Annex: Llistats

1. Elelelin.m

```
%[q,qos,K,state_new,ok]=elelin(d,ele,state)
%Total Interaction Nonlinear Sectional Analysis
%Sectional Linear Element
%By: J. M. Bairan
%under development at UPC
%
%Input description:
%******************
%d: degrees of freedom d=[ksia;df];
%ele: element's description structure
%*.ra: nodal coordinates with respect to the beam's reference axis
%*.Abar: area of a bar
%*.Sx: bar spacement spacement
%*.thetha: inclination angle of bars on the plane x-s, whith angle=0
% meaning bars parallel to the element's line, and pi/2 bars parallel to x.
%*.mat: structure of material's properties
%*.mat.name: material id. name
%*.mat.fname: name of the constitutive equation
%*.mat.prop: material properties

%state: state of the element:
%*.Ag: elements gross area
%*.W: internal work of the element
%*.xgm: 1st area moment of shear strains.
%*.mat: material's state structure at each gauss-point (vector)
%(depends on the material's constitutive model)
%
%Output description:
%*******************
%q:vector of generalized stresses corresponding to ksia and warp
%q=[qksia,qw].
%qos: fictitious force vector corresponding to elastic prestrains, follows
%the same structure as q.
%K: stiffness matrix relating q and d [ksia;df]X[ksia;df]
%state_new: new element state (follows same structure as state)
%ok: 1 good result, 0 bad result
%

function [q,qos,K,state_new,ok]=elelin(d,ele,state)
ok=0;
%check to initialize state
if ~isfield(state,'Ag'); state=setfield(state,'Ag',0); end;
if ~isfield(state,'Bem'); state=setfield(state,'Bem',0); end;
if ~isfield(state,'W'); state=setfield(state,'W',0); end;
if ~isfield(state,'xgm'); state=setfield(state,'xgm',0); end;
if ~isfield(state,'V'); state=setfield(state,'V',0); end;
if ~isfield(state,'mat'); state=setfield(state,'mat',cell(1,1)); end;
if ~isfield(state,'RME'); state=setfield(state,'RME',0); end;

%initialize
ngl=size(d,1);
ksia=d(1:8);
df=d(9:ngl);
intAg=0; if state.Ag==0; intAg=1; end
MX=[1,0,0,0,0,0;
    0,0,0,0,0,0;
    0,0,0,0,0,0];
qw1=0;qk=0;Kww=0;Kwk=0;Kkw=0;Kkk=0;
qwos=0;qkos=0;
qw2=0;
Qwk=0;
RME=0;

%Gauss-Legendre Integration parameters
npg=1;
ZI=[0]; WI=[1];
Iksi=[1];
```

```
state_new.W=0;
state_new.xgm=0;
state_new.V=0;

%Loop over all Gauss-Points
for ipg=1:npg
    ksi=ZI(Iksi(ipg));

    %material principal direction: transformation matrixes
    slong=norm(ele.ra(:,2)-ele.ra(:,1),2);
    ey=(ele.ra(1,2)-ele.ra(1,1))/slong;
    ez=(ele.ra(2,2)-ele.ra(2,1))/slong;
    l=sin(ele.thetha); %x directional cosine with of principal direction
    m=cos(ele.thetha)*ey; %y directional cosine with of principal direction
    n=cos(ele.thetha)*ez; %z directional cosine with of principal direction
    t=[l;m;n];
    T=[t',zeros(1,3);zeros(1,3),t']; %vector transformation matrix (from global to local)
    ne=[l^2,m^2,n^2,l*m,n*l,m*n]; %transformation vector from global coordinates (strain
tensor) to principal direction (scalar)
    ns=[l^2,m^2,n^2,2*l*m,2*n*l,2*m*n]; %transformation vector from global coordinates (stress
tensor) to principal direction (scalar)

    %Equivalent J determinant
    detJ=slong*ele.Abar/ele.Sx;

    %Shape functions and derivatives in Gauss-Point:
    Nke=0.5*[(1-ksi),(1+ksi)];

    %Interpolation matrixes for displacements and quantities (scalar)
    Nf=[Nke(1)*eye(3,3),Nke(2)*eye(3,3)];
    %Interpolation matrix for derivative along s (in plane projection of the bar) (scalar)
    dNs=1/slong*[-1,1];
    %Interpolation matrix for derivatives along Y and Z
    if ey==0; dNy=zeros(1,2); else; dNy=1/ey*dNs; end;
    if ez==0; dNz=zeros(1,2); else; dNz=1/ez*dNs; end;

    %physical location of gauss point
    Y=Nke*ele.ra(1,:)';
    Z=Nke*ele.ra(2,:)';

    %strains interpolation matrixes
    %plain global section:
    Npsa=[1,0,Z,-Y;zeros(2,4);0,-Z,0,0;0,Y,0,0;zeros(1,4)];
    %warping strains:
    Bf1=[0,0,0;0,dNy(1),0;0,0,dNz(1);dNy(1),0,0;dNz(1),0,0;0,dNz(1),dNy(1)];
    Bf2=[0,0,0;0,dNy(2),0;0,0,dNz(2);dNy(2),0,0;dNz(2),0,0;0,dNz(2),dNy(2)];
    Bf=[Bf1,Bf2];

    %
    %strains:
    eps=Npsa*ksia(1:4); %plane section strains
    deps=Npsa*ksia(5:8); %derivatives of plane section strains
    ew=Bf*df; %warp-distortion strains
    e=(eps+ew); %total strain
    eL=ne*e; %total strain on local direction

    %stresses:
    [sL,sosL,eL,DL,state_new.mat{ipg},ok]=feval(ele.mat.fname,eL,ele.mat.prop,state.mat{ipg});
    %component on global directions
    s=ne'*sL;
    sos=ne'*sosL;
    D=ne'*DL*ne;

    %derivative of the traction vector normal to the cross-section (on global direction):
    ds=D*deps;
    txp=MX*ds;

    %integrations:
    %gross area and mean strains matrix
    if intAg==1
        state.Ag=state.Ag+WI(Iksi(ipg))*detJ;
        state.Bem=state.Bem+[Npsa,zeros(6,4),Bf]*WI(Iksi(ipg))*detJ;
```

```
    end
    %work:
    state_new.W=state_new.W+state_new.mat{ipg}.W*(WI(Iksi(ipg))*detJ);
    %shear strains 1st momemt of area
    state_new.xgm=state_new.xgm+e(4:5)*(WI(Iksi(ipg))*detJ);
    %shear force
    state_new.V=state_new.V+s(4:5)*(WI(Iksi(ipg))*detJ);


    %Internal forces:
    %warp-distortion problem
    qw2=qw2+(Nf'*txp)*(WI(Iksi(ipg))*WI(Iksi(ipg))*detJ);
    qw1=qw1+(Bf'*s)*(WI(Iksi(ipg))*WI(Iksi(ipg))*detJ);
    qwos=qwos+(Bf'*sos)*(WI(Iksi(ipg))*WI(Iksi(ipg))*detJ);

    %generalized forces equilibrium
    qk=qk+([Npsa',zeros(4,6);zeros(4,6),Npsa'*MX'*MX]*[s;ds])*(WI(Iksi(ipg))*detJ);

qkos=qkos+([Npsa',zeros(4,6);zeros(4,6),Npsa'*MX'*MX]*[sos;zeros(6,1)])*(WI(Iksi(ipg))*detJ);

    %stiffness:
    %warp-distortion problem
    Kww=Kww+(Bf'*D*Bf)*(WI(Iksi(ipg))*detJ);
    Kwk=Kwk+([Bf'*D*Npsa,zeros(ngl-8,4)]*(WI(Iksi(ipg))*detJ));
    Qwk=Qwk+([zeros(ngl-8,4),Nf'*MX*D*Npsa]*(WI(Iksi(ipg))*detJ));
    %generalized forces equilibrium
    %Kkw=Kkw+([Npsa'*D*Bf;-Npsa'*D*MX'*Nf]*(WI(Iksi(ipg))*detJ));
    Kkw=Kkw+([Npsa'*D*Bf;zeros(4,ngl-8)])*(WI(Iksi(ipg))*detJ);
    Kkk=Kkk+([Npsa'*D*Npsa,zeros(4,4);zeros(4,4),Npsa'*D*Npsa])*(WI(Iksi(ipg))*detJ);

   %Rigid movement matrix
    C=[1,0,0;
        0,1,0;
        0,0,1;
        0,-Z,Y];

    RME=RME+WI(Iksi(ipg))*C*Nf*detJ;

end

q=[qk;qw1];
qos=[qkos;qwos];

state_new.Ag=state.Ag;
state_new.Bem=state.Bem;
state_new.RME=RME;
state_new.qw2=qw2;
state_new.Qwk=Qwk;

K=[Kkk,Kkw;Kwk,Kww];
ok=1;
return
```

2. Elelelin2.m

```
%[q,qos,K,state_new,ok]=elelin2(d,ele,state)
%Total Interaction Nonlinear Sectional Analysis
%Sectional Linear Element
%By: J. M. Bairan
%under development at UPC
%
%Input description:
%******************
%d: degrees of freedom d=[ksia;df];
%ele: element's description structure
%*.ra: nodal coordinates with respect to the beam's reference axis
%*.Abar: row containing the areas of the bars
%*.Sx: row containing bar spacements
```

```
%*.thetha: row containing inclination angles of the bars on the plane x-s,
%  whith angle=0 meaning bars parallel to the element's line, and pi/2 bars
%  parallel to x.
%*.mat: structure of material's properties
%*.mat.name: material id. name
%*.mat.fname: name of the constitutive equation
%*.mat.prop: material properties

%state: state of the element:
%*.Ag: elements gross area
%*.W: internal work of the element
%*.xgm: 1st area moment of shear strains.
%*.mat: material's state structure at each gauss-point (vector)
%(depends on the material's constitutive model)
%
%Output description:
%******************
%q:vector of generalized stresses corresponding to ksia and warp
%q=[qksia,qw].
%qos: fictitious force vector corresponding to elastic prestrains, follows
%the same structure as q.
