Topology Optimization Tutorial Report

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March 13, 2018

Problem 1

Using the default MMB-beam, Figure 1 illustrates the affects of the filter radius, Firgure 2 illustrates the affects of the penalty power, and Figure 3 illustrates the affects of the discretization.

Filter Radius

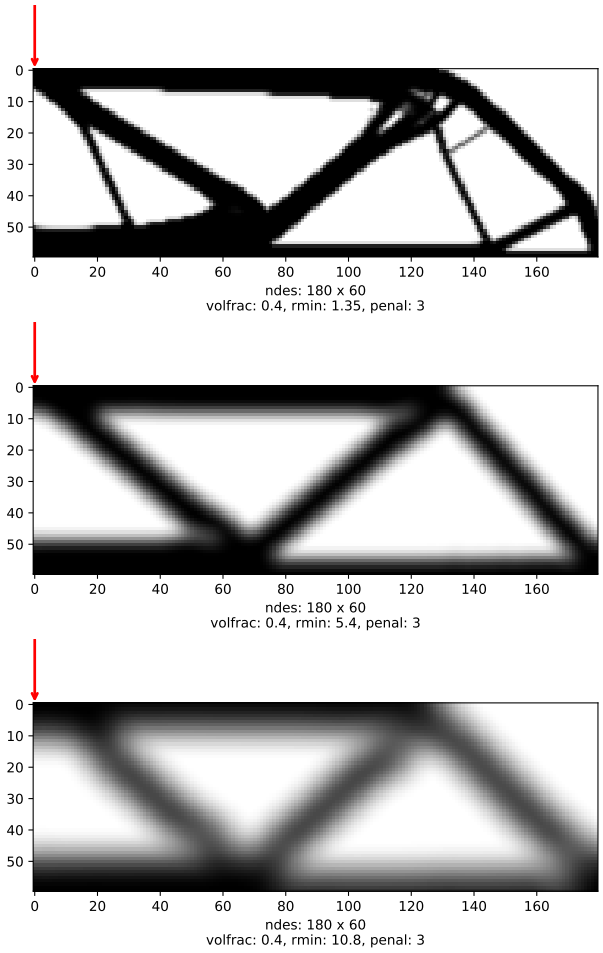

Figure 1: Differing values of rmin.

The filter radius affects how fine the details are. Decreasing the radius leads to finer structures. Increasing the radius produces softer densities.

Penalization Power

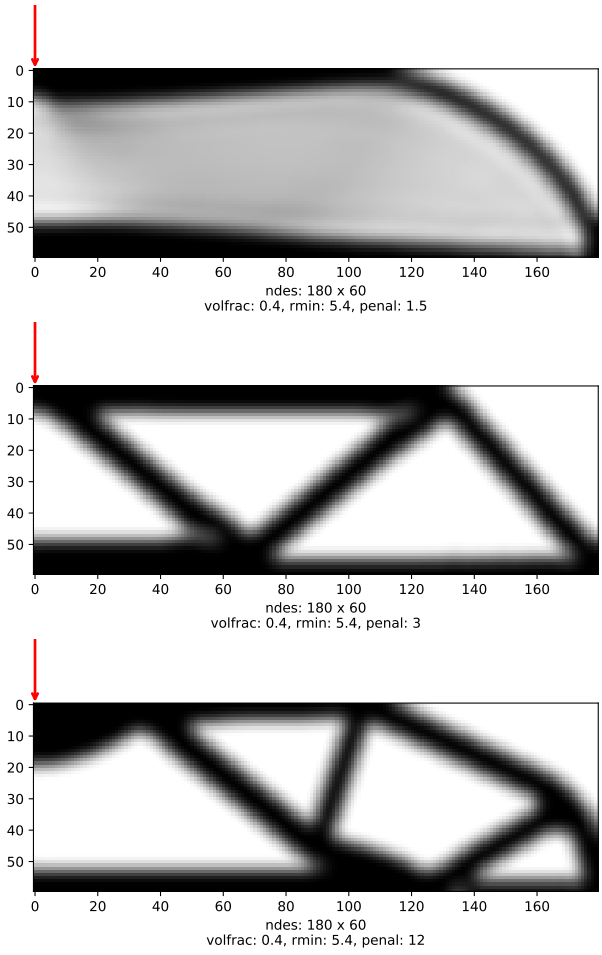

Figure 2: Differing values of penal.

The penalization power ensures that the solution is black and white. Decreasing the penalization power will soften the results and increasing will sharpen the features.

