Max load is Px = 131595 N using max stress

Max load is Px = -106428 N using Tsai Wu

Max load is Mx = 56.5544 Nm using max stress

Max load is Mx = 42.8641 Nm using Tsai Wu

Main:

clc;clear;

L=0.254;

W=0.254;

laminate = [138e9,9e9,6.9e9,0.3,0.0002,0,1448e6,1172e6,48.3e6,248e6,62.1e6,0,0,0,0,0,0;...

138e9,9e9,6.9e9,0.3,0.0002,30,1448e6,1172e6,48.3e6,248e6,62.1e6,0,0,0,0,0,0;...

138e9,9e9,6.9e9,0.3,0.0002,-30,1448e6,1172e6,48.3e6,248e6,62.1e6,0,0,0,0,0,0;...

138e9,9e9,6.9e9,0.3,0.0002,-30,1448e6,1172e6,48.3e6,248e6,62.1e6,0,0,0,0,0,0;...

138e9,9e9,6.9e9,0.3,0.0002,30,1448e6,1172e6,48.3e6,248e6,62.1e6,0,0,0,0,0,0;...

138e9,9e9,6.9e9,0.3,0.0002,0,1448e6,1172e6,48.3e6,248e6,62.1e6,0,0,0,0,0,0];

[PxMaxStress]=compositePlateFailureMaxStress(laminate,L,W);

[PxMaxTsaiWu]=compositePlateFailureTsaiWu(laminate,L,W);

fprintf('Max load is Px = %g N using max stress\n',PxMaxStress)

fprintf('Max load is Px = %g N using Tsai Wu\n',PxMaxTsaiWu)

[MxMaxStress]=compositePlateFailureMaxStressMx(laminate,L,W);

[MxMaxTsaiWu]=compositePlateFailureTsaiWuMx(laminate,L,W);

fprintf('Max load is Mx = %g Nm using max stress\n',MxMaxStress)

fprintf('Max load is Mx = %g Nm using Tsai Wu\n',MxMaxTsaiWu)

Functions:

function [PxMax]=compositePlateFailureMaxStress(laminate,L,W)

[~,~,~,~,~,~,longStrengthTen,longStrengthCom,tranStrengthTen,tranStrengthCom,strengthLT,~,~,~,~,~,~] = laminateReader(laminate);

Nx=1/W;

Ny=0;

Nxy=0;

Mx=0;

My=0;

Mxy=0;

[~,~,~,sigma1,sigma2,tau12,~,~,~,~,~,~]=forces2StressStrainLaminateNoPlot(laminate,Nx,Ny,Nxy,Mx,My,Mxy);

for i=2:2:length(sigma1)

PxTen1(i)=longStrengthTen(i/2)/sigma1(i);

PxCom1(i)=longStrengthCom(i/2)/sigma1(i);

PxTen2(i)=tranStrengthTen(i/2)/sigma2(i);

PxCom2(i)=tranStrengthCom(i/2)/sigma2(i);

Px12(i)=strengthLT(i/2)/tau12(i);

PxTen1(i-1)=longStrengthTen(i/2)/sigma1(i-1);

PxCom1(i-1)=longStrengthCom(i/2)/sigma1(i-1);

PxTen2(i-1)=tranStrengthTen(i/2)/sigma2(i-1);

PxCom2(i-1)=tranStrengthCom(i/2)/sigma2(i-1);

Px12(i-1)=strengthLT(i/2)/tau12(i-1);

end

PxTen1Max=min(PxTen1);

PxCom1Max=min(abs(PxCom1));

PxTen2Max=min(PxTen2);

PxCom2Max=min(abs(PxCom2));

Px12Max=min(abs(Px12));

PxMax=[PxTen1Max,PxCom1Max,PxTen2Max,PxCom2Max,Px12Max];

PxMax=min(abs(PxMax));

end

function [PxMaxTsaiWu]=compositePlateFailureTsaiWu(laminate,L,W)

[~,~,~,~,~,~,longStrengthTen,longStrengthCom,tranStrengthTen,tranStrengthCom,strengthLT,~,~,~,~,~,~] = laminateReader(laminate);

Nx=1/W;

Ny=0;

Nxy=0;

Mx=0;

My=0;

Mxy=0;

[~,~,~,sigma1,sigma2,tau12,~,~,~,~,~,~]=forces2StressStrainLaminateNoPlot(laminate,Nx,Ny,Nxy,Mx,My,Mxy);

for i=2:2:length(sigma1)

F11=1/(longStrengthTen(i/2)\*longStrengthCom(i/2));

F22=1/(tranStrengthTen(i/2)\*tranStrengthCom(i/2));

F66=1/strengthLT(i/2)^2;

