Problem Set 5

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Question 3

Matlab Code:

```
% Assuming densities and sensitivities are loaded or defined here
nelx = 1; nely = 20; volfrac = 0.3;
% Call the modified OC function
xnew = OC(nelx, nely, density, volfrac, sensitivity);
% Prepare the output matrix
outputMatrix = [density(:), sensitivity(:), xnew(:), xnew(:) - density(:)];
% Display the output matrix
disp('Densities, Sensitivities, NewDensities, Differences:');
for i = 1:size(outputMatrix, 1)
   fprintf('%10.4f %10.4f %10.4f %10.4f\n', outputMatrix(i, 1),
outputMatrix(i, 2), outputMatrix(i, 3), outputMatrix(i, 4));
end
% Optimality criteria function definition.
function [xnew]=OC(nelx, nely, x, volfrac, dc)
   l1 = 0; l2 = 100000; move = 0.25;
   while (l2-l1 > 1e-4)
       lmid = 0.5*(l2+l1);
       xnew = max(0.001, max(x-move, min(1., min(x+move,
x.*((-dc./lmid).^0.6)))));
       if sum(xnew(:)) - volfrac*nelx*nely > 0
           l1 = lmid;
       else
           l2 = lmid;
       end
   end
end
```

Output:

Densities, Sensitivities, NewDensities, Differences:

0.5612	-28.5839	0.4834	-0.0778
0.3201	-75.7200	0.4948	0.1746
0.0811	-75.3729	0.1250	0.0439
0.0873	-38.0446	0.0893	0.0020
0.1507	-56.7822	0.1959	0.0452
0.4919	-7.5854	0.2419	-0.2500
0.1488	-5.3950	0.0471	-0.1016
0.4764	-53.0798	0.5949	0.1185
0.1425	-77.9167	0.2240	0.0815
0.5437	-93.4011	0.7937	0.2500
0.2048	-12.9906	0.1099	-0.0949

0.1150	-56.8824	0.1497	0.0347
0.1469	-46.9391	0.1704	0.0235
0.3604	-1.1902	0.1104	-0.2500
0.2769	-33.7123	0.2633	-0.0136
0.2057	-16.2182	0.1261	-0.0796
0.4861	-79.4285	0.7361	0.2500
0.3424	-31.1215	0.3104	-0.0320
0.3216	-52.8533	0.4006	0.0790
0.5366	-16.5649	0.3332	-0.2034

Explanation:

The optimality criteria is updated based on the conditions given in the question to arrive at the updated density values. The damping factor is updated respectively in the code as well.