Department of Aerospace Engineering
IIST, Thiruvananthapuram

Multi-disciplinary Optimisation
(AE 844)

9:00-10:00AM
12/02/2018
(D4-C104)

Maximum Marks: 15

Note:

1. All questions are compulsory.
2. Clearly state all the assumptions/approximations in the derivations/answers.

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1. Write a short note comparing the relative strengths and weaknesses of gradient and non-gradient optimisation algorithms.

[2]

2. How is the rate of convergence of an optimisation algorithm defined and what is the significance of the rate of convergence? Show that a sequence defined as $x^{(k)} = 3^{-k^2}$ shows a superlinear convergence.

[2 + 1]

3. Write a short note on various numerical step-size calculation methods by clearly outlining their relative advantages and disadvantages.

[3]

4. Write down the complete algorithm for Marquardt's method, either using a flowchart, or a pseudo-code. Please *add extra text* at the bottom of the algorithm to further clarify each step (if needed). *Do not neglect* to mention even simple (obvious) steps like "Calculate the gradient c".

[4]

5. Show that the BFGS formula given below is symmetric and satisfies the secant condition,

$$B^{(k+1)} = B^{(k)} + \frac{y^{(k)} y^{(k)^T}}{y^{(k)^T} s^{(k)}} + \frac{c^{(k)} c^{(k)^T}}{c^{(k)^T} d^{(k)}}$$

where, c is the gradient vector, d is the descent direction, $y^{(k)} = c^{(k+1)} - c^{(k)}$, $s^{(k)} = x^{(k+1)} - x^{(k)}$ and B is an approximation of the Hessian matrix H.

[3]

Student's name: End of exam