Supplementary Information

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%%The script is estructured in 06 modules:
%%MODULE 01: GENERAL DATA FOR THE URBAN CANYON
%%MODULE 02: PHYSICAL PROPERTIES
%%MODULE 03: DATA FOR THE CALCULATION FACADE. After this module a graph is
%%produced to see the energy distribution with data from this module.
%%MODULE 04: DATA FOR THE OPPOSITE FACADE. After this module a graph is
%%produced to see the energy distribution with data from Modules 03+04
%%(cumulative)
%%MODULE 05. GROUND PLANE. After this module a graph is
%%produced to see the energy distribution with data from Modules 03+04+05
%%(cumulative)
%%MODULE 06: "FALSE ROOFTOP' OF THE STREET. After this module a graph is
%%produced to see the energy distribution with data from Modules
%%03+04+05+06 (cumulative), which gives the final result.


%%MODULE 01: GENERAL DATA FOR THE URBAN CANYON
%%General data for the selected case-study should be input first. X,Y and Z
%%dimension are identified for the sake of clarity when performing
%%calculations. T variable should be input between ' signs, as Matlab
%%recognizes is as text. For example 'case study 01'
T=input('PERIOD OF STUDY? (Write a title for the  graph)-->');
A=input('Y DIMENSION: HEIGHT OF THE CALCULATION FACADE OF THE CANYON (m)-->');
B=input('X DIMENSION -> LENGHT OF THE CANYON (m)-->');
C=input('Z DIMENSION -> WIDTH OF THE CANYON (m)-->');
R1=0;
%%MODULE 02: PHYSICAL PROPERTIES
%%Mean reflectance values should be input for each of the surfaces. If
%%there are surfaces with different reflectance values, a mean value should
%%be input, taking into account the relative weight of each material (for
%%example, glass windows in fa?ades or green surfaces in the street
%%pavement
R2=input('MEAN REFLECTANCE VALUE OF THE STREET PAVEMENT (adimensional)-->');
R3=input('MEAN REFLECTANCE VALUE OF THE OPPOSITE FACADE (adimensional)--> ');
R4=0;
R5=0;
R6=0;
%%MODULE 03: DATA FOR THE CALCULATION FACADE.
%% In this module data regarding the calculation facade will be introduced.
%%First, value for direct solar radiation hitting on the calculation facade
%%should be input at this point.
V1=input('IF THE FACADE WHERE YOUR ARE DOING THE CALCULATION RECEIVES DIRECT
SOLAR RADIATION, PLEASE INPUT ITS VALUE HERE (Wh/m2)-->');
V2=0;
V3=0;
V4=0;
V5=0;
V6=0;
%%d variable is inserted as equal to a very small quantity. If zero
%%value were introduced, the calculations would fail, as it is not possible
%%to perform some operations with zero (such as divisions).
d=0.000001;
B1=B/2;
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a=B;
e111=input('INPUT THE VERTICAL DIMENSION OF THE AREA THAT RECEIVES DIRECT SOLAR
RADIATION IN THE CALCULATION FACADE (m)');
%%After introducing this variable, the script will automatically understand
%%that the area hit by direct solar radiation should be placed in the upper
%%part of the facade. If the weather scenario is cloudy, this value should
%equal zero, that is 'd'.
C1=A-(e111/2);
M=[atan(A/B),atan(B/A),atan(B/C),atan(A/C),atan(A/sqrt(B^2+C^2)),atan(B/sqrt(A^2+C^2)),
atan(C/sqrt(A^2+B^2)),atan(C/A)];
P=0.5*(M-0.5*tan(M).*log(sin(M))+(0.5./tan(M)).*log(cos(M)));
F=2/(A*pi)*(A*P(1,2)+C*P(1,3)-sqrt(A^2+C^2)*P(1,6));
F1=2/(B*pi)*(B*P(1,1)+C*P(1,4)-sqrt(B^2+C^2)*P(1,5));
F2=4/pi*((1/A)*(sqrt(A^2+C^2)*P(1,6)-C*P(1,3))+(1/B)*(sqrt(B^2+C^2)*P(1,5)-C*P(1,4)));
F3=4/pi*((1/B)*(sqrt(B^2+A^2)*P(1,7)-A*P(1,8))+(1/C)*(sqrt(C^2+A^2)*P(1,6)-A*P(1,2)));
G=[F,F1,F2,F3]
A1=A*B;
A2=B*C;
A5=A*C;
K3=A1/A2;K4=A1/A5;K5=A2/A5;
K1=(1-2*F-F2)/2;
K2=(1-K3*2*F-F3)/2;
M1=[0,F,F,F2,K1,K1;
F*K3,0,F3,F*K3,K2,K2;
F*K3,F3,0,F*K3,K2,K2;
F2,F,F,0,K1,K1;
K4*K1,K5*K2,K5*K2,K4*K1,0,(1-2*K4*K1-2*K5*K2);
K4*K1,K5*K2,K5*K2,K4*K1,(1-2*K4*K1-2*K5*K2),0];
R=[R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6
;R1,R2,R3,R4,R5,R6];
Ed=[V1;V1*M1(2,1)+V2;V1*M1(3,1)+V3;V1*M1(4,1)+V4;V1*M1(5,1)+V5;V1*M1(6,1)+V6]
Q=[1,0,0,0,0,0;0,1,0,0,0,0;0,0,1,0,0,0;0,0,0,1,0,0;0,0,0,0,1,0;0,0,0,0,0,1];
FED=M1.*R;FER=(-1)*FED+Q; Er=inv(FER)*FED*Ed;
V=Ed(1,1)-Er(1,1);S=(V4+Er(4,1))*a*e111/A1;
x=-B1:0.1:B-B1;
y=-C1:0.1:A-C1;[X,Y]=meshgrid(x,y);


