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A case study of Parameter Estimation in Mathematical Modelling

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Abstract

Parameter estimation in mathematical modeling is a somewhat tricky matter. As it is a mathematical process, there are several software packages available for this purpose. Most parameter estimation packages suffer from two serious drawbacks that inhibit their ability to optimize parameters. One is that a model normally needs to be partially recorded in the estimation program in order to communicate with an estimation program and the other is that the performance of many estimators is seriously degraded when optimizing parameters for large numerical models. PEST (Parameter ESTimation) is a software package that can be used to overcome these difficulties in parameter estimation.It implements both traditional parameter estimations that are based on the use of only a few parameters, as well as highly parameterized, regularized inversion that are based on the use of hundreds of parameters.This study describes a methodology of parameter estimation using PEST program. The model used for the parameter estimation is Lotka-Volterra Predator Prey model. Purpose of this research is to identify PEST as a successful software approach for parameter estimation through determining the deviation between the real world scenario and the results gained by PEST. The raw data that has used for this study was obtained by the famous example which describes the interaction between Lynx (a type of wildcat) and Hare (a mammal in the family of rabbits), as measured using pelts collected by the Hudson Bay Company between 1900 and 1920. The graph obtained by the estimated parameters using PEST for the Lotkka Volterra model will be compared with the graph obtained by so called famous example.Through the comparison, once a parameter set has been determined for which model behavior matches real system behavior, they are again used as initial guesses for parameters to get much closer results with a very good approximation of parameters.

Keywords: *Parameter Estimation, Mathematical Modelling, PEST, Lotka-Volterra Predator Prey model*