Discretization

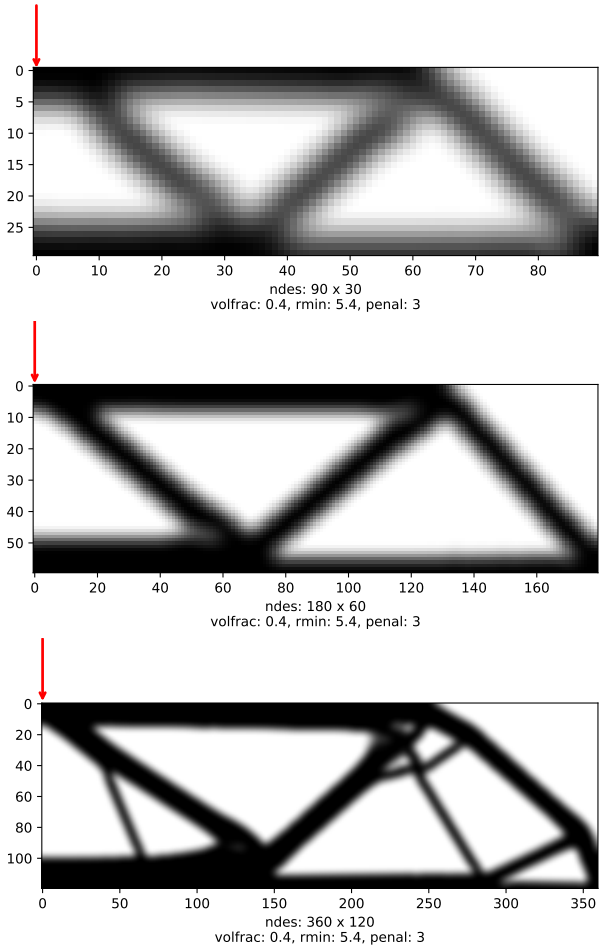

Figure 3: Differing values of (nelx*nely).

Decreasing the discretization results in lower resolution results meaning the features are more soft. Increasing the discretization introduces more grid cells resulting in sharper more well defined structures.

Problem 2

Part 1

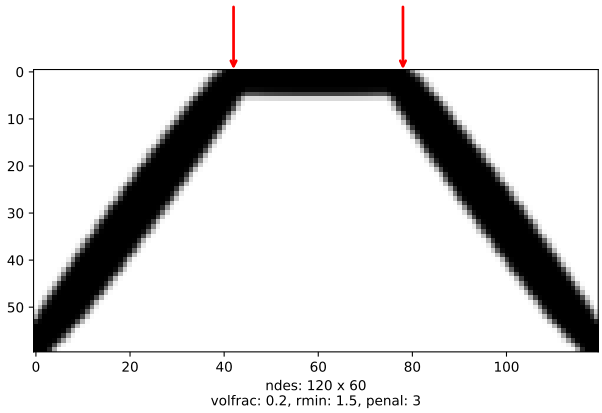

Figure 4: Two simultaneous point loads.

Part 2

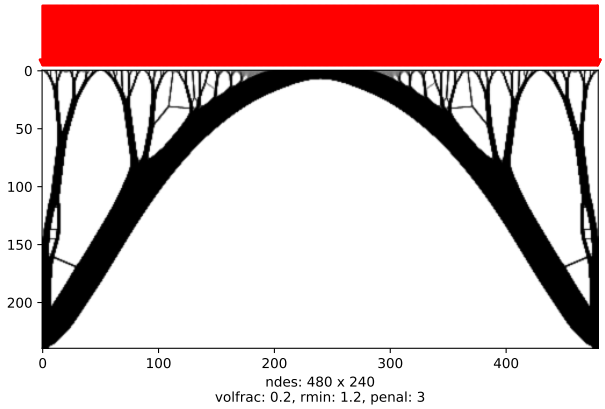

Figure 5: Distributed load.

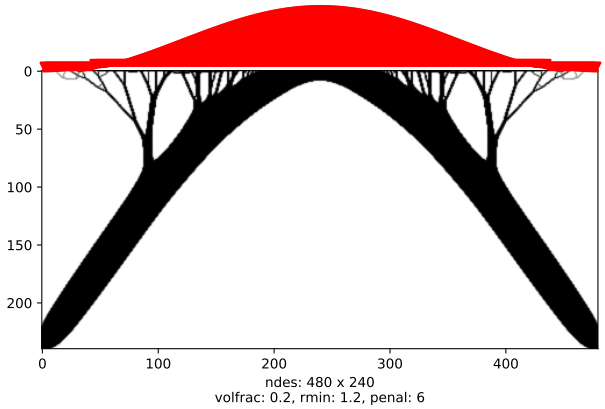

Figure 6: Non-uniform Distributed load.