l1=(X+a/2)./sqrt((X+a/2).^2+d^2);l2=(X-a/2)./sqrt((X-a/2).^2+d^2);
l3=(Y+e111/2)./sqrt((Y+e111/2).^2+d^2);l4=(Y-e111/2)./sqrt((Y-e111/2).^2+d^2);
k1=atan((Y+e111/2)./sqrt((X+a/2).^2+d^2))-atan((Y-e111/2)./sqrt((X+a/2).^2+d^2));
k2=atan((Y-e111/2)./sqrt((X-a/2).^2+d^2))-atan((Y+e111/2)./sqrt((X-a/2).^2+d^2));
k3=atan((X+a/2)./sqrt((Y+e111/2).^2+d^2))-atan((X-a/2)./sqrt((Y+e111/2).^2+d^2));
k4=atan((X-a/2)./sqrt((Y-e111/2).^2+d^2))-atan((X+a/2)./sqrt((Y-e111/2).^2+d^2));
PE=V/(2*pi)*(l1.*k1+l2.*k2+l3.*k3+l4.*k4)+S;
j=mean(PE);j1=mean(j);f=max(PE);f1=max(f);g=min(PE);g1=min(g);r=[j1,f1,g1];

FAC0=PE;
q=mean(FAC0);q1=mean(q);w=max(FAC0);w1=max(w);e=min(FAC0);e1=min(e);u=[q1,w1,e1];
surf(X,Y,FAC0);shading interp;view(0,90);
title([T,' MEDIA=',num2str(q1),' MAX=',num2str(w1),' MIN=',num2str(e1),' (Wh/m2)' ]); xlabel('X
METROS'); ylabel('Y METROS');
colorbar;colormap(jet);
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%%MODULE 04: DATA FOR THE OPPOSITE FACADE. Data regarding solar
%%radiation and dimensions of the areas hit by direct solar radiation
%%should be input.