%K: stiffness matrix relating q and d [ksia;df]X[ksia;df]
%state_new: new element state (follows same structure as state)
%ok: 1 good result, 0 bad result
%

function [q,qos,K,state_new,ok]=elelin2(d,ele,state)
ok=0;
%check to initialize state
if ~isfield(state,'Ag'); state=setfield(state,'Ag',0); end;
if ~isfield(state,'Bem'); state=setfield(state,'Bem',0); end;
if ~isfield(state,'W'); state=setfield(state,'W',0); end;
if ~isfield(state,'xgm'); state=setfield(state,'xgm',0); end;
if ~isfield(state,'V'); state=setfield(state,'V',0); end;
if ~isfield(state,'mat'); state=setfield(state,'mat',cell(1,2)); end;
if ~isfield(state,'RME'); state=setfield(state,'RME',0); end;

%initialize
ngl=size(d,1);
ksia=d(1:8);
df=d(9:ngl);
intAg=0; if state.Ag==0; intAg=1; end
MX=[1,0,0,0,0,0;
    0,0,0,0,0,0;
    0,0,0,0,0,0];
RME=0;
qw1=0;qk=0;Kww=0;Kwk=0;Kkw=0;Kkk=0;
qwos=0;qkos=0;
qw2=0;
Qwk=0;
nbar=length(ele.thetha);
q=[]; qos=[]; K=[]; state_new=[];

%Gauss-Legendre Integration parameters
npg=1;
ZI=[0]; WI=[1];
Iksi=[1];

state_new.W=0;
state_new.xgm=0;
state_new.V=0;

%Loop over all bars
for ibar=1:nbar
%Loop over all Gauss-Points
for ipg=1:npg

    ksi=ZI(Iksi(ipg));

    %material principal direction: transformation matrixes
    slong=norm(ele.ra(:,2)-ele.ra(:,1),2);
    ey=(ele.ra(1,2)-ele.ra(1,1))/slong;
```

```
    ez=(ele.ra(2,2)-ele.ra(2,1))/slong;
    l=sin(ele.thetha(ibar)); %x directional cosine with of principal direction
    m=cos(ele.thetha(ibar))*ey; %y directional cosine with of principal direction
    n=cos(ele.thetha(ibar))*ez; %z directional cosine with of principal direction
    t=[l;m;n];
    T=[t',zeros(1,3);zeros(1,3),t']; %vector transformation matrix (from global to local)
    ne=[l^2,m^2,n^2,l*m,n*l,m*n]; %transformation vector from global coordinates (strain
tensor) to principal direction (scalar)
    ns=[l^2,m^2,n^2,2*l*m,2*n*l,2*m*n]; %transformation vector from global coordinates (stress
tensor) to principal direction (scalar)

    %Equivalent J determinant
    detJ=slong*ele.Abar(ibar)/ele.Sx(ibar);

    %Shape functions and derivatives in Gauss-Point:
    Nke=0.5*[(1-ksi),(1+ksi)];

    %Interpolation matrixes for displacements and quantities (scalar)
    Nf=[Nke(1)*eye(3,3),Nke(2)*eye(3,3)];
    %Interpolation matrix for derivative along s (in plane projection of the bar) (scalar)
    dNs=1/slong*[-1,1];
    %Interpolation matrix for derivatives along Y and Z
    if ey==0; dNy=zeros(1,2); else; dNy=1/ey*dNs; end;
    if ez==0; dNz=zeros(1,2); else; dNz=1/ez*dNs; end;

    %physical location of gauss point
    Y=Nke*ele.ra(1,:)';
    Z=Nke*ele.ra(2,:)';

    %strains interpolation matrixes
    %plain global section:
    Npsa=[1,0,Z,-Y;zeros(2,4);0,-Z,0,0;0,Y,0,0;zeros(1,4)];

    %warping strains:
    Bf1=[0,0,0;0,dNy(1),0;0,0,dNz(1);dNy(1),0,0;dNz(1),0,0;0,dNz(1),dNy(1)];
    Bf2=[0,0,0;0,dNy(2),0;0,0,dNz(2);dNy(2),0,0;dNz(2),0,0;0,dNz(2),dNy(2)];
    Bf=[Bf1,Bf2];

    %
    %strains:
    eps=Npsa*ksia(1:4); %plane section strains
    deps=Npsa*ksia(5:8); %derivatives of plane section strains
    ew=Bf*df; %warp-distortion strains
    e=(eps+ew); %total strain
    eL=ne*e; %total strain on local direction

    %stresses:

[sL,sosL,eL,DL,state_new.mat{ibar},ok]=feval(ele.mat.fname,eL,ele.mat.prop,state.mat{ibar});
    %component on global directions
    s=ne'*sL;
    sos=ne'*sosL;
    D=ne'*DL*ne;

    %derivative of the traction vector normal to the cross-section (on global direction):
    ds=D*deps;
    txp=MX*ds;

    %integrations:
    %gross area and mean strains matrix
    if intAg==1
        state.Ag=state.Ag+WI(Iksi(ipg))*detJ;
        state.Bem=state.Bem+[Npsa,zeros(6,4),Bf]*WI(Iksi(ipg))*detJ;
    end
    %work:
    state_new.W=state_new.W+state_new.mat{ipg}.W*(WI(Iksi(ipg))*detJ);
    %shear strains 1st momemt of area
    state_new.xgm=state_new.xgm+e(4:5)*(WI(Iksi(ipg))*detJ);
    %shear force
    state_new.V=state_new.V+s(4:5)*(WI(Iksi(ipg))*detJ);
```

```
    %Internal forces:
    %warp-distortion problem
    qw2=qw2+(Nf'*txp)*(WI(Iksi(ipg))*WI(Iksi(ipg))*detJ);
    qw1=qw1+(Bf'*s)*(WI(Iksi(ipg))*WI(Iksi(ipg))*detJ);
    qwos=qwos+(Bf'*sos)*(WI(Iksi(ipg))*detJ);
    %generalized forces equilibrium
    qk=qk+([Npsa',zeros(4,6);zeros(4,6),Npsa'*MX'*MX]*[s;ds])*(WI(Iksi(ipg))*detJ);

qkos=qkos+([Npsa',zeros(4,6);zeros(4,6),Npsa'*MX'*MX]*[sos;zeros(6,1)])*(WI(Iksi(ipg))*detJ);

    %stiffness:
    %warp-distortion problem
    Kww=Kww+(Bf'*D*Bf)*(WI(Iksi(ipg))*detJ);
    Kwk=Kwk+([Bf'*D*Npsa,zeros(ngl-8,4)]*(WI(Iksi(ipg))*detJ));
    Qwk=Qwk+([zeros(ngl-8,4),Nf'*MX*D*Npsa]*(WI(Iksi(ipg))*detJ));
    %generalized forces equilibrium
    Kkw=Kkw+([Npsa'*D*Bf;zeros(4,ngl-8)])*(WI(Iksi(ipg))*detJ);
    Kkk=Kkk+([Npsa'*D*Npsa,zeros(4,4);zeros(4,4),Npsa'*D*Npsa])*(WI(Iksi(ipg))*detJ);

   %Rigid movement matrix
    C=[1,0,0;
       0,1,0;
       0,0,1;
       0,-Z,Y];
    RME=RME+WI(Iksi(ipg))*C*Nf*detJ;

end % Gauss points

q=[qk;qw1];
qos=[qkos;qwos];

state_new.Ag=state.Ag;
state_new.Bem=state.Bem;
state_new.RME=RME;
state_new.qw2=qw2;
state_new.Qwk=Qwk;

K=[Kkk,Kkw;Kwk,Kww];


end % bars


ok=1;
return
```

3. Codi de buildtinsa2.m corresponent a la construcció d'elements inclinats dobles

```
%elelin2 structure:
nnodele=2;
for i=1:section.nelel2
    j=j+1;
    section.ele{j}.fele=fele{j};
    section.ele{j}.conec=conec{3}(i,1:nnodele);
    section.ele{j}.ra(1,:)=section.coord(section.ele{j}.conec,1)';%-section.r0(1);
    section.ele{j}.ra(2,:)=section.coord(section.ele{j}.conec,2)';%-section.r0(2);
    section.ele{j}.thetha(1)=conec{3}(i,nnodele+1);
    section.ele{j}.Abar(1)=conec{3}(i,nnodele+2);
    section.ele{j}.Sx(1)=conec{3}(i,nnodele+3);
    section.ele{j}.thetha(2)=conec{3}(i,nnodele+4);
    section.ele{j}.Abar(2)=conec{3}(i,nnodele+5);
    section.ele{j}.Sx(2)=conec{3}(i,nnodele+6);
    section.ele{j}.mat=section.mat{conec{3}(i,nnodele+7)};
    section.ele{j}.npg=2;
end
```

4. Tepetit.m

```
%1. Section's name
PName='section1';

%1.1. Allowed degrees of freedom for warp-distortion
ADOF=[1,1,1]';

%2. Reference position of the bar's axis
r0=[           75,           197.4137931]';

%3. Materials definition
%number of materials
nmat=      3;
mat{      1}.name='H30';
mat{      1}.fname='OU3DC';
mat{1}.prop.fc=35.;
mat{1}.prop.e0=0.0022;
mat{1}.prop.E0=3e4;
mat{1}.prop.nu=0.2;
mat{1}.prop.epres=zeros(6,1);
mat{1}.prop.ft_=0.1;
mat{1}.prop.fbc_=1.5;
mat{1}.prop.ksi1_=3.67;
mat{1}.prop.r1_=1.59;
mat{1}.prop.ksi2_=3.67;
mat{1}.prop.r2_=1.94;
mat{1}.prop.bbcurveC='CoPor';%mat{1}.prop.bbcurveC='ParSq';
mat{1}.prop.bbcurveT='Cervk';
mat{1}.prop.surface='FSWilliam_Warnke5P';

%material 2: acero celosia
mat{2}.name='B500';;
mat{2}.fname='BilPlaCyclic';
mat{2}.prop.fy=809;
mat{2}.prop.E0=2e5;
mat{2}.prop.E1=2e1;
mat{2}.prop.epres=0;

%material 3: acero longitudinal
mat{3}.name='B500';;
mat{3}.fname='BilPlaCyclic';
mat{3}.prop.fy=588;
mat{3}.prop.E0=2e5;
mat{3}.prop.E1=2e1;
mat{3}.prop.epres=0;

%4. Coordinates
%number of nodes
nnod=    273;
%                         1               2
%                         Y               Z
coord(      1,:)=[          425,          300];
coord(      2,:)=[          425,          290];
coord(      3,:)=[          425,          280];
coord(      4,:)=[          425,          265];
coord(      5,:)=[        387.5,          300];
coord(      6,:)=[        387.5,          290];
coord(      7,:)=[        387.5,          280];
coord(      8,:)=[          425,          250];
coord(      9,:)=[        387.5,          265];
coord(     10,:)=[        387.5,          250];
coord(     11,:)=[          350,          300];
coord(     12,:)=[          350,          290];
coord(     13,:)=[          350,          280];
coord(     14,:)=[          350,          265];
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```
coord(     15,:)=[         350,         250];
coord(     16,:)=[       312.5,         300];
coord(     17,:)=[       312.5,         290];
coord(     18,:)=[       312.5,         280];
coord(     19,:)=[       312.5,         265];
coord(     20,:)=[       312.5,         250];
coord(     21,:)=[         275,         300];
coord(     22,:)=[         275,         290];
coord(     23,:)=[         275,         280];
coord(     24,:)=[         275,         265];
coord(     25,:)=[         275,         250];
coord(     26,:)=[      243.75,         300];
coord(     27,:)=[      243.75,         290];
coord(     28,:)=[      243.75,         280];
coord(     29,:)=[      243.75,         265];
coord(     30,:)=[      243.75,         250];
coord(     31,:)=[       212.5,         300];
coord(     32,:)=[       212.5,         290];
coord(     33,:)=[       212.5,         280];
coord(     34,:)=[       212.5,         265];
coord(     35,:)=[       212.5,         250];
coord(     36,:)=[      181.25,         300];
coord(     37,:)=[      181.25,         290];
coord(     38,:)=[      181.25,         280];
coord(     39,:)=[      181.25,         265];
coord(     40,:)=[      181.25,         250];
coord(     41,:)=[         150,         300];
coord(     42,:)=[         150,         290];
coord(     43,:)=[         150,         280];
coord(     44,:)=[         150,         265];
coord(     45,:)=[         150,         250];
coord(     46,:)=[         150,      234.59];
coord(     47,:)=[         150,      216.65];