Problem 3

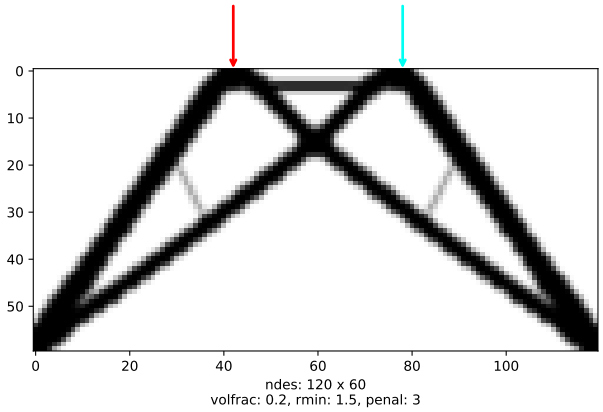

Figure 7: Bridge structure with two load cases (red and cyan vectors). Solved using CHOLMOD.

Problem 4

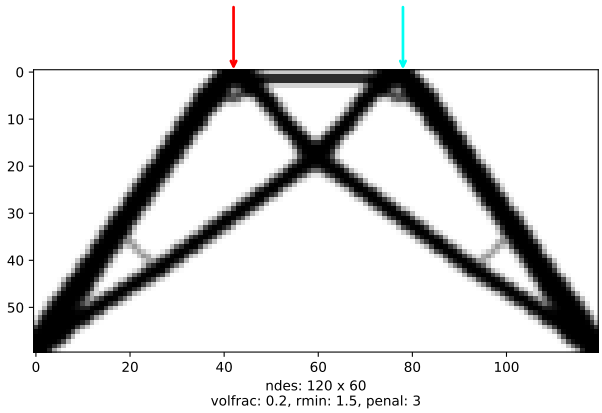

Figure 8: Bridge structure with two load cases (red and cyan vectors). Solved using NLOPT's MMA.

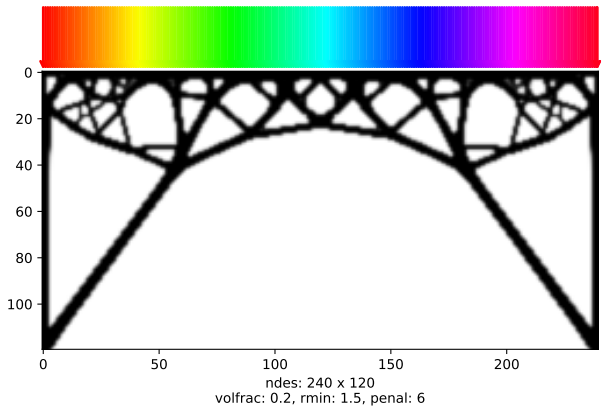

Figure 9: Bridge structure with multiple load cases. Solved using NLOPT's MMA.

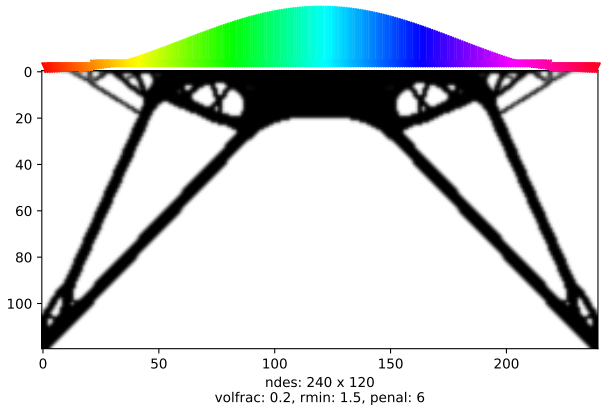

Figure 10: Bridge structure with multiple non-uniform load cases. Solved using NLOPT's MMA.

Problem 5

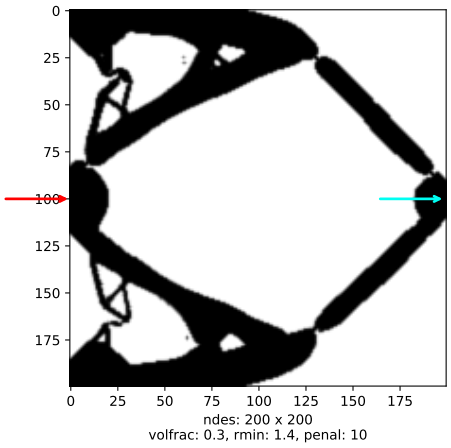

Figure 11: Compliant mechanism synthesis with a filter radius of 1.4.

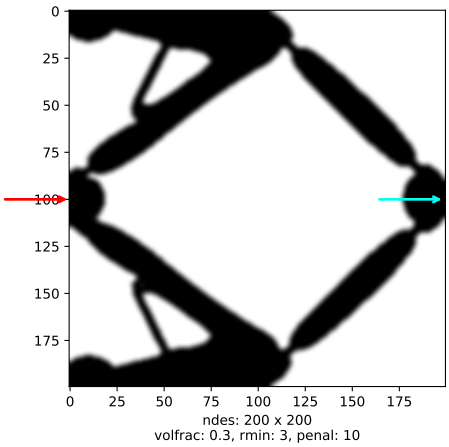

Figure 12: Compliant mechanism synthesis with a filter radius of 3.