Solutions Matlab Optimization Assignment 1

4DM20 Engineering Optimization
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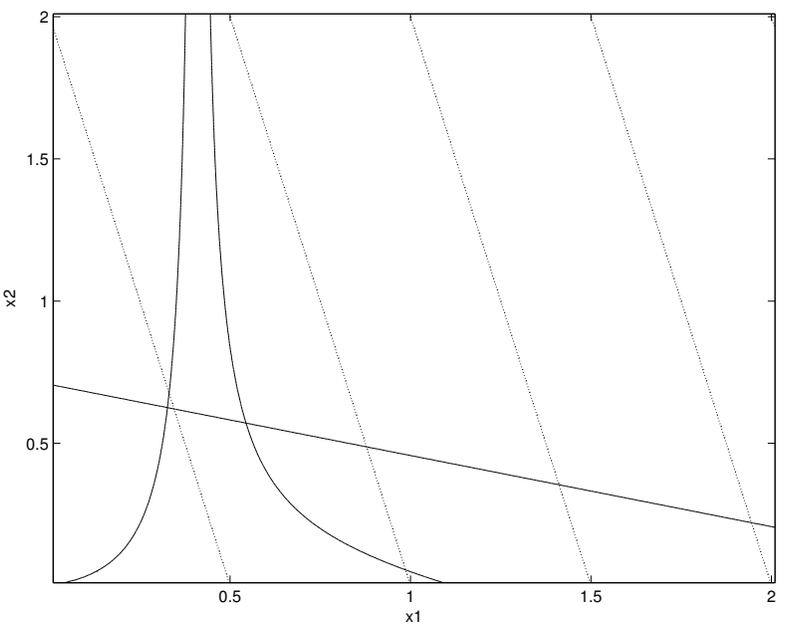
Questions

a) Note the storage of evaluations of objective function and constraints into matrices `F` , `g1`, `g2`, `g3`, `g4`, `g5`, and `g6`. Note that x_1 corresponds with rows, and x_2 with columns (see help of function `contour`). If the user provides the heights of the contour lines, one has to provide a vector of size larger than 1 (otherwise contour interprets the value provided as the number of contour lines instead). Therefore `[0 0]` is specified (ie two times contour line 0 is plotted for the constraints).

b) In the plot $g_6 = 0$ (left one), $g_1 = 0$ (middle one), and $g_2 = 0$ (straigth line) are visible. The contour lines 0 of the other constraints fall outside the plottted domain.



c) The minizer lies at the intersection of $g_1 = 0$ and $g_2 = 0$. These two constraints are active. The other constraints are dominated (e.g. g_1 dominates g_6.

d) See Exercise 4 of Exercises and Study Questions 1). Constraints g_1 and g_2 are convex; the others not convex. Thus the optimization problem is not convex over χ. How-

ever, since the active constraints g_1 and g_2 are convex, the feasible domain spanned by the active constraints is convex.

e) The main file becomes:

```
% GS1g.m

% Options using optimset
%options = optimset('fmincon');
%options = optimset(options,'Display','Iter')

% Options using optimoptions (latest Matlab versions)
options = optimoptions('fmincon');
options = optimoptions(options,'Display','Iter')


% Initial guess
x0 = [2.0 2.0];

% Lower and upper bounds
lb = [0.00001 0.00001];
ub = [inf inf];

[x,fval,exitflag,output,lambda,grad]=...
    fmincon(@objfunGS1,x0,[],[],[],[],lb,ub,@confunGS1,options);

x
fval
exitflag
```

The m-file containing the objective function:

```
function f = objfunGS1(x)
% objfunASG1.m

% Design variable values
x1= x(1);
x2= x(2);

% Objective function
f = 4*x1 + x2;
```

The m-file containing the constraint functions:

```
function [g,h] = confunGS1(x)
% confunASG1.m

% Design variables
x1 = x(1);
x2 = x(2);

% Stresses
```

```
s1 = 0.5*sqrt(2)*( sqrt(3)./(3*x1) + 1./(x1+4*x2) );
s2 = 2*sqrt(2)./(x1+4*x2);
s3 = 0.5*sqrt(2)*(-sqrt(3)./(3*x1) + 1./(x1+4*x2) );

% Constraints
g(1) = s1 - 1;
g(2) = s2 - 1;
g(3) = s3 - 1;
g(4) = -s1 - 1;
g(5) = -s2 - 1;
g(6) = -s3 - 1;
h = []; % no equality constraints
```