coord(     48,:)=[         150,      195.13];
coord(     49,:)=[         125,         300];
coord(     50,:)=[         125,         290];
coord(     51,:)=[         125,         280];
coord(     52,:)=[      125.42,      264.21];
coord(     53,:)=[      125.83,      248.42];
coord(     54,:)=[         150,       169.7];
coord(     55,:)=[      125.96,      231.19];
coord(     56,:)=[      126.06,      212.53];
coord(     57,:)=[         150,      140.11];
coord(     58,:)=[       126.1,      190.65];
coord(     59,:)=[         100,         300];
coord(     60,:)=[         100,         290];
coord(     61,:)=[         100,         280];
coord(     62,:)=[      100.83,      263.42];
coord(     63,:)=[      101.66,      246.84];
coord(     64,:)=[      122.58,      172.34];
coord(     65,:)=[      101.93,      229.22];
coord(     66,:)=[         150,      110.39];
coord(     67,:)=[       102.2,      211.61];
coord(     68,:)=[      126.79,      144.68];
coord(     69,:)=[        87.5,         300];
coord(     70,:)=[        87.5,         290];
coord(     71,:)=[        87.5,         280];
coord(     72,:)=[      87.915,      266.73];
coord(     73,:)=[      101.43,      199.52];
coord(     74,:)=[       88.33,      253.25];
coord(     75,:)=[      88.548,      238.53];
coord(     76,:)=[      88.932,       223.9];
coord(     77,:)=[      89.986,      211.48];
coord(     78,:)=[         150,       85.33];
coord(     79,:)=[      127.68,      116.18];
coord(     80,:)=[          75,         300];
coord(     81,:)=[          75,         290];
coord(     82,:)=[          75,         280];
coord(     83,:)=[          75,      270.26];
coord(     84,:)=[          75,      259.67];
coord(     85,:)=[          75,      247.76];
coord(     86,:)=[       80.44,      212.24];
```

```
coord(     87,:)=[          75,         234];
coord(     88,:)=[      87.419,      184.32];
coord(     89,:)=[       79.14,      205.14];
coord(     90,:)=[          75,      217.18];
coord(     91,:)=[      95.431,      152.27];
coord(     92,:)=[      130.33,      89.992];
coord(     93,:)=[         150,      64.573];
coord(     94,:)=[      80.692,      187.82];
coord(     95,:)=[        62.5,         300];
coord(     96,:)=[        62.5,         290];
coord(     97,:)=[        62.5,         280];
coord(     98,:)=[      62.085,      266.73];
coord(     99,:)=[          75,       197.1];
coord(    100,:)=[       69.56,      212.24];
coord(    101,:)=[       61.67,      253.25];
coord(    102,:)=[       70.86,      205.14];
coord(    103,:)=[      103.59,      119.66];
coord(    104,:)=[      61.452,      238.53];
coord(    105,:)=[       81.21,      164.73];
coord(    106,:)=[      61.068,       223.9];
coord(    107,:)=[          75,      173.16];
coord(    108,:)=[      133.02,      68.178];
coord(    109,:)=[      69.308,      187.82];
coord(    110,:)=[         150,      47.641];
coord(    111,:)=[          50,         300];
coord(    112,:)=[          50,         290];
coord(    113,:)=[          50,         280];
coord(    114,:)=[      60.014,      211.48];
coord(    115,:)=[      85.789,      137.22];
coord(    116,:)=[      110.53,      91.898];
coord(    117,:)=[       49.17,      263.42];
coord(    118,:)=[      48.339,      246.84];
coord(    119,:)=[      62.581,      184.32];
coord(    120,:)=[       68.79,      164.73];
coord(    121,:)=[         150,          34];
coord(    122,:)=[          75,      145.14];
coord(    123,:)=[      135.44,      49.459];
coord(    124,:)=[       48.07,      229.22];
coord(    125,:)=[      116.33,      68.688];
coord(    126,:)=[      83.361,      119.34];
coord(    127,:)=[      47.801,      211.61];
coord(    128,:)=[      89.293,      104.97];
coord(    129,:)=[      48.574,      199.52];
coord(    130,:)=[       137.5,          34];
coord(    131,:)=[      97.444,      84.662];
coord(    132,:)=[      121.11,      49.565];
coord(    133,:)=[         150,          17];
coord(    134,:)=[          75,      115.83];
coord(    135,:)=[      64.211,      137.22];
coord(    136,:)=[      104.14,      66.321];
coord(    137,:)=[      54.569,      152.27];
coord(    138,:)=[          25,         300];
coord(    139,:)=[          25,         290];
coord(    140,:)=[          25,         280];
coord(    141,:)=[         125,          34];
coord(    142,:)=[      66.639,      119.34];
coord(    143,:)=[      24.585,      264.21];
coord(    144,:)=[      137.47,      16.999];
coord(    145,:)=[      105.92,      52.563];
coord(    146,:)=[       24.17,      248.42];
coord(    147,:)=[      85.817,      75.456];
coord(    148,:)=[      24.045,      231.19];
coord(    149,:)=[         150,           0];
coord(    150,:)=[          75,      90.294];
coord(    151,:)=[      91.853,       62.78];
coord(    152,:)=[      23.938,      212.53];
coord(    153,:)=[      104.45,      42.003];
coord(    154,:)=[         125,          17];
coord(    155,:)=[      60.707,      104.97];
coord(    156,:)=[      93.981,      52.365];
coord(    157,:)=[      80.651,      68.083];
coord(    158,:)=[       137.5,           0];
```

```
coord(    159,:)=[        23.9,      190.65];
coord(    160,:)=[      27.422,      172.34];
coord(    161,:)=[      94.339,      44.882];
coord(    162,:)=[      83.476,      56.977];
coord(    163,:)=[      46.414,      119.66];
coord(    164,:)=[      97.077,      38.556];
coord(    165,:)=[          75,      68.437];
coord(    166,:)=[         100,          34];
coord(    167,:)=[      85.031,      48.169];
coord(    168,:)=[         125,           0];
coord(    169,:)=[      69.349,      68.083];
coord(    170,:)=[      64.183,      75.456];
coord(    171,:)=[           0,         300];
coord(    172,:)=[      87.669,      41.336];
coord(    173,:)=[           0,         290];
coord(    174,:)=[           0,         280];
coord(    175,:)=[           0,         265];
coord(    176,:)=[           0,         250];
coord(    177,:)=[           0,      234.59];
coord(    178,:)=[          75,          50];
coord(    179,:)=[      52.556,      84.662];
coord(    180,:)=[      23.207,      144.68];
coord(    181,:)=[         100,          17];
coord(    182,:)=[      66.524,      56.977];
coord(    183,:)=[           0,      216.65];
coord(    184,:)=[          75,          42];
coord(    185,:)=[      58.147,       62.78];
coord(    186,:)=[           0,      195.13];
coord(    187,:)=[      39.475,      91.898];
coord(    188,:)=[      64.969,      48.169];
coord(    189,:)=[          75,          34];
coord(    190,:)=[         100,           0];
coord(    191,:)=[      22.323,      116.18];
coord(    192,:)=[      56.019,      52.365];
coord(    193,:)=[           0,       169.7];
coord(    194,:)=[       45.86,      66.321];
coord(    195,:)=[      62.331,      41.336];
coord(    196,:)=[      55.661,      44.882];
coord(    197,:)=[          75,          17];
coord(    198,:)=[           0,      140.11];
coord(    199,:)=[      44.081,      52.563];
coord(    200,:)=[      33.672,      68.688];
coord(    201,:)=[      52.923,      38.556];
coord(    202,:)=[      -31.25,         300];
coord(    203,:)=[      -31.25,         290];
coord(    204,:)=[      19.671,      89.992];
coord(    205,:)=[      -31.25,         280];
coord(    206,:)=[     -31.253,         265];
coord(    207,:)=[      45.551,      42.003];
coord(    208,:)=[      -31.25,         250];
coord(    209,:)=[          50,          34];
coord(    210,:)=[          75,           0];
coord(    211,:)=[           0,      110.39];
coord(    212,:)=[      28.891,      49.565];
coord(    213,:)=[      16.975,      68.178];
coord(    214,:)=[          50,          17];
coord(    215,:)=[           0,       85.33];
coord(    216,:)=[          50,           0];
coord(    217,:)=[          25,          34];
coord(    218,:)=[      14.557,      49.459];
coord(    219,:)=[           0,      64.573];
coord(    220,:)=[       -62.5,         300];
coord(    221,:)=[       -62.5,         290];
coord(    222,:)=[       -62.5,         280];
coord(    223,:)=[     -62.499,         265];
coord(    224,:)=[          25,          17];
coord(    225,:)=[       -62.5,         250];
coord(    226,:)=[        12.5,          34];
coord(    227,:)=[           0,      47.641];
coord(    228,:)=[          25,           0];
coord(    229,:)=[       12.53,      17.002];
coord(    230,:)=[           0,          34];
```

```
coord(    231,:)=[        12.5,           0];
coord(    232,:)=[           0,          17];
coord(    233,:)=[      -93.75,         300];
coord(    234,:)=[      -93.75,         290];
coord(    235,:)=[      -93.75,         280];
coord(    236,:)=[     -93.751,         265];
coord(    237,:)=[           0,           0];
coord(    238,:)=[      -93.75,         250];
coord(    239,:)=[        -125,         300];
coord(    240,:)=[        -125,         290];
coord(    241,:)=[        -125,         280];
coord(    242,:)=[        -125,         265];
coord(    243,:)=[        -125,         250];
coord(    244,:)=[        -150,         300];
coord(    245,:)=[        -150,         290];
coord(    246,:)=[        -150,         280];
coord(    247,:)=[        -150,         265];
coord(    248,:)=[        -150,         250];
coord(    249,:)=[        -175,         300];
coord(    250,:)=[        -175,         290];
