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% AER1403 Assignment 8 Q2

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E = 120*10^9;
nu = 0.3;
coords = [0.1 0.3 1.2 0.9; 1.3 0.4 0.1 1.1];

syms zeta eta;

N1 = 0.25*(1 - zeta)*(1 - eta);
N2 = 0.25*(1 + zeta)*(1 - eta);
N3 = 0.25*(1 + zeta)*(1 + eta);
N4 = 0.25*(1 - zeta)*(1 + eta);

J = 0.25*[eta-1 1-eta 1+eta -1-eta; zeta-1 -1-zeta 1+zeta
1-zeta]*[transpose(coords)];

D = (E/(1 - nu^2))*[1 nu 0; nu 1 0; 0 0 0.5*(1-nu)];

%Ae_1 = abs(0.5*det([0.1 1.3 1;0.3 0.4 1;0.9 1.1 1]));
%Ae_2 = abs(0.5*det([1.2 1.3 1;0.1 0.4 1;0.9 1.1 1]));
%Ae = Ae_1+Ae_2;

H_temp = inv(J)*[diff(N1,zeta) diff(N2,zeta) diff(N3,zeta) diff(N4,zeta);
diff(N1,eta) diff(N2,eta) diff(N3,eta) diff(N4,eta)];

H = ([H_temp(1,1) 0 H_temp(1,2) 0 H_temp(1,3) 0 H_temp(1,4) 0; 0 H_temp(2,1) 0
H_temp(2,2) 0 H_temp(2,3) 0 H_temp(2,4); H_temp(2,1) H_temp(1,1) H_temp(2,2)
H_temp(1,2) H_temp(2,3) H_temp(1,3) H_temp(2,4) H_temp(1,4)]);

K_temp = transpose(H)*D*H;

n_gp = [-0.7745966692 0 0.7745966692];
wts = [0.5555555556 0.8888888889 0.5555555556];

fin_K = zeros(size(K_temp));
for i =1:length(n_gp)
    for j = 1:length(n_gp)
        zeta = n_gp(i);
        wt_z = wts(i);

        eta = n_gp(j);
        wt_e = wts(j);

        fin_K = fin_K + wt_z*wt_e*subs(K_temp*det(J));
    end
end

K = double(fin_K)
```

----------Code
Ends----------

Stiffnes Matrix:

1.0e+11 *

0.4890	-0.0698	0.0718	-0.0559	-0.0909	0.1636	-0.4699	-0.0379
-0.0698	0.4312	-0.0229	-0.3410	0.1636	-0.0707	-0.0709	-0.0195
0.0718	-0.0229	1.0053	0.4222	-0.4355	-0.0628	-0.6415	-0.3366
-0.0559	-0.3410	0.4222	0.9220	-0.0298	0.0116	-0.3366	-0.5927
-0.0909	0.1636	-0.4355	-0.0298	0.4251	-0.0849	0.1013	-0.0489
0.1636	-0.0707	-0.0628	0.0116	-0.0849	0.3733	-0.0159	-0.3143
-0.4699	-0.0709	-0.6415	-0.3366	0.1013	-0.0159	1.0102	0.4234
-0.0379	-0.0195	-0.3366	-0.5927	-0.0489	-0.3143	0.4234	0.9265