V1=input('IF THE OPPOSITE FACADE RECEIVES DIRECT SOLAR RADIATION, PLEASE INPUT ITS
VALUE HERE (Wh/m2)-->');
V2=0;
V3=0;
V4=0;
V5=0;
V6=0;
d=C;
B1=B/2;
C2=input('INPUT THE HEIGHT OF THE OPPOSITE FA?ADE (m)');
%% At this point the script will interpret that the opposite facade has a different height as the calculation
facade.
a=B;
e=input('INPUT THE VERTICAL DIMENSION OF THE AREA THAT RECEIVES DIRECT SOLAR
RADIATION IN THE OPPOSITE FACADE (m)-->');
%%As in module 03, the script will interpreter that this area is located in
%%the upper part of the facade.
C1=C2-(e/2);
M=[atan(A/B),atan(B/A),atan(B/C),atan(A/C),atan(A/sqrt(B^2+C^2)),atan(B/sqrt(A^2+C^2)),
atan(C/sqrt(A^2+B^2)),atan(C/A)];
P=0.5*(M-0.5*tan(M).*log(sin(M))+(0.5./tan(M)).*log(cos(M)));
F=2/(A*pi)*(A*P(1,2)+C*P(1,3)-sqrt(A^2+C^2)*P(1,6));
F1=2/(B*pi)*(B*P(1,1)+C*P(1,4)-sqrt(B^2+C^2)*P(1,5));
F2=4/pi*((1/A)*(sqrt(A^2+C^2)*P(1,6)-C*P(1,3))+(1/B)*(sqrt(B^2+C^2)*P(1,5)-C*P(1,4)));
F3=4/pi*((1/B)*(sqrt(B^2+A^2)*P(1,7)-A*P(1,8))+(1/C)*(sqrt(C^2+A^2)*P(1,6)-A*P(1,2)));
G=[F,F1,F2,F3]
A1=A*B;
A2=B*C;
A5=A*C;
K3=A1/A2;K4=A1/A5;K5=A2/A5;
K1=(1-2*F-F2)/2;
K2=(1-K3*2*F-F3)/2;
M1=[0,F,F,F2,K1,K1;
F*K3,0,F3,F*K3,K2,K2;
F*K3,F3,0,F*K3,K2,K2;
F2,F,F,0,K1,K1;
K4*K1,K5*K2,K5*K2,K4*K1,0,(1-2*K4*K1-2*K5*K2);
K4*K1,K5*K2,K5*K2,K4*K1,(1-2*K4*K1-2*K5*K2),0];
R=[R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6
;R1,R2,R3,R4,R5,R6];
Ed=[V1;V1*M1(2,1)+V2;V1*M1(3,1)+V3;V1*M1(4,1)+V4;V1*M1(5,1)+V5;V1*M1(6,1)+V6]
Q=[1,0,0,0,0,0;0,1,0,0,0,0;0,0,1,0,0,0;0,0,0,1,0,0;0,0,0,0,1,0;0,0,0,0,0,1];
FED=M1.*R;FER=(-1)*FED+Q; Er=inv(FER)*FED*Ed;
V=Ed(1,1)-Er(1,1);S=(V4+Er(4,1))*a*e/A1;
x=-B1:0.1:B-B1;
y=-C1:0.1:A-C1;[X,Y]=meshgrid(x,y);

l1=(X+a/2)./sqrt((X+a/2).^2+d^2);l2=(X-a/2)./sqrt((X-a/2).^2+d^2);
l3=(Y+e/2)./sqrt((Y+e/2).^2+d^2);l4=(Y-e/2)./sqrt((Y-e/2).^2+d^2);
k1=atan((Y+e/2)./sqrt((X+a/2).^2+d^2))-atan((Y-e/2)./sqrt((X+a/2).^2+d^2));
k2=atan((Y-e/2)./sqrt((X-a/2).^2+d^2))-atan((Y+e/2)./sqrt((X-a/2).^2+d^2));
k3=atan((X+a/2)./sqrt((Y+e/2).^2+d^2))-atan((X-a/2)./sqrt((Y+e/2).^2+d^2));
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k4=atan((X-a/2)./sqrt((Y-e/2).^2+d^2))-atan((X+a/2)./sqrt((Y-e/2).^2+d^2));
PE=V/(2*pi)*(l1.*k1+l2.*k2+l3.*k3+l4.*k4)+S;
j=mean(PE);j1=mean(j);f=max(PE);f1=max(f);g=min(PE);g1=min(g);r=[j1,f1,g1];