coord(    251,:)=[        -175,         280];
coord(    252,:)=[        -175,         265];
coord(    253,:)=[        -175,         250];
coord(    254,:)=[        -200,         300];
coord(    255,:)=[        -200,         290];
coord(    256,:)=[        -200,         280];
coord(    257,:)=[        -200,         265];
coord(    258,:)=[        -200,         250];
coord(    259,:)=[        -225,         300];
coord(    260,:)=[        -225,         290];
coord(    261,:)=[        -225,         280];
coord(    262,:)=[        -225,         265];
coord(    263,:)=[        -225,         250];
coord(    264,:)=[        -250,         300];
coord(    265,:)=[        -250,         290];
coord(    266,:)=[        -250,         280];
coord(    267,:)=[        -250,         265];
coord(    268,:)=[        -250,         250];
coord(    269,:)=[        -275,         300];
coord(    270,:)=[        -275,         290];
coord(    271,:)=[        -275,         280];
coord(    272,:)=[        -275,         265];
coord(    273,:)=[        -275,         250];

%5. Concrete elements' conections
%Number of concrete elements
nelec=    230;
%                      1        2        3        4        5        6
%                   ID         N1        N2        N3        N4        propc
conec(      1,:)=[      1,     143,     140,     174,     175,       1];
conec(      2,:)=[      2,     143,     175,     176,     146,       1];
conec(      3,:)=[      3,     143,     146,     118,     117,       1];
conec(      4,:)=[      4,     143,     117,     113,     140,       1];
conec(      5,:)=[      5,     148,     146,     176,     177,       1];
conec(      6,:)=[      6,     148,     177,     183,     152,       1];
conec(      7,:)=[      7,     148,     152,     127,     124,       1];
conec(      8,:)=[      8,     148,     124,     118,     146,       1];
conec(      9,:)=[      9,      98,      83,      82,      97,       1];
conec(     10,:)=[     10,      98,      97,     113,     117,       1];
conec(     11,:)=[     11,      98,     117,     118,     101,       1];
conec(     12,:)=[     12,      98,     101,      84,      83,       1];
conec(     13,:)=[     13,     218,     227,     230,     226,       1];
conec(     14,:)=[     14,     218,     226,     217,     212,       1];
conec(     15,:)=[     15,     218,     212,     200,     213,       1];
conec(     16,:)=[     16,     218,     213,     219,     227,       1];
conec(     17,:)=[     17,     104,      85,      84,     101,       1];
conec(     18,:)=[     18,     104,     101,     118,     124,       1];
conec(     19,:)=[     19,     104,     124,     127,     106,       1];
conec(     20,:)=[     20,     104,     106,      87,      85,       1];
conec(     21,:)=[     21,     159,     160,     119,     129,       1];
conec(     22,:)=[     22,     159,     129,     127,     152,       1];
conec(     23,:)=[     23,     159,     152,     183,     186,       1];
```

```
conec(     24,:)=[     24,    159,    186,    193,    160,      1];
conec(     25,:)=[     25,    204,    215,    219,    213,      1];
conec(     26,:)=[     26,    204,    213,    200,    187,      1];
conec(     27,:)=[     27,    204,    187,    163,    191,      1];
conec(     28,:)=[     28,    204,    191,    211,    215,      1];
conec(     29,:)=[     29,    180,    198,    211,    191,      1];
conec(     30,:)=[     30,    180,    191,    163,    137,      1];
conec(     31,:)=[     31,    180,    137,    119,    160,      1];
conec(     32,:)=[     32,    180,    160,    193,    198,      1];
conec(     33,:)=[     33,     87,    106,    114,    100,      1];
conec(     34,:)=[     34,    127,    129,    114,    106,      1];
conec(     35,:)=[     35,    119,    100,    114,    129,      1];
conec(     36,:)=[     36,    188,    195,    189,    184,      1];
conec(     37,:)=[     37,    188,    184,    178,    182,      1];
conec(     38,:)=[     38,    188,    182,    185,    192,      1];
conec(     39,:)=[     39,    188,    192,    196,    195,      1];
conec(     40,:)=[     40,    199,    192,    185,    194,      1];
conec(     41,:)=[     41,    199,    194,    200,    212,      1];
conec(     42,:)=[     42,    199,    212,    217,    207,      1];
conec(     43,:)=[     43,    199,    207,    196,    192,      1];
conec(     44,:)=[     44,    179,    194,    185,    170,      1];
conec(     45,:)=[     45,    179,    170,    150,    155,      1];
conec(     46,:)=[     46,    179,    155,    163,    187,      1];
conec(     47,:)=[     47,    179,    187,    200,    194,      1];
conec(     48,:)=[     48,    120,    107,     99,    109,      1];
conec(     49,:)=[     49,    120,    109,    119,    137,      1];
conec(     50,:)=[     50,    120,    137,    163,    135,      1];
conec(     51,:)=[     51,    120,    135,    122,    107,      1];
conec(     52,:)=[     52,    189,    195,    201,    209,      1];
conec(     53,:)=[     53,    196,    207,    201,    195,      1];
conec(     54,:)=[     54,    217,    209,    201,    207,      1];
conec(     55,:)=[     55,    185,    182,    169,    170,      1];
conec(     56,:)=[     56,    178,    165,    169,    182,      1];
conec(     57,:)=[     57,    150,    170,    169,    165,      1];
conec(     58,:)=[     58,     99,     90,    102,    109,      1];
conec(     59,:)=[     59,     87,    100,    102,     90,      1];
conec(     60,:)=[     60,    119,    109,    102,    100,      1];
conec(     61,:)=[     61,    122,    135,    142,    134,      1];
conec(     62,:)=[     62,    163,    155,    142,    135,      1];
conec(     63,:)=[     63,    150,    134,    142,    155,      1];
conec(     64,:)=[     64,     52,     44,     43,     51,      1];
conec(     65,:)=[     65,     52,     51,     61,     62,      1];
conec(     66,:)=[     66,     52,     62,     63,     53,      1];
conec(     67,:)=[     67,     52,     53,     45,     44,      1];
conec(     68,:)=[     68,     55,     46,     45,     53,      1];
conec(     69,:)=[     69,     55,     53,     63,     65,      1];
conec(     70,:)=[     70,     55,     65,     67,     56,      1];
conec(     71,:)=[     71,     55,     56,     47,     46,      1];
conec(     72,:)=[     72,     72,     71,     82,     83,      1];
conec(     73,:)=[     73,     72,     83,     84,     74,      1];
conec(     74,:)=[     74,     72,     74,     63,     62,      1];
conec(     75,:)=[     75,     72,     62,     61,     71,      1];
conec(     76,:)=[     76,    123,    130,    121,    110,      1];
conec(     77,:)=[     77,    123,    110,     93,    108,      1];
conec(     78,:)=[     78,    123,    108,    125,    132,      1];
conec(     79,:)=[     79,    123,    132,    141,    130,      1];
conec(     80,:)=[     80,     75,     74,     84,     85,      1];
conec(     81,:)=[     81,     75,     85,     87,     76,      1];
conec(     82,:)=[     82,     75,     76,     67,     65,      1];
conec(     83,:)=[     83,     75,     65,     63,     74,      1];
conec(     84,:)=[     84,     58,     73,     88,     64,      1];
conec(     85,:)=[     85,     58,     64,     54,     48,      1];
conec(     86,:)=[     86,     58,     48,     47,     56,      1];
conec(     87,:)=[     87,     58,     56,     67,     73,      1];
conec(     88,:)=[     88,     92,    108,     93,     78,      1];
conec(     89,:)=[     89,     92,     78,     66,     79,      1];
conec(     90,:)=[     90,     92,     79,    103,    116,      1];
conec(     91,:)=[     91,     92,    116,    125,    108,      1];
conec(     92,:)=[     92,     68,     79,     66,     57,      1];
conec(     93,:)=[     93,     68,     57,     54,     64,      1];
conec(     94,:)=[     94,     68,     64,     88,     91,      1];
conec(     95,:)=[     95,     68,     91,    103,     79,      1];
```

```
conec(     96,:)=[     96,     67,     76,     77,     73,      1];
conec(     97,:)=[     97,     87,     86,     77,     76,      1];
conec(     98,:)=[     98,     88,     73,     77,     86,      1];
conec(     99,:)=[     99,    226,    229,    224,    217,      1];
conec(    100,:)=[    100,    230,    232,    229,    226,      1];
conec(    101,:)=[    101,    229,    231,    228,    224,      1];
conec(    102,:)=[    102,    232,    237,    231,    229,      1];
conec(    103,:)=[    103,    209,    214,    197,    189,      1];
conec(    104,:)=[    104,    217,    224,    214,    209,      1];
conec(    105,:)=[    105,    214,    216,    210,    197,      1];
conec(    106,:)=[    106,    224,    228,    216,    214,      1];
conec(    107,:)=[    107,    166,    181,    154,    141,      1];
conec(    108,:)=[    108,    189,    197,    181,    166,      1];
conec(    109,:)=[    109,    181,    190,    168,    154,      1];
conec(    110,:)=[    110,    197,    210,    190,    181,      1];
conec(    111,:)=[    111,    130,    144,    133,    121,      1];
conec(    112,:)=[    112,    141,    154,    144,    130,      1];
conec(    113,:)=[    113,    144,    158,    149,    133,      1];
conec(    114,:)=[    114,    154,    168,    158,    144,      1];
conec(    115,:)=[    115,    266,    265,    270,    271,      1];
conec(    116,:)=[    116,    261,    260,    265,    266,      1];
