

PARAMETER ESTIMATION TECHNIQUES AND MODEL VALIDATION

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Significant challenges exist in fitting mathematical models to data including the well-known and difficult issue of identifiability in high-dimensional estimation problems. The notion of identifiability addresses the question of whether it is possible to obtain unique solutions for unknown parameters in a mathematical model given a set of data collected in experiments performed on the real system. It is clearly a critical aspect of the modeling process, especially when the parameters are analogs to the physical and/or biological attributes of interest and the model is needed to quantify them. In these seminars, I will provide an overview on the following concepts. In particular, I plan to emphasize applicability and limitations.

- 1) Parameter Estimation in General
 - Basic concepts and examples
- 2) Sensitivity Identifiability
- 3) Nonlinear Least Squares Estimation
 - Gauss-Newton method
 - Subset selection and reduced-order estimation
 - Sampling optimization algorithms
- 5) Kalman Filter Based Estimation

References:

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- [5] J. G. Reid, "Structural identifiability in linear time-invariant systems", *IEEE Trans. AC*, Vol. 22, 242-246, 1977.