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% Thomas Satterly
% AAE 550, HW 3
% Problem 4

close all;
clear;

options = aae550.hw3.p3.goptions([]);

% Gene encoding:
%
%      |   Beam 1   |   Beam 2   |   Beam 3   |
% x = [Material, Area, Material, Area, Material, Area]
% Area in [m^2]
minArea = 1e-9;
maxArea = 5e-4;
vlb = [1 minArea 1 minArea 1 minArea]; %Lower bound of each gene
vub = [4 maxArea 4 maxArea 4 maxArea]; %Upper bound of each gene
bits = [2 40 2 40 2 40]; % Number of bits describing each gene

l = sum(bits); % Chromosome length

% Basic guidelines for population and mutation rate
nPop = 4 * l;
pMutation = (1 + 1) / (2 * nPop * l);

% Set options
options(11) = nPop; % Set the population size
options(13) = pMutation; % Set the mutation probability
options(14) = 1e6; % Maximum number of generations

% Evaluate
pMult = 7e2; % Penalty multiplier
[x,fbest,stats,nfit,fgen,lgen,lfit]= aae550.hw3.p3.GA550(@(x)
    aae550.hw3.p4.evalTruss(x, pMult),[],options,vlb,vub,bits);

% Print results
resolution = (vub(2) - vlb(2)) / (2^bits(2));
fprintf('Cross sectional area resolution: %0.9f %sm^2 \n', resolution
    * 1e12, char(956));

disp(x)
[phi, g] = aae550.hw3.p4.evalTruss(x)
assert(all(g <= 0), 'Constraints violated!');
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