FAC1=R3*PE;
TOTAL1=FAC0+FAC1
q=mean(TOTAL1);q1=mean(q);w=max(TOTAL1);w1=max(w);e=min(TOTAL1);e1=min(e);u=[q1,w1,e1];
surf(X,Y,TOTAL1);shading interp;view(0,90);
title([T,' MEDIA=',num2str(q1),' MAX=',num2str(w1),' MIN=',num2str(e1),' (Wh/m2)' ]); xlabel('X
METROS'); ylabel('Y METROS');
colorbar;colormap(jet);

%%DATA FOR THE OPPOSITE FACADE. AREA NOT HIT BY DIRECT RADIATION.

V1=input('INPUT THE VALUE OF SOLAR RADIATION IN THE OPPOSITE FACADE FOR THE AREA
THAT IS NOT BEING HIT BY DIRECT SOLAR RADIATION. IF THIS VALUE IS ZERO, INPUT d
(Wh/m2)-->');
%%The script will interpret that this area receives diffuse radiation,
%%and that it is located in the lower part of the opposite facade.
C3=C2-e111;
e222=C2-(C3/2);
C2=C3;
a=B;
M=[atan(A/B),atan(B/A),atan(B/C),atan(A/C),atan(A/sqrt(B^2+C^2)),atan(B/sqrt(A^2+C^2)),
atan(C/sqrt(A^2+B^2)),atan(C/A)];
P=0.5*(M-0.5*tan(M).*log(sin(M))+(0.5./tan(M)).*log(cos(M)));
F=2/(A*pi)*(A*P(1,2)+C*P(1,3)-sqrt(A^2+C^2)*P(1,6));
F1=2/(B*pi)*(B*P(1,1)+C*P(1,4)-sqrt(B^2+C^2)*P(1,5));
F2=4/pi*((1/A)*(sqrt(A^2+C^2)*P(1,6)-C*P(1,3))+(1/B)*(sqrt(B^2+C^2)*P(1,5)-C*P(1,4)));
F3=4/pi*((1/B)*(sqrt(B^2+A^2)*P(1,7)-A*P(1,8))+(1/C)*(sqrt(C^2+A^2)*P(1,6)-A*P(1,2)));
G=[F,F1,F2,F3]
A1=A*B;
A2=B*C;
A5=A*C;
K3=A1/A2;K4=A1/A5;K5=A2/A5;
K1=(1-2*F-F2)/2;
K2=(1-K3*2*F-F3)/2;
M1=[0,F,F,F2,K1,K1;
F*K3,0,F3,F*K3,K2,K2;
F*K3,F3,0,F*K3,K2,K2;
F2,F,F,0,K1,K1;
K4*K1,K5*K2,K5*K2,K4*K1,0,(1-2*K4*K1-2*K5*K2);
K4*K1,K5*K2,K5*K2,K4*K1,(1-2*K4*K1-2*K5*K2),0];
R=[R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6
;R1,R2,R3,R4,R5,R6];
Ed=[V1;V1*M1(2,1)+V2;V1*M1(3,1)+V3;V1*M1(4,1)+V4;V1*M1(5,1)+V5;V1*M1(6,1)+V6]
Q=[1,0,0,0,0,0;0,1,0,0,0,0;0,0,1,0,0,0;0,0,0,1,0,0;0,0,0,0,1,0;0,0,0,0,0,1];
FED=M1.*R;FER=(-1)*FED+Q; Er=inv(FER)*FED*Ed;
V=Ed(1,1)-Er(1,1);S=(V4+Er(4,1))*a*e222/A1;
x=-B1:0.1:B-B1;
y=-C1:0.1:A-C1;[X,Y]=meshgrid(x,y);



