Optimization Methods for Mechanical Design (ME7223)

Assignment 5

September 24, 2020

Max marks: 20

Instructions

- Answer all questions.
- Assume any missing data appropriately.
- Append the graphs to the scanned version of the answer sheets.
- Contact the TA (Mayank Raj) if you have any questions.

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1. Implement quadratic interpolation method of optimization of one dimensional function. Find more details on Matlab grader. (6)
2. Implement Newton method of optimization of a single variable function. Find more details on Matlab grader. (1.5)
3. Implement Quasi-newton method of optimization of a single variable function. Find more details on Matlab grader. (1.5)
4. Apply all the three methods (i) Quadratic interpolation, (ii) Newton method, and (iii) Quasi Newton method on minimizing $f(x) = \exp|x|$. Assume starting point/initial guess to be $x = 5$ for all the methods. Comment on your observation. (4)
5. Apply the methods (i) Fibonacci search, and (ii) Golden ratio search on minimizing $f(x) = \exp|x|$. Assume initial interval of uncertainty to be (-5, 5). Do a maximum of 10 iterations of both the methods using the code from Assignment 4. Compare these methods with Netwon method and Quasi Newton method in terms of number of iteration and final error/interval of uncertainty. (4)
6. Answer the following questions briefly: (3)
   (a) What is the average number of iterations in which Netwon's method of optimization would converge for a multi-variable quadratic objective function. Assume that Hessian can be computed with infinite precision. Justify your answer.
   (b) What is the average number of iterations in which Quasi Newton method of optimization would converge for a multi-variable quadratic function. Justify.
   (c) What do you think would be the computational challenges in implementing Newton method and Quasi Newton method of optimization for a multi-variable function?