conec(    117,:)=[    117,    265,    264,    269,    270,      1];
conec(    118,:)=[    118,    260,    259,    264,    265,      1];
conec(    119,:)=[    119,      2,      6,      7,      3,      1];
conec(    120,:)=[    120,      1,      5,      6,      2,      1];
conec(    121,:)=[    121,      6,     12,     13,      7,      1];
conec(    122,:)=[    122,      5,     11,     12,      6,      1];
conec(    123,:)=[    123,     12,     17,     18,     13,      1];
conec(    124,:)=[    124,     11,     16,     17,     12,      1];
conec(    125,:)=[    125,     17,     22,     23,     18,      1];
conec(    126,:)=[    126,     16,     21,     22,     17,      1];
conec(    127,:)=[    127,      4,      9,     10,      8,      1];
conec(    128,:)=[    128,      3,      7,      9,      4,      1];
conec(    129,:)=[    129,      9,     14,     15,     10,      1];
conec(    130,:)=[    130,      7,     13,     14,      9,      1];
conec(    131,:)=[    131,     14,     19,     20,     15,      1];
conec(    132,:)=[    132,     13,     18,     19,     14,      1];
conec(    133,:)=[    133,     19,     24,     25,     20,      1];
conec(    134,:)=[    134,     18,     23,     24,     19,      1];
conec(    135,:)=[    135,     28,     29,     24,     23,      1];
conec(    136,:)=[    136,     33,     34,     29,     28,      1];
conec(    137,:)=[    137,     38,     39,     34,     33,      1];
conec(    138,:)=[    138,     43,     44,     39,     38,      1];
conec(    139,:)=[    139,     29,     30,     25,     24,      1];
conec(    140,:)=[    140,     34,     35,     30,     29,      1];
conec(    141,:)=[    141,     39,     40,     35,     34,      1];
conec(    142,:)=[    142,     44,     45,     40,     39,      1];
conec(    143,:)=[    143,     42,     37,     36,     41,      1];
conec(    144,:)=[    144,     43,     38,     37,     42,      1];
conec(    145,:)=[    145,     37,     32,     31,     36,      1];
conec(    146,:)=[    146,     38,     33,     32,     37,      1];
conec(    147,:)=[    147,     32,     27,     26,     31,      1];
conec(    148,:)=[    148,     33,     28,     27,     32,      1];
conec(    149,:)=[    149,     27,     22,     21,     26,      1];
conec(    150,:)=[    150,     28,     23,     22,     27,      1];
conec(    151,:)=[    151,    260,    255,    254,    259,      1];
conec(    152,:)=[    152,    261,    256,    255,    260,      1];
conec(    153,:)=[    153,    255,    250,    249,    254,      1];
conec(    154,:)=[    154,    256,    251,    250,    255,      1];
conec(    155,:)=[    155,    250,    245,    244,    249,      1];
conec(    156,:)=[    156,    251,    246,    245,    250,      1];
conec(    157,:)=[    157,    245,    240,    239,    244,      1];
conec(    158,:)=[    158,    246,    241,    240,    245,      1];
conec(    159,:)=[    159,    266,    267,    262,    261,      1];
conec(    160,:)=[    160,    271,    272,    267,    266,      1];
conec(    161,:)=[    161,    267,    268,    263,    262,      1];
conec(    162,:)=[    162,    272,    273,    268,    267,      1];
conec(    163,:)=[    163,    246,    247,    242,    241,      1];
conec(    164,:)=[    164,    251,    252,    247,    246,      1];
conec(    165,:)=[    165,    256,    257,    252,    251,      1];
conec(    166,:)=[    166,    261,    262,    257,    256,      1];
conec(    167,:)=[    167,    247,    248,    243,    242,      1];
```

```
conec(    168,:)=[    168,    252,    253,    248,    247,      1];
conec(    169,:)=[    169,    257,    258,    253,    252,      1];
conec(    170,:)=[    170,    262,    263,    258,    257,      1];
conec(    171,:)=[    171,    238,    236,    242,    243,      1];
conec(    172,:)=[    172,    225,    223,    236,    238,      1];
conec(    173,:)=[    173,    208,    206,    223,    225,      1];
conec(    174,:)=[    174,    176,    175,    206,    208,      1];
conec(    175,:)=[    175,    236,    235,    241,    242,      1];
conec(    176,:)=[    176,    223,    222,    235,    236,      1];
conec(    177,:)=[    177,    206,    205,    222,    223,      1];
conec(    178,:)=[    178,    175,    174,    205,    206,      1];
conec(    179,:)=[    179,    235,    234,    240,    241,      1];
conec(    180,:)=[    180,    222,    221,    234,    235,      1];
conec(    181,:)=[    181,    205,    203,    221,    222,      1];
conec(    182,:)=[    182,    174,    173,    203,    205,      1];
conec(    183,:)=[    183,    234,    233,    239,    240,      1];
conec(    184,:)=[    184,    221,    220,    233,    234,      1];
conec(    185,:)=[    185,    203,    202,    220,    221,      1];
conec(    186,:)=[    186,    173,    171,    202,    203,      1];
conec(    187,:)=[    187,    140,    139,    173,    174,      1];
conec(    188,:)=[    188,    113,    112,    139,    140,      1];
conec(    189,:)=[    189,    139,    138,    171,    173,      1];
conec(    190,:)=[    190,    112,    111,    138,    139,      1];
conec(    191,:)=[    191,    112,     96,     95,    111,      1];
conec(    192,:)=[    192,    113,     97,     96,    112,      1];
conec(    193,:)=[    193,     96,     81,     80,     95,      1];
conec(    194,:)=[    194,     97,     82,     81,     96,      1];
conec(    195,:)=[    195,     81,     70,     69,     80,      1];
conec(    196,:)=[    196,     82,     71,     70,     81,      1];
conec(    197,:)=[    197,     70,     60,     59,     69,      1];
conec(    198,:)=[    198,     71,     61,     60,     70,      1];
conec(    199,:)=[    199,     51,     50,     60,     61,      1];
conec(    200,:)=[    200,     43,     42,     50,     51,      1];
conec(    201,:)=[    201,     50,     49,     59,     60,      1];
conec(    202,:)=[    202,     42,     41,     49,     50,      1];
conec(    203,:)=[    203,    167,    184,    189,    172,      1];
conec(    204,:)=[    204,    167,    172,    161,    156,      1];
conec(    205,:)=[    205,    167,    156,    151,    162,      1];
conec(    206,:)=[    206,    167,    162,    178,    184,      1];
conec(    207,:)=[    207,    145,    136,    151,    156,      1];
conec(    208,:)=[    208,    145,    156,    161,    153,      1];
conec(    209,:)=[    209,    145,    153,    141,    132,      1];
conec(    210,:)=[    210,    145,    132,    125,    136,      1];
conec(    211,:)=[    211,    131,    147,    151,    136,      1];
conec(    212,:)=[    212,    131,    136,    125,    116,      1];
conec(    213,:)=[    213,    131,    116,    103,    128,      1];
conec(    214,:)=[    214,    131,    128,    150,    147,      1];
conec(    215,:)=[    215,    105,     94,     99,    107,      1];
conec(    216,:)=[    216,    105,    107,    122,    115,      1];
conec(    217,:)=[    217,    105,    115,    103,     91,      1];
conec(    218,:)=[    218,    105,     91,     88,     94,      1];
conec(    219,:)=[    219,    161,    172,    164,    153,      1];
conec(    220,:)=[    220,    189,    166,    164,    172,      1];
conec(    221,:)=[    221,    141,    153,    164,    166,      1];
conec(    222,:)=[    222,    178,    162,    157,    165,      1];
conec(    223,:)=[    223,    151,    147,    157,    162,      1];
conec(    224,:)=[    224,    150,    165,    157,    147,      1];
conec(    225,:)=[    225,     87,     90,     89,     86,      1];
conec(    226,:)=[    226,     99,     94,     89,     90,      1];
conec(    227,:)=[    227,     88,     86,     89,     94,      1];
conec(    228,:)=[    228,    103,    115,    126,    128,      1];
conec(    229,:)=[    229,    122,    134,    126,    115,      1];
conec(    230,:)=[    230,    150,    128,    126,    134,      1];
for i=1:nelec
    fele{i}='elesup';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir=     24;
%                       1           2        3         4           5        6        7
%                 ElemID       Nod1   Nod2 alpha      As      Sx    mat
```

```
XStir(     1,:)=[     247,      43,      38,   0,      78.54,     150, 3];
XStir(     2,:)=[     248,      38,      33,   0,      78.54,     150, 3];
XStir(     3,:)=[     249,      33,      28,   0,      78.54,     150, 3];
XStir(     4,:)=[     250,      28,      23,   0,      78.54,     150, 3];
XStir(     5,:)=[     251,      23,      18,   0,      78.54,     150, 3];
XStir(     6,:)=[     252,      18,      13,   0,      78.54,     150, 3];
XStir(     7,:)=[     253,      13,       7,   0,      78.54,     150, 3];
XStir(     8,:)=[     254,       7,       3,   0,      78.54,     150, 3];
XStir(     9,:)=[     255,     261,     256,   0,      78.54,     150, 3];
XStir(     10,:)=[    256,     256,     251,   0,      78.54,     150, 3];
XStir(     11,:)=[    257,     251,     246,   0,      78.54,     150, 3];
XStir(     12,:)=[    258,     246,     241,   0,      78.54,     150, 3];
XStir(     13,:)=[    259,     113,      97,   0,      78.54,     150, 3];
XStir(     14,:)=[    260,      97,      82,   0,      78.54,     150, 3];
XStir(     15,:)=[    261,      82,      71,   0,      78.54,     150, 3];
XStir(     16,:)=[    262,      71,      61,   0,      78.54,     150, 3];
XStir(     17,:)=[    263,     241,     235,   0,      78.54,     150, 3];
XStir(     18,:)=[    264,     235,     222,   0,      78.54,     150, 3];