l1=(X+a/2)./sqrt((X+a/2).^2+d^2);l2=(X-a/2)./sqrt((X-a/2).^2+d^2);
l3=(Y+e222/2)./sqrt((Y+e222/2).^2+d^2);l4=(Y-e222/2)./sqrt((Y-e222/2).^2+d^2);
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k1=atan((Y+e222/2)./sqrt((X+a/2).^2+d^2))-atan((Y-e222/2)./sqrt((X+a/2).^2+d^2));
k2=atan((Y-e222/2)./sqrt((X-a/2).^2+d^2))-atan((Y+e222/2)./sqrt((X-a/2).^2+d^2));
k3=atan((X+a/2)./sqrt((Y+e222/2).^2+d^2))-atan((X-a/2)./sqrt((Y+e222/2).^2+d^2));
k4=atan((X-a/2)./sqrt((Y-e222/2).^2+d^2))-atan((X+a/2)./sqrt((Y-e222/2).^2+d^2));
PE=V/(2*pi)*(l1.*k1+l2.*k2+l3.*k3+l4.*k4)+S;
j=mean(PE);j1=mean(j);f=max(PE);f1=max(f);g=min(PE);g1=min(g);r=[j1,f1,g1];

FAC2=R3*PE;
TOTAL2=TOTAL1+FAC2;
q=mean(TOTAL2);q1=mean(q);w=max(TOTAL2);w1=max(w);e=min(TOTAL2);e1=min(e);u=[q1,w1,e1];
surf(X,Y,TOTAL2);shading interp;view(0,90);
title([T,' MEDIA=',num2str(q1),' MAX=',num2str(w1),' MIN=',num2str(e1),' (Wh/m2)' ]); xlabel('X
METERS'); ylabel('Y METERS');
colorbar;colormap(jet);

%%MODULE 05. GROUND PLANE
%%GROUND PLANE. AREA THAT BORDERS ON THE CALCULATION FACADE
%%As the street can also be divided into an area hit by direct solar
%%radiation, and other only affected by diffuse radiation, first the user
%%should input values for the area that borders on the calculation facade,
%%whether it receives direct or diffuse radiation.

