MTH 711 Presentation

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Nonlinear inverse problem is usually like

where  is a nonlinear operator and cannot be represented as a combination of linear mappings of parameter to the observed data . The structure of is very important in solving for , different properties of lead to different ways of solving this problem.

Here, we give an example of one-diminsion nonlinear problem and discuss how to solve it. Consider problem as follows:

Solve it for all the positive roots. This is obviously nonlinear inverse problem because the highest order of is 3.

By Descartes' rule of signs, we know that this function has only one positive root because there is only one variation in sign of the sequence of coefficients. By letting its first derivative we know that this function is monotone increasing on, since and we know that the root lie on .

Rewrite the equation as , then it’s easy to verify . Since , thus is a contraction map on Then the Contraction Mapping Theorem, there is a unique fixed point on such that , i.e. the root of .

Then by the iteration method, let and we can just set and run enough times, say 100, in MATLAB and we will finally get the fixed point 1.3247, which is the solution.