XStir(     19,:)=[    265,     222,     205,   0,      78.54,     150, 3];
XStir(     20,:)=[    266,     205,     174,   0,      78.54,     150, 3];
XStir(     21,:)=[    267,     174,     140,   0,      78.54,     150, 3];
XStir(     22,:)=[    268,     140,     113,   0,      78.54,     150, 3];
XStir(     23,:)=[    269,      61,      51,   0,      78.54,     150, 3];
XStir(     24,:)=[    270,      51,      43,   0,      78.54,     150, 3];
for i=nelec+1:nelec+nstir
    fele{i}='elelin';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir2=16;
XStir2(  1,:)=[ 231, 217, 212, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  2,:)=[ 232, 212, 200, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  3,:)=[ 233, 200, 187, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  4,:)=[ 234, 187, 163, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  5,:)=[ 235, 163, 137, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  6,:)=[ 236, 137, 119, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  7,:)=[ 237, 119, 100, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  8,:)=[ 238, 100,  87, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2(  9,:)=[ 239,  87,  86, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2( 10,:)=[ 240,  86,  88, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2( 11,:)=[ 241,  88,  91, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2( 12,:)=[ 242,  91, 103, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2( 13,:)=[ 243, 103, 116, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2( 14,:)=[ 244, 116, 125, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2( 15,:)=[ 245, 125, 132, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
XStir2( 16,:)=[ 246, 132, 141, 0.451633441, 12.5663 200, -0.451633441, 12.5663 200, 2];
for i=nelec+nstir+1:nelec+nstir+nstir2
    fele{i}='elelin2';
end


%7. Longitudinal Reinforcements (along element's axis)
%Numero de barras longitudinales
nbar= 8;
%                 1     2    3
%               NodID  As    mat
XReBar( 1,:)=[     23,  78.54,3];
XReBar( 2,:)=[     61,  78.54,3];
XReBar( 3,:)=[     87,  50.27,2];
XReBar( 4,:)=[    113,  78.54,3];
XReBar( 5,:)=[    141,  50.27,2];
XReBar( 6,:)=[    178,  78.54,3];
XReBar( 7,:)=[    217,  50.27,2];
XReBar( 8,:)=[    241,  78.54,3];
for i=nelec+nstir+nstir2+1:nelec+nstir+nstir2+nbar
    fele{i}='elepoint';
end

return
```

5. tegran.m (abreujat)

```
%1. Section's name
PName='section1';

%1.1. Allowed degrees of freedom for warp-distortion
ADOF=[1,1,1]';

%2. Reference position of the bar's axis
r0=[           75,           197.4137931]';

%3. Materials definition
%number of materials
nmat=      3;
mat{      1}.name='H30';
mat{      1}.fname='OU3DC';
mat{1}.prop.fc=35.;
mat{1}.prop.e0=0.0022;
mat{1}.prop.E0=3e4;
mat{1}.prop.nu=0.2;
mat{1}.prop.epres=zeros(6,1);
mat{1}.prop.ft_=0.1;
mat{1}.prop.fbc_=1.5;
mat{1}.prop.ksi1_=3.67;
mat{1}.prop.r1_=1.59;
mat{1}.prop.ksi2_=3.67;
mat{1}.prop.r2_=1.94;
mat{1}.prop.bbcurveC='CoPor';%mat{1}.prop.bbcurveC='ParSq';
mat{1}.prop.bbcurveT='Cervk';
mat{1}.prop.surface='FSWilliam_Warnke5P';

%material 2: acero celosia
mat{2}.name='B500';;
mat{2}.fname='BilPlaCyclic';
mat{2}.prop.fy=778;
mat{2}.prop.E0=2e5;
mat{2}.prop.E1=2e1;
mat{2}.prop.epres=0;

%material 3: acero longitudinal
mat{3}.name='B500';;
mat{3}.fname='BilPlaCyclic';
mat{3}.prop.fy=661;
mat{3}.prop.E0=2e5;
mat{3}.prop.E1=2e1;
mat{3}.prop.epres=0;


%4. Coordinates
%number of nodes
nnod=    303;
%                         1             2
%                         Y             Z
coord(      1,:)=[         425,         300];
coord(      2,:)=[         425,         290];
```

(… s'obvia la resta de la matriu de coordenades)

```
%5. Concrete elements' conections
%Number of concrete elements
nelec=    260;
%                        1       2       3       4       5       6
%                       ID      N1      N2      N3      N4   propc
conec(      1,:)=[       1,    168,    138,    133,    166,       1];
conec(      2,:)=[       2,    168,    166,    201,    203,       1];
```

(… s'obvia la resta de la matriu de connectivitats)

```
for i=1:nelec
    fele{i}='elesup';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir=     24;
%                    1       2       3         4            5              6         7
%                 ElemID    Nod1    Nod2     alpha          As             Sx        mat
XStir(     1,:)=[    285,     43,     38,         0,          78.54,         150,      3];
XStir(     2,:)=[    286,     38,     33,         0,          78.54,         150,      3];
XStir(     3,:)=[    287,     33,     28,         0,          78.54,         150,      3];
XStir(     4,:)=[    288,     28,     23,         0,          78.54,         150,      3];
XStir(     5,:)=[    289,     23,     18,         0,          78.54,         150,      3];
XStir(     6,:)=[    290,     18,     13,         0,          78.54,         150,      3];
XStir(     7,:)=[    291,     13,      7,         0,          78.54,         150,      3];
XStir(     8,:)=[    292,      7,      3,         0,          78.54,         150,      3];
XStir(     9,:)=[    293,    291,    286,         0,          78.54,         150,      3];
XStir(     10,:)=[    294,    286,    281,         0,          78.54,         150,      3];
XStir(     11,:)=[    295,    281,    276,         0,          78.54,         150,      3];
XStir(     12,:)=[    296,    276,    271,         0,          78.54,         150,      3];
XStir(     13,:)=[    297,    133,    113,         0,          78.54,         150,      3];
XStir(     14,:)=[    298,    113,     83,         0,          78.54,         150,      3];
XStir(     15,:)=[    299,     83,     75,         0,          78.54,         150,      3];
XStir(     16,:)=[    300,     75,     65,         0,          78.54,         150,      3];
XStir(     17,:)=[    301,    271,    265,         0,          78.54,         150,      3];
XStir(     18,:)=[    302,    265,    252,         0,          78.54,         150,      3];
XStir(     19,:)=[    303,    252,    233,         0,          78.54,         150,      3];
XStir(     20,:)=[    304,    233,    201,         0,          78.54,         150,      3];
XStir(     21,:)=[    305,    201,    166,         0,          78.54,         150,      3];
XStir(     22,:)=[    306,    166,    133,         0,          78.54,         150,      3];
XStir(     23,:)=[    307,     65,     51,         0,          78.54,         150,      3];
XStir(     24,:)=[    308,     51,     43,         0,          78.54,         150,      3];
for i=nelec+1:nelec+nstir
    fele{i}='elelin';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir2=24;
XStir2( 1,:)=[ 261, 247, 243,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 2,:)=[ 262, 243, 238,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 3,:)=[ 263, 238, 224,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 4,:)=[ 264, 224, 212,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 5,:)=[ 265, 212, 189,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 6,:)=[ 266, 189, 171,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 7,:)=[ 267, 171, 152,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 8,:)=[ 268, 152, 135,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 9,:)=[ 269, 135, 123,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 10,:)=[ 270, 123, 107, 0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 11,:)=[ 271, 107, 99,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 12,:)=[ 272, 99,  91,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 13,:)=[ 273, 91,  87,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 14,:)=[ 274, 87,  85,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 15,:)=[ 275, 85,  84,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 16,:)=[ 276, 84,  88,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 17,:)=[ 277, 88,  97,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 18,:)=[ 278, 97, 103,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 19,:)=[ 279, 103, 119, 0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 20,:)=[ 280, 119, 128, 0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 21,:)=[ 281, 128, 142, 0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 22,:)=[ 282, 142, 151, 0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 23,:)=[ 283, 151, 161, 0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 24,:)=[ 284, 161, 167, 0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
for i=nelec+nstir+1:nelec+nstir+nstir2
 fele{i}='elelin2';
end

%7. Longitudinal Reinforcements (along element's axis)
%Numero de barras longitudinales
nbar=      8;
%                              1           2        3
```

```
%                                   NodID        As        mat
XReBar(      1,:)=[     23,        78.54,3];
XReBar(      2,:)=[     65,        78.54,3];
XReBar(      3,:)=[     91,        50.27,2];
XReBar(      4,:)=[    133,        78.54,3];
XReBar(      5,:)=[    167,        50.27,2];
XReBar(      6,:)=[    206,        78.54,3];
XReBar(      7,:)=[    247,        50.27,2];
XReBar(      8,:)=[    271,        78.54,3];


for i=nelec+nstir+nstir2+1:nelec+nstir+nstir2+nbar
    fele{i}='elepoint';
end

return
```

6. Tearpetit (abreujat)

```