XX=A;
YY=B;
ZZ=C;
A=XX;
B=YY;
C=XX;
%%Part of the street pavement which is located birdering on the calculation
%%facade.
V1=input('INPUT THE VALUE OF SOLAR RADIATION IN THE PART OF THE GROUND PLANE
THAT BORDERS THE CALCULATION FACADE (Wh/m2)-->');
V2=0;
V3=0;
V4=0;
V5=0;
V6=0;
B1=B/2;
a=B;
f=0;
g=input('INPUT THE WITDH OF THIS AREA (Z DIMENSION)(m)-->');
%% In accordance with the coordinate system established at the beginning of the script, dimensions in the
witdh of the street corresponds to Z dimension.
x=-B1:0.1:B-B1;
y=0:0.1:C;[X,Y]=meshgrid(x,y);
M=[atan(A/B),atan(B/A),atan(B/C),atan(A/C),atan(A/sqrt(B^2+C^2)),atan(B/sqrt(A^2+C^2)),
atan(C/sqrt(A^2+B^2)),atan(C/A)];
P=0.5*(M-0.5*tan(M).*log(sin(M))+(0.5./tan(M)).*log(cos(M)));
F=2/(A*pi)*(A*P(1,2)+C*P(1,3)-sqrt(A^2+C^2)*P(1,6));
F1=2/(B*pi)*(B*P(1,1)+C*P(1,4)-sqrt(B^2+C^2)*P(1,5));
F2=4/pi*((1/A)*(sqrt(A^2+C^2)*P(1,6)-C*P(1,3))+(1/B)*(sqrt(B^2+C^2)*P(1,5)-C*P(1,4)));
F3=4/pi*((1/B)*(sqrt(B^2+A^2)*P(1,7)-A*P(1,8))+(1/C)*(sqrt(C^2+A^2)*P(1,6)-A*P(1,2)));
G=[F,F1,F2,F3]
A1=A*B;
A2=B*C;
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A5=A*C;
K3=A1/A2;K4=A1/A5;K5=A2/A5;
K1=(1-2*F-F2)/2;
K2=(1-K3*2*F-F3)/2;
M1=[0,F,F,F2,K1,K1;
F*K3,0,F3,F*K3,K2,K2;
F*K3,F3,0,F*K3,K2,K2;
F2,F,F,0,K1,K1;
K4*K1,K5*K2,K5*K2,K4*K1,0,(1-2*K4*K1-2*K5*K2);
K4*K1,K5*K2,K5*K2,K4*K1,(1-2*K4*K1-2*K5*K2),0];
R=[R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6
;R1,R2,R3,R4,R5,R6];
Ed=[V1;V1*M1(2,1)+V2;V1*M1(3,1)+V3;V1*M1(4,1)+V4;V1*M1(5,1)+V5;V1*M1(6,1)+V6]
Q=[1,0,0,0,0,0;0,1,0,0,0,0;0,0,1,0,0,0;0,0,0,1,0,0;0,0,0,0,1,0;0,0,0,0,0,1];
FED=M1.*R;FER=(-1)*FED+Q; Er=inv(FER)*FED*Ed;
V=Ed(1,1)-Er(1,1);S=(V2+Er(2,1))*a*g/A1;
s1=Y./sqrt(f^2+Y.^2);
s2=Y./sqrt((f+g)^2+Y.^2);
r=atan((X+a/2)./sqrt(f^2+Y.^2));
r1=atan((X-a/2)./sqrt(f^2+Y.^2));
v=atan((X+a/2)./sqrt((f+g)^2+Y.^2));
v1=atan((X-a/2)./sqrt((f+g)^2+Y.^2));
t=r-r1;
u=v-v1;
Z=R2*(V/(2*pi)*(s1.*t-s2.*u)+S);
TOTAL3=TOTAL2+Z;
q=mean(TOTAL3);q1=mean(q);w=max(TOTAL3);w1=max(TOTAL3);e=min(TOTAL3);e1=min(e);u=[q1,w
1,e1];
surf(X,Y,TOTAL3);shading interp;view(0,90);
title([T,' MEDIA=',num2str(q1),' MAX=',num2str(w1),' MIN=',num2str(e1),' (Wh/m2) ' ]); xlabel('X
METERS'); ylabel('Y METERS');
colorbar;colormap(jet);

