The lighter the surface the more it is facing toward the viewer.

ViewGr requires that the ViewGr.hlp file be in the same directory as ViewGr.exe and DOS4GW.exe be in the current working directory or a directory included in the DOS Path command. There may be some versions of Windows where this program does not work.

ViewHT is an MS Windows console application that uses a set of view factors and a set of surface temperatures to compute the net radiant flux at each surface. It uses a command line interface to define the two input files and output file.

    ViewHT VFfile TKfile OutputFile

Each line of the TKfile consists of a first surface number, a last surface number, and an absolute temperature [K]. The temperature is applied to all surface between the first and the last, inclusive. Zeroes for the surface numbers indicate the last line of the input file.

Sample TKfile:
```
 1  8  293.15    ! set surfaces 1 through 8 to 293.15K (20C)
 3  3  283.15    ! reset surface 3 to 283.15K (10C)
 0  0  0         ! zeroes indicate end of data
```

Sample output file:
```
Srf #     area    emit    T [K]    q [W/m^2]      Q [W]
    1    9.000   0.900   293.15  -1.706e+001  -1.5350e+002
    2    3.000   0.900   293.15  -1.483e+001  -4.4483e+001
    3    6.000   0.900   283.15   4.748e+001   2.8488e+002
    4    6.000   0.900   293.15  -3.343e-001  -2.0060e+000
    5    3.000   0.900   293.15  -4.038e-001  -1.2114e+000
    6    9.000   0.900   293.15  -1.769e+000  -1.5920e+001
    7    5.000   0.900   293.15  -6.776e+000  -3.3878e+001
    8    5.000   0.900   293.15  -6.776e+000  -3.3878e+001
                                              =========
                                   balance:   1.562e-005
```

ViewEm is an MS Windows console application that uses a set of "black" view factors and a set of surface emissivities to compute a set of "gray" view factors. Ref: Hottel, H.C. and A.F. Sarofim. 1967. *Radiative Transfer*, McGraw-Hill, New York NY, pp 93-102.

    ViewHT VFfile(in) Emfile VFfile(out)

The view factor output file will have the same format, text or binary, as the view factor input file. Binary files are about half as long and slightly more precise, but they can only be read by the programs.

Each line of the Emfile consists of a first surface number, a last surface number, and an emittance [0.01 <= ε <= 0.99]. The emittance is applied to all surface between the first and the last, inclusive. Zeroes for the surface numbers indicate the last line of the input file.

Sample Emfile:
```
 1  8  0.9      ! set surfaces 1 through 8 to 0.9
 3  3  0.8      ! reset surface 3 to 0.8
 0  0  0        ! zeroes indicate end of data
```

VS3fix is an MS Windows console application that converts non-planar quadrilaterals into two or four triangles. The algorithms in View3D assume simple, flat polygons. The four vertices that define a quadrilateral should lie in a plane. Those in the VS3file may not because of rounding or human error. View3D and ViewGr check if surfaces defined by four vertices are sufficiently flat signaling an error if they are not. The ViewGr graphic display can be used to find the human errors – misidentified vertex numbers or bad coordinates. VS3fix can be used to fix the surfaces where the vertices have not been defined to sufficient accuracy.

        VS3fix VS3file(in) N VS3file(out)

N is the number of triangles generated from that each bad quadrilateral, 2 or 4. A revised VS3file is created where the non-planar quadrilaterals have been divided into triangles. The view factors of the subdivided surfaces will be recombined during post-processing in View3D.

VFbintxt is an MS Windows console application that converts a binary VFfile to text format. This was developed primarily to verify that the binary files were correct, but it can also be useful to produce a text file that can be read by any program.

        VFbintxt VFfile(bin) VFfile(txt)