%1. Section's name
PName='section1';

%1.1. Allowed degrees of freedom for warp-distortion
ADOF=[1,1,1]';

%2. Reference position of the bar's axis
r0=[           75,           197.162]';

%3. Materials definition
%number of materials
nmat=      3;
mat{      1}.name='H30';
mat{      1}.fname='OU3DC';
mat{1}.prop.fc=35.;
mat{1}.prop.e0=0.0022;
mat{1}.prop.E0=3e4;
mat{1}.prop.nu=0.2;
mat{1}.prop.epres=zeros(6,1);
mat{1}.prop.ft_=0.1;
mat{1}.prop.fbc_=1.5;
mat{1}.prop.ksi1_=3.67;
mat{1}.prop.r1_=1.59;
mat{1}.prop.ksi2_=3.67;
mat{1}.prop.r2_=1.94;
mat{1}.prop.bbcurveC='CoPor';%mat{1}.prop.bbcurveC='ParSq';
mat{1}.prop.bbcurveT='Cervk';
mat{1}.prop.surface='FSWilliam_Warnke5P';

%material 2: acero celosia
mat{2}.name='B500';;
mat{2}.fname='BilPlaCyclic';
mat{2}.prop.fy=809;
mat{2}.prop.E0=2e5;
mat{2}.prop.E1=2e1;
mat{2}.prop.epres=0;

%material 3: acero longitudinal
mat{3}.name='B500';;
mat{3}.fname='BilPlaCyclic';
mat{3}.prop.fy=588;
mat{3}.prop.E0=2e5;
mat{3}.prop.E1=2e1;
mat{3}.prop.epres=0;

%4. Coordinates
%number of nodes
nnod=    389;
```

```
%                       1               2
%                       Y               Z

coord(      1,:)=[          425,          300];
coord(      2,:)=[          425,          290];
```

(… s'obvia la resta de la matriu de coordenades)

```
%5. Concrete elements' conections
%Number of concrete elements
nelec=    338;
%                       1       2       3       4       5       6
%                      ID      N1      N2      N3      N4   propc
conec(      1,:)=[      1,    356,    351,    350,    355,      1];
conec(      2,:)=[      2,    357,    352,    351,    356,      1];
```

(… s'obvia la resta de la matriu de connectivitats)

```
for i=1:nelec
    fele{i}='elesup';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir=     32;
%                       1       2       3         4                5            6        7
%                  ElemID    Nod1    Nod2     alpha               As           Sx      mat
XStir(     01,:)=[    359,     23,     18,         0,          78.54,          150,      3];
XStir(     02,:)=[    360,     18,     13,         0,          78.54,          150,      3];
XStir(     03,:)=[    361,     13,      7,         0,          78.54,          150,      3];
XStir(     04,:)=[    362,      7,      3,         0,          78.54,          150,      3];
XStir(     05,:)=[    363,    377,    372,         0,          78.54,          150,      3];
XStir(     06,:)=[    364,    372,    367,         0,          78.54,          150,      3];
XStir(     07,:)=[    365,    367,    362,         0,          78.54,          150,      3];
XStir(     08,:)=[    366,    362,    357,         0,          78.54,          150,      3];
XStir(     09,:)=[    367,    175,    158,         0,          78.54,          150,      3];
XStir(     10,:)=[    368,    158,    137,         0,          78.54,          150,      3];
XStir(     11,:)=[    369,    137,    123,         0,          78.54,          150,      3];
XStir(     12,:)=[    370,    123,    111,         0,          78.54,          150,      3];
XStir(     13,:)=[    371,    244,    203,         0,          78.54,          150,      3];
XStir(     14,:)=[    372,    203,    175,         0,          78.54,          150,      3];
XStir(     15,:)=[    373,    111,     94,         0,          78.54,          150,      3];
XStir(     16,:)=[    374,     94,     75,         0,          78.54,          150,      3];
XStir(     17,:)=[    375,    323,    335,         0,          78.54,          150,      3];
XStir(     18,:)=[    376,    335,    346,         0,          78.54,          150,      3];
XStir(     19,:)=[    377,    346,    352,         0,          78.54,          150,      3];
XStir(     20,:)=[    378,    352,    357,         0,          78.54,          150,      3];
XStir(     21,:)=[    379,    244,    268,         0,          78.54,          150,      3];
XStir(     22,:)=[    380,    268,    295,         0,          78.54,          150,      3];
XStir(     23,:)=[    381,    295,    311,         0,          78.54,          150,      3];
XStir(     24,:)=[    382,    311,    323,         0,          78.54,          150,      3];
XStir(     25,:)=[    383,     43,     38,         0,          78.54,          150,      3];
XStir(     26,:)=[    384,     38,     33,         0,          78.54,          150,      3];
XStir(     27,:)=[    385,     33,     28,         0,          78.54,          150,      3];
XStir(     28,:)=[    386,     28,     23,         0,          78.54,          150,      3];
XStir(     29,:)=[    387,     43,     51,         0,          78.54,          150,      3];
XStir(     30,:)=[    388,     51,     59,         0,          78.54,          150,      3];
XStir(     31,:)=[    389,     59,     67,         0,          78.54,          150,      3];
XStir(     32,:)=[    390,     67,     75,         0,          78.54,          150,      3];
for i=nelec+1:nelec+nstir
    fele{i}='elelin';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir2=20;
XStir2(  1,:)=[ 339, 328, 318, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2(  2,:)=[ 340, 318, 303, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2(  3,:)=[ 341, 303, 281, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2(  4,:)=[ 342, 281, 249, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2(  5,:)=[ 343, 249, 218, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2(  6,:)=[ 344, 218, 193, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2(  7,:)=[ 345, 193, 180, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
```

```
XStir2(  8,:)=[ 346, 180, 166, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2(  9,:)=[ 347, 166, 153, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 10,:)=[ 348, 153, 144, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 11,:)=[ 349, 144, 142, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 12,:)=[ 350, 142, 143, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 13,:)=[ 351, 143, 145, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 14,:)=[ 352, 145, 149, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 15,:)=[ 353, 149, 161, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 16,:)=[ 354, 161, 169, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 17,:)=[ 355, 169, 179, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 18,:)=[ 356, 179, 187, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 19,:)=[ 357, 187, 196, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
XStir2( 20,:)=[ 358, 196, 204, 0.451633441,  12.5663 200, -0.451633441,  12.5663 200, 2];
for i=nelec+nstir+1:nelec+nstir+nstir2
 fele{i}='elelin2';
end


%7. Longitudinal Reinforcements (along element's axis)
%Numero de barras longitudinales
nbar=      8;
%                        1        2     3
%                    NodID        As    mat
XReBar(      1,:)=[     23,       78.54,3];
XReBar(      2,:)=[    111,       78.54,3];
XReBar(      3,:)=[    144,       50.27,2];
XReBar(      4,:)=[    175,       78.54,3];
XReBar(      5,:)=[    204,       50.27,2];
XReBar(      6,:)=[    250,       78.54,3];
XReBar(      7,:)=[    328,       50.27,2];
XReBar(      8,:)=[    357,       78.54,3];
for i=nelec+nstir+nstir2+1:nelec+nstir+nstir2+nbar
    fele{i}='elepoint';
end

return
```

7. Teargran.m (abreujat)

```
%1. Section's name
PName='section1';

%1.1. Allowed degrees of freedom for warp-distortion
ADOF=[1,1,1]';

%2. Reference position of the bar's axis
r0=[           75,           197.162]';

%3. Materials definition
%number of materials
nmat=      3;
mat{      1}.name='H30';
mat{      1}.fname='OU3DC';
mat{1}.prop.fc=35.;
mat{1}.prop.e0=0.0022;
mat{1}.prop.E0=3e4;
mat{1}.prop.nu=0.2;
mat{1}.prop.epres=zeros(6,1);
mat{1}.prop.ft_=0.1;
mat{1}.prop.fbc_=1.5;
mat{1}.prop.ksi1_=3.67;
mat{1}.prop.r1_=1.59;
mat{1}.prop.ksi2_=3.67;
mat{1}.prop.r2_=1.94;
mat{1}.prop.bbcurveC='CoPor';%mat{1}.prop.bbcurveC='ParSq';
mat{1}.prop.bbcurveT='Cervk';
mat{1}.prop.surface='FSWilliam_Warnke5P';
```

```
%material 2: acero celosia
mat{2}.name='B500';;
mat{2}.fname='BilPlaCyclic';
mat{2}.prop.fy=778;
mat{2}.prop.E0=2e5;
mat{2}.prop.E1=2e1;
mat{2}.prop.epres=0;

%material 3: acero longitudinal
mat{3}.name='B500';;
mat{3}.fname='BilPlaCyclic';
mat{3}.prop.fy=661;
mat{3}.prop.E0=2e5;
mat{3}.prop.E1=2e1;
mat{3}.prop.epres=0;

%4. Coordinates
%number of nodes
nnod=    411;
%                        1               2
%                        Y               Z
coord(      1,:)=[         425,          300];
coord(      2,:)=[         425,          290];
```

(… s'obvia la resta de la matriu de coordenades)

```
%5. Concrete elements' conections
%Number of concrete elements
nelec=    360;
%                       1        2        3        4        5        6
%                    ID         N1       N2       N3       N4       propc
conec(      1,:)=[      1,     380,     375,     374,     379,       1];
conec(      2,:)=[      2,     381,     376,     375,     380,       1];
```

(… s'obvia la resta de la matriu de connectivitats)

```
for i=1:nelec
    fele{i}='elesup';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir=     32;
%                    1        2        3           4            5              6       7
%                 ElemID    Nod1     Nod2       alpha            As            Sx     mat