%%PART OF THE STREET PAVEMENT THAT DOES NOT BORDER ON THE CALCULATION
PLANE
%% The same procedures as for the area that borders the calculation plane is followed.
XX=A;
YY=B;
ZZ=C;
A=XX;
B=YY;
C=XX;
V1=input('INPUT VALUE FOR RADIATION IN THE PART OF THE GROUND PLANE THAT DOES
NOT BORDER ON THE CALCULATION PLANE (Wh/m2) -->');
%%This value is sufficient to perform calculation for the street pavement,
%%as its witdh is deducted from the values that were introduced in the
%%previous step.
V2=0;
V3=0;
V4=0;
V5=0;
V6=0;
B1=B/2;
a=B;
g111=g;
f=g111;
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g=C-g111;
x=-B1:0.1:B-B1;
y=0:0.1:C;[X,Y]=meshgrid(x,y);
M=[atan(A/B),atan(B/A),atan(B/C),atan(A/C),atan(A/sqrt(B^2+C^2)),atan(B/sqrt(A^2+C^2)),
atan(C/sqrt(A^2+B^2)),atan(C/A)];
P=0.5*(M-0.5*tan(M).*log(sin(M))+(0.5./tan(M)).*log(cos(M)));
F=2/(A*pi)*(A*P(1,2)+C*P(1,3)-sqrt(A^2+C^2)*P(1,6));
F1=2/(B*pi)*(B*P(1,1)+C*P(1,4)-sqrt(B^2+C^2)*P(1,5));
F2=4/pi*((1/A)*(sqrt(A^2+C^2)*P(1,6)-C*P(1,3))+(1/B)*(sqrt(B^2+C^2)*P(1,5)-C*P(1,4)));
F3=4/pi*((1/B)*(sqrt(B^2+A^2)*P(1,7)-A*P(1,8))+(1/C)*(sqrt(C^2+A^2)*P(1,6)-A*P(1,2)));
G=[F,F1,F2,F3]
A1=A*B;
A2=B*C;
A5=A*C;
K3=A1/A2;K4=A1/A5;K5=A2/A5;
K1=(1-2*F-F2)/2;
K2=(1-K3*2*F-F3)/2;
M1=[0,F,F,F2,K1,K1;
F*K3,0,F3,F*K3,K2,K2;
F*K3,F3,0,F*K3,K2,K2;
F2,F,F,0,K1,K1;
K4*K1,K5*K2,K5*K2,K4*K1,0,(1-2*K4*K1-2*K5*K2);
K4*K1,K5*K2,K5*K2,K4*K1,(1-2*K4*K1-2*K5*K2),0];
R=[R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6
;R1,R2,R3,R4,R5,R6];
Ed=[V1;V1*M1(2,1)+V2;V1*M1(3,1)+V3;V1*M1(4,1)+V4;V1*M1(5,1)+V5;V1*M1(6,1)+V6]
Q=[1,0,0,0,0,0;0,1,0,0,0,0;0,0,1,0,0,0;0,0,0,1,0,0;0,0,0,0,1,0;0,0,0,0,0,1];
FED=M1.*R;FER=(-1)*FED+Q; Er=inv(FER)*FED*Ed;
V=Ed(1,1)-Er(1,1);S=(V2+Er(2,1))*a*g/A1;
s1=Y./sqrt(f^2+Y.^2);
s2=Y./sqrt((f+g)^2+Y.^2);
r=atan((X+a/2)./sqrt(f^2+Y.^2));
r1=atan((X-a/2)./sqrt(f^2+Y.^2));
v=atan((X+a/2)./sqrt((f+g)^2+Y.^2));
v1=atan((X-a/2)./sqrt((f+g)^2+Y.^2));
t=r-r1;
u=v-v1;
Z2=R2*(V/(2*pi)*(s1.*t-s2.*u)+S);
TOTAL4=TOTAL3+Z2;
q=mean(TOTAL4);q1=mean(q);w=max(TOTAL4);w1=max(TOTAL4);e=min(TOTAL4);e1=min(e);u=[
q1,w1,e1];
surf(X,Y,TOTAL4);shading interp;view(0,90);
title([T,' MEDIA=',num2str(q1),' MAX=',num2str(w1),' MIN=',num2str(e1),' (Wh/m2)' ]); xlabel('X
METERS'); ylabel('Y METERS');
colorbar;colormap(jet);

%%MODULE  06: "FALSE ROOFTOP' OF THE STREET.
%%This denomination is employed to name the false surface, with
%%reflectance=0 that limits the canyon on its upper side.