F1=(1/longStrengthTen(i/2))-(1/longStrengthCom(i/2));

F2=(1/tranStrengthTen(i/2))-(1/tranStrengthCom(i/2));

C1=(F11\*sigma1(i)^2+F22\*sigma2(i)^2+F66\*tau12(i)^2);

C2=F1\*sigma1(i)+F2\*sigma2(i);

C3=-1;

C=[C1,C2,C3];

sol=roots(C);

PxMax(1,i)=sol(1);

PxMax(2,i)=sol(2);

C1=(F11\*sigma1(i-1)^2+F22\*sigma2(i-1)^2+F66\*tau12(i-1)^2);

C2=F1\*sigma1(i-1)+F2\*sigma2(i-1);

C3=-1;

C=[C1,C2,C3];

sol=roots(C);

PxMax(1,i-1)=sol(1);

PxMax(2,i-1)=sol(2);

end

[PxMaxTsaiWu,I]=min(abs(PxMax),[],'all','linear');

PxMaxTsaiWu=PxMax(I);

end

function [MxMax]=compositePlateFailureMaxStressMx(laminate,L,W)

[~,~,~,~,~,~,longStrengthTen,longStrengthCom,tranStrengthTen,tranStrengthCom,strengthLT,~,~,~,~,~,~] = laminateReader(laminate);

Nx=0;

Ny=0;

Nxy=0;

Mx=1/W;

My=0;

Mxy=0;

[~,~,~,sigma1,sigma2,tau12,~,~,~,~,~,~]=forces2StressStrainLaminateNoPlot(laminate,Nx,Ny,Nxy,Mx,My,Mxy);

for i=2:2:length(sigma1)

PxTen1(i)=longStrengthTen(i/2)/sigma1(i);

PxCom1(i)=longStrengthCom(i/2)/sigma1(i);

PxTen2(i)=tranStrengthTen(i/2)/sigma2(i);

PxCom2(i)=tranStrengthCom(i/2)/sigma2(i);

Px12(i)=strengthLT(i/2)/tau12(i);

PxTen1(i-1)=longStrengthTen(i/2)/sigma1(i-1);

PxCom1(i-1)=longStrengthCom(i/2)/sigma1(i-1);

PxTen2(i-1)=tranStrengthTen(i/2)/sigma2(i-1);

PxCom2(i-1)=tranStrengthCom(i/2)/sigma2(i-1);

Px12(i-1)=strengthLT(i/2)/tau12(i-1);

end

PxTen1Max=min(PxTen1);

PxCom1Max=min(abs(PxCom1));

PxTen2Max=min(PxTen2);

PxCom2Max=min(abs(PxCom2));

Px12Max=min(abs(Px12));

MxMax=[PxTen1Max,PxCom1Max,PxTen2Max,PxCom2Max,Px12Max];

MxMax=min(abs(MxMax));

end

function [MxMaxTsaiWu]=compositePlateFailureTsaiWuMx(laminate,L,W)

[~,~,~,~,~,~,longStrengthTen,longStrengthCom,tranStrengthTen,tranStrengthCom,strengthLT,~,~,~,~,~,~] = laminateReader(laminate);

Nx=0;

Ny=0;

Nxy=0;

Mx=1/W;

My=0;

Mxy=0;

[~,~,~,sigma1,sigma2,tau12,~,~,~,~,~,~]=forces2StressStrainLaminateNoPlot(laminate,Nx,Ny,Nxy,Mx,My,Mxy);

for i=2:2:length(sigma1)

F11=1/(longStrengthTen(i/2)\*longStrengthCom(i/2));

F22=1/(tranStrengthTen(i/2)\*tranStrengthCom(i/2));

F66=1/strengthLT(i/2)^2;

F1=(1/longStrengthTen(i/2))-(1/longStrengthCom(i/2));

F2=(1/tranStrengthTen(i/2))-(1/tranStrengthCom(i/2));

C1=(F11\*sigma1(i)^2+F22\*sigma2(i)^2+F66\*tau12(i)^2);

C2=F1\*sigma1(i)+F2\*sigma2(i);

C3=-1;

C=[C1,C2,C3];

sol=roots(C);

MxMax(1,i)=sol(1);

MxMax(2,i)=sol(2);

C1=(F11\*sigma1(i-1)^2+F22\*sigma2(i-1)^2+F66\*tau12(i-1)^2);

C2=F1\*sigma1(i-1)+F2\*sigma2(i-1);

C3=-1;

C=[C1,C2,C3];

sol=roots(C);

MxMax(1,i-1)=sol(1);

MxMax(2,i-1)=sol(2);

end

[MxMaxTsaiWu,I]=min(abs(MxMax),[],'all','linear');

MxMaxTsaiWu=MxMax(I);

end