XStir(     1,:)=[    385,     23,      18,           0,         78.54,         150,      3];
XStir(     2,:)=[    386,     18,      13,           0,         78.54,         150,      3];
XStir(     3,:)=[    387,     13,       7,           0,         78.54,         150,      3];
XStir(     4,:)=[    388,      7,       3,           0,         78.54,         150,      3];
XStir(     5,:)=[    389,    399,     394,           0,         78.54,         150,      3];
XStir(     6,:)=[    390,    394,     389,           0,         78.54,         150,      3];
XStir(     7,:)=[    391,    389,     384,           0,         78.54,         150,      3];
XStir(     8,:)=[    392,    384,     379,           0,         78.54,         150,      3];
XStir(     9,:)=[    393,    187,     167,           0,         78.54,         150,      3];
XStir(     10,:)=[    394,    167,     137,           0,         78.54,         150,      3];
XStir(     11,:)=[    395,    137,     128,           0,         78.54,         150,      3];
XStir(     12,:)=[    396,    128,     114,           0,         78.54,         150,      3];
XStir(     13,:)=[    397,    379,     374,           0,         78.54,         150,      3];
XStir(     14,:)=[    398,    374,     368,           0,         78.54,         150,      3];
XStir(     15,:)=[    399,    368,     357,           0,         78.54,         150,      3];
XStir(     16,:)=[    400,    357,     345,           0,         78.54,         150,      3];
XStir(     17,:)=[    401,    265,     224,           0,         78.54,         150,      3];
XStir(     18,:)=[    402,    224,     187,           0,         78.54,         150,      3];
XStir(     19,:)=[    403,    114,      95,           0,         78.54,         150,      3];
XStir(     20,:)=[    404,     95,      74,           0,         78.54,         150,      3];
XStir(     21,:)=[    405,     23,      28,           0,         78.54,         150,      3];
XStir(     22,:)=[    406,     28,      33,           0,         78.54,         150,      3];
XStir(     23,:)=[    407,     33,      38,           0,         78.54,         150,      3];
XStir(     24,:)=[    408,     38,      43,           0,         78.54,         150,      3];
XStir(     25,:)=[    409,     74,      67,           0,         78.54,         150,      3];
```

```
XStir(     26,:)=[    410,     67,     59,          0,         78.54,         150,      3];
XStir(     27,:)=[    411,     59,     51,          0,         78.54,         150,      3];
XStir(     28,:)=[    412,     51,     43,          0,         78.54,         150,      3];
XStir(     29,:)=[    413,    345,    333,          0,         78.54,         150,      3];
XStir(     30,:)=[    414,    333,    315,          0,         78.54,         150,      3];
XStir(     31,:)=[    415,    315,    290,          0,         78.54,         150,      3];
XStir(     32,:)=[    416,    290,    265,          0,         78.54,         150,      3];
for i=nelec+1:nelec+nstir
    fele{i}='elelin';
end

%6. Transversal Reinforcements (in-plane reinforcements)
%Numero de elementos de estribos
nstir2=24;
XStir2(  1,:)=[ 361,350,  340,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  2,:)=[ 362, 340, 328,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  3,:)=[ 363, 328, 308,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  4,:)=[ 364, 308, 283,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  5,:)=[ 365, 283, 251,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  6,:)=[ 366, 251, 229,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  7,:)=[ 367, 229, 205,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  8,:)=[ 368, 205, 188,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2(  9,:)=[ 369, 188, 176,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 10,:)=[ 370, 176, 162,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 11,:)=[ 371, 162, 153,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 12,:)=[ 372, 153, 145,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 13,:)=[ 373, 145, 141,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 14,:)=[ 374, 141, 139,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 15,:)=[ 375, 139, 138,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 16,:)=[ 376, 138, 142,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 17,:)=[ 377, 142, 150,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 18,:)=[ 378, 150, 157,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 19,:)=[ 379, 157, 172,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 20,:)=[ 380, 172, 183,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 21,:)=[ 381, 183, 194,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 22,:)=[ 382, 194, 204,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 23,:)=[ 383, 204, 215,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
XStir2( 24,:)=[ 384, 215, 225,  0.409351919,  12.5663 200, -0.409351919,  12.5663 200, 2];
for i=nelec+nstir+1:nelec+nstir+nstir2
 fele{i}='elelin2';
end


%7. Longitudinal Reinforcements (along element's axis)
%Numero de barras longitudinales
nbar= 8;
% 1   2   3
% NodID   As   mat
XReBar( 1,:)=[ 23,  78.54,3];
XReBar( 2,:)=[ 114,  78.54,3];
XReBar( 3,:)=[ 145,  50.27,2];
XReBar( 4,:)=[ 187,  78.54,3];
XReBar( 5,:)=[ 225,  50.27,2];
XReBar( 6,:)=[ 272,  78.54,3];
XReBar( 7,:)=[ 350,  50.27,2];
XReBar( 8,:)=[ 379,  78.54,3];
for i=nelec+nstir+nstir2+1:nelec+nstir+nstir2+nbar
 fele{i}='elepoint';
end

return
```

8. Tinsa_te*.m

```
tepetit; %tearpetit; tegran; teargran; (aquí cal executar el fitxer amb la malla que toqui)
conecc={conec(:,2:6);XStir(:,2:7);XStir2(:,2:10);XReBar};

c=-1.5395e-006;
rampc=[0.125:0.125:1,1.1:0.1:3];
rampc=[rampc(1:18),2:0.1:3];
rampc=[rampc(1:23),2.4:0.1:3];
rampc=[rampc(1:24),2.5:0.1:3];
rampc=[rampc(1:30),3.1:0.1:4];
rampc=[rampc(1:40),4.1:0.1:5];
nstep=size(rampc,2);


for ibatch=2:2
 batchName=['tegran_out_',int2str(ibatch)];

restart=0;
istart=41;
stoprun=0;
istop=20;


if restart==0
 %new start
 clear ss ssos es Ks state mate mats
 state=cell(nstep,1);
 [section,state{1}]=buildtinsa2(ADOF,r0,coord,mat,conecc,fele);
 i0=1;
elseif restart==1
 i0=istart;
end



totaltime=0;
initime=0;
endtime=0;
if stoprun==1;
 iend=istop;
else
 iend=nstep;
end

disp(['--------------------------']);
disp(['TINSA']);
disp(['TOTAL INTERACTION NONLINEAR SECTION ANALYSIS' ]);
disp(['J. M. BAIRAN']);
disp(['ver 1.0.0 / october 2004']);
disp(['Analysis: ',batchName]);
disp(['from step: ',int2str(i0),' to step: ',int2str(iend)]);
disp(['--------------------------']);
disp(['press ENTER to begin analysis...']);
%pause;disp(' ');
disp(['begining...']);

for i=i0:iend
 if i==1
   state0=state{1};
 else
   state0=state{i-1};
 end

 boundc.nresq=5;
 boundc.dofresq=[1,2,3,4,5,6];
 boundc.valresq=[0,0,0,0,0,0];
 boundc.nresd=1;
 boundc.dofresd=[];
```

```
boundc.valresd=[];

param.maxinc=20;
param.incauto=1;
param.lamb(1)=0.3;
param.flmin=0.01;
param.iteropt=4;
param.itercoef=0.5;
param.maxiter=20;
param.Iq=0;
param.Id=0;
param.Ie=1;
param.bq=0.01;
param.bd=0.01;
param.be=0.01;
param.smallq=0.1;
param.smalld=1e-7;
param.smalle=1e-7;
L=1*sqrt(state0.Ag);iL=1/L;
param.Sq=[1,0,0,0,0,0;
  0,1,0,0,0,0;
  0,0,1,0,0,0;
  0,0,0,iL,0,0;
  0,0,0,0,iL,0;
  0,0,0,0,0,iL];
param.Sd=[1,0,0,0,0,0;
  0,1,0,0,0,0;
  0,0,1,0,0,0;
  0,0,0,L,0,0;
  0,0,0,0,L,0;
  0,0,0,0,0,L];

param.dcontrol.do=1;
param.dcontrol.igl=5;
param.dcontrol.val=c*rampc(i);
param.dcontrol.valresqbar=[0,0,1,0,350,0];

param.control=2;
param.tansec=2;
param.NR=0;
param.LS.do=0;



tic;
[ss{i},ssos{i},es{i},Ks{i},state{i},control,ok]=tinsa_3(boundc,section,state0,param);
steptime=toc;
totaltime=totaltime+steptime;

niter(i)=control.niter;
ninc(i)=control.ninc;

if ok==0
  disp(['--------------------------']);
  disp(['!NOT CONVERGED!']);
  disp(['iteration failed on step: ',int2str(i),' out of: ',int2str(iend)]);
  disp(['total number of iterations: ',int2str(niter(i))]);
  disp(['total number of increments: ',int2str(ninc(i))]);
  disp(['step time: ',num2str(steptime)]);
  break
else
  disp(['--------------------------']);
  disp(['converged on step: ',int2str(i),' out of: ',int2str(iend)]);
  disp(['total number of iterations: ',int2str(niter(i))]);
  disp(['total number of increments: ',int2str(ninc(i))]);
  disp(['step time: ',num2str(steptime)]);
end

j=i;
mate(:,j)=state{j}.es;
mats(:,j)=state{j}.ss;
```

```
 matdw(:,j)=state{j}.dw;
 dades_Ks{j}=state{j}.Ks;
 for k=1:nelec
  for m=1:4
   dades_mat{j,k}{m}.e=state{j}.ele{k}.mat{m}.e;
   dades_mat{j,k}{m}.s=state{j}.ele{k}.mat{m}.s;
   dades_mat{j,k}{m}.dt=state{j}.ele{k}.mat{m}.dt;
   dades_mat{j,k}{m}.fca=state{j}.ele{k}.mat{m}.fca;
  end
 end
   for k=nelec+1:nelec+nstir+nstir2+nbar
  dades_mat{j,k}=state{j}.ele{k}.mat;
   end

   state_new=state{i};
   save resultats mate mats matdw dades_Ks dades_mat control state_new;

end



if ok==1;
 disp(['--------------------------']);
 disp(['Analysis completed']);
 disp(['total time: ',num2str(totaltime)]);
 disp(['ok']);
 disp(['--------------------------']);
else
 disp(['--------------------------']);
 disp(['Analysis not completed']);
 disp(['total time: ',num2str(totaltime)]);
 disp(['--------------------------']);
end


save(batchName)


end %(end batch)
```