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%Analytical Truss
%Tau vs Lambda, who will win?

mu = 76.92e9; lam = 115.4e9;
nu = 0.3; Kap = (3*lam+2*mu)/3;

L = 1;
l = [1:0.01:1.5];

lambda = l./L;
epsilon = log(lambda);
J      = lambda.^(1-2*nu);

Tau_1 = mu.*lambda;
Tau_2 = mu.*lambda.*(1+2.*nu.*lambda.^(2*nu-1));

Cauchy1 = Tau_1./J;
Cauchy2 = Tau_2./J;

Cauchy3 = Kap.*(J-1)+mu.*J.^(-5/3)*(2/3).*lambda.^2;
Cauchy4 = lam.*log(lambda)+mu.*(lambda.^2 - 1);

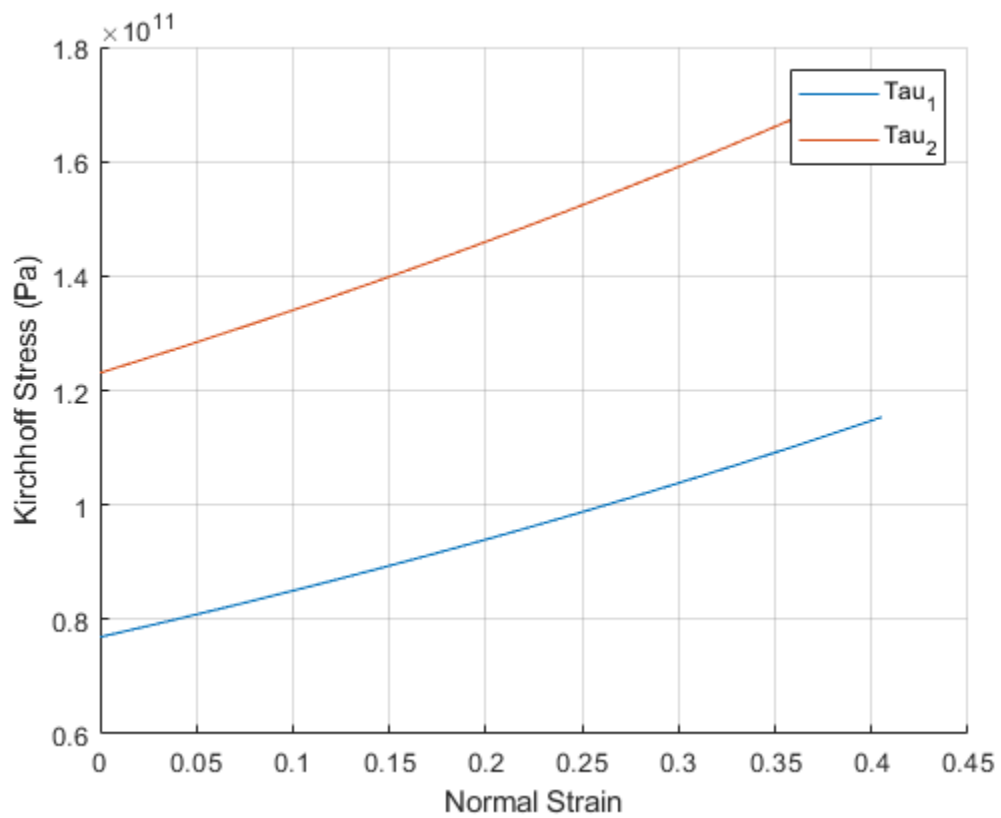
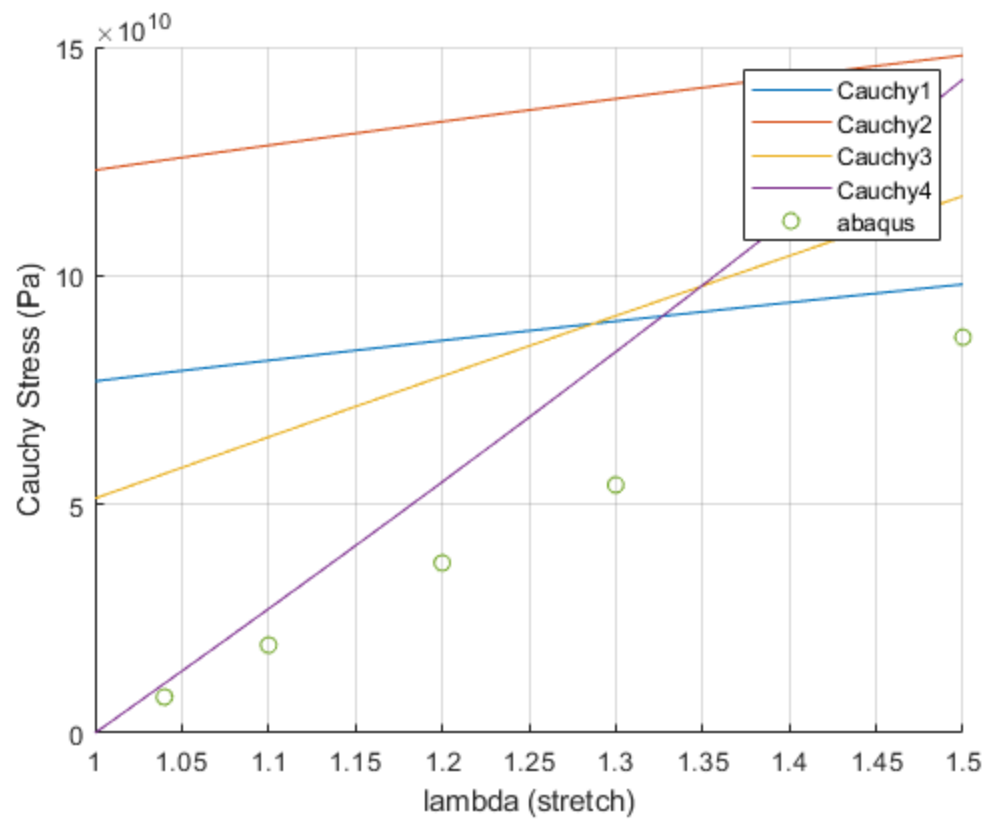
Ablam = [1.04 1.1 1.2 1.3 1.5];
Absig = [0.7865 1.921 3.718 5.425 8.654]*10^10;

figure();
hold on; grid on;
plot(lambda, Cauchy1, 'DisplayName','Cauchy1');
plot(lambda, Cauchy2, 'DisplayName','Cauchy2');
plot(lambda, Cauchy3, 'DisplayName','Cauchy3');
plot(lambda, Cauchy4, 'DisplayName','Cauchy4');
plot(Ablam, Absig, 'o', 'DisplayName', 'abaqus');
legend('show');
ylabel("Cauchy Stress (Pa)");
xlabel("lambda (stretch)");

figure();
hold on; grid on;
plot(epsilon, Tau_1, 'DisplayName','Tau_1');
plot(epsilon, Tau_2, 'DisplayName','Tau_2');
legend('show');
ylabel("Kirchhoff Stress (Pa)");
xlabel("Normal Strain");

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