XX=A;
YY=B;
ZZ=C;
A=XX;
B=YY;
C=XX;
```

```
V1=input('INPUT VALUE FOR DIFFUSE HORIZONTAL RADIATION IN OPEN FIELD (Wh/m2) -->');
%%As direct radiation has already been considered in the precceeding
%%calculations, in this step only the value for diffuse horizontal
%%radiation is neccesary.
V2=0;
V3=0;
V4=0;
V5=0;
V6=0;
B1=B/2;
a=B;
f=0;
g=d;
x=-B1:0.1:B-B1;
y=0:0.1:C;[X,Y]=meshgrid(x,y);
M=[atan(A/B),atan(B/A),atan(B/C),atan(A/C),atan(A/sqrt(B^2+C^2)),atan(B/sqrt(A^2+C^2)),
atan(C/sqrt(A^2+B^2)),atan(C/A)];
P=0.5*(M-0.5*tan(M).*log(sin(M))+(0.5./tan(M)).*log(cos(M)));
F=2/(A*pi)*(A*P(1,2)+C*P(1,3)-sqrt(A^2+C^2)*P(1,6));
F1=2/(B*pi)*(B*P(1,1)+C*P(1,4)-sqrt(B^2+C^2)*P(1,5));
F2=4/pi*((1/A)*(sqrt(A^2+C^2)*P(1,6)-C*P(1,3))+(1/B)*(sqrt(B^2+C^2)*P(1,5)-C*P(1,4)));
F3=4/pi*((1/B)*(sqrt(B^2+A^2)*P(1,7)-A*P(1,8))+(1/C)*(sqrt(C^2+A^2)*P(1,6)-A*P(1,2)));
G=[F,F1,F2,F3]
A1=A*B;
A2=B*C;
A5=A*C;
K3=A1/A2;K4=A1/A5;K5=A2/A5;
K1=(1-2*F-F2)/2;
K2=(1-K3*2*F-F3)/2;
M1=[0,F,F,F2,K1,K1;
F*K3,0,F3,F*K3,K2,K2;
F*K3,F3,0,F*K3,K2,K2;
F2,F,F,0,K1,K1;
K4*K1,K5*K2,K5*K2,K4*K1,0,(1-2*K4*K1-2*K5*K2);
K4*K1,K5*K2,K5*K2,K4*K1,(1-2*K4*K1-2*K5*K2),0];
R=[R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6;R1,R2,R3,R4,R5,R6
;R1,R2,R3,R4,R5,R6];
Ed=[V1;V1*M1(2,1)+V2;V1*M1(3,1)+V3;V1*M1(4,1)+V4;V1*M1(5,1)+V5;V1*M1(6,1)+V6]
Q=[1,0,0,0,0,0;0,1,0,0,0,0;0,0,1,0,0,0;0,0,0,1,0,0;0,0,0,0,1,0;0,0,0,0,0,1];
FED=M1.*R;FER=(-1)*FED+Q; Er=inv(FER)*FED*Ed;
V=Ed(1,1)-Er(1,1);S=(V2+Er(2,1))*a*g/A1;
s1=Y./sqrt(f^2+Y.^2);
s2=Y./sqrt((f+g)^2+Y.^2);
r=atan((X+a/2)./sqrt(f^2+Y.^2));
r1=atan((X-a/2)./sqrt(f^2+Y.^2));
v=atan((X+a/2)./sqrt((f+g)^2+Y.^2));
v1=atan((X-a/2)./sqrt((f+g)^2+Y.^2));
t=r-r1;
u=v-v1;
Z3=flipud((V/(2*pi)*(s1.*t-s2.*u)+S));

Z4=ones((10*C)-(10*e111)+1,(20*B1)+1);
Z5=zeros((10*e111),(20*B1)+1);
Z6=[Z4;Z5];
Z7=Z3.*Z6;
```

```
TOTAL5=TOTAL4+Z3;
q=mean(TOTAL5);q1=mean(q);w=max(TOTAL5);w1=max(TOTAL5);e=min(TOTAL5);e1=min(e);u=[
q1,w1,e1];
surf(X,Y,TOTAL5);shading interp;view(0,90);
title([T,' (Wh/m2)' ]); xlabel('X METERS'); ylabel('Y METERS');
colorbar;colormap(jet);
```