- List of symbols
- Preface
- Chapter 1. Introduction
  - o 1.1. The optimum experimental design problem in context
  - o 1.2. A general review of literature
- Chapter 2. Basic concepts
  - o 2.1. System description
  - o 2.2. Parameter identification
  - o 2.3. Measurement location problem
  - o 2.4. Main impediments
    - 2.4.1. High dimensionality of the multi-modal optimization problem
    - 2.4.2. Loss of the underlying properties of the estimator for finite horizons of observation
    - 2.4.3. Sensor clusterization
    - 2.4.4. Dependence of the solution on the parameters to be identified
  - 2.5. Deterministic interpretation of the FIM
  - 2.6. Calculation of sensitivity coefficients
    - 2.6.1. Finite-difference method
    - 2.6.2. Direct-differentation method
    - 2.6.3. Adjoint method
  - o 2.7. A final introductory note

## Chapter 3. Locally optimal location of stationary sensors

- o 3.1. Linear-in-parameters lumped models
- o 3.2. Continuous designs in measurement optimization
- o 3.3. Clusterization-free designs
- o 3.4. Non-linear programming approach
- o 3.5. A critical note on some deterministic approach
- o 3.6. Summary

## Chapter 4. Locally optimal location of moving internal observations

- o 4.1. Adapting the idea of continuous designs
  - 4.1.1. Optimal time-dependent measures
  - 4.1.2. Parametrization of sensor trajectories
- o 4.2. Optimization via optimal-control techniques
  - 4.2.1. Statement of the problem and notation
    - Equations of sensor motion
    - Induced pathwise state inequality constraints
    - Optimal measurement problem
  - 4.2.2. Equivalent Mayer problem and existence results
  - 4.2.3. Linearization of the optimal-control problem
  - 4.2.4. A numerical technique of solving the optimal measurement problem
  - 4.2.5. Special cases
    - Optimal planning of sensor movements along given paths
    - Measurement optimization with minimax criteria
    - Minimal number of sensors
- o 4.3. Concluding remarks
- Chapter 5. Robustness of solutions to the sensor location problem
  - o 5.1. Sequential designs
  - 5.2. Optimal designs in the average sense
    - 5.2.1. Problem statement
      - 5.2.2. Stochastic-approximation algorithms
  - o 5.3. Optimal designs in the minimax sense
    - 5.3.1. Problem statement and characterization
    - 5.3.2. Numerical techniques for exact designs
  - o 5.4. Concluding remarks
- Chapter 6. Conclusions and future research directions

- o Further development of robust approaches
- o Coupled input and measurement system design
- Alternative objectives in the problem formulation
- Further results on clusterization-free designs
- Modifications of the design procedures to allow for discrete-time measurements
- o Coupled parameter identification and experimental design
- Appendix A. Differentiation of non-linear operators
  - o A.1. Gateaux and Frechet derivatives
  - A.2. Chain rule of differentiation
  - o A.3. Partial derivatives
  - o A.4. One-dimensional domains
  - A.5. Second derivatives
  - o A.6. Functionals on Hilbert spaces
  - o A.7. Directional derivatives
- Appendix B. Accessory results for PDE's
  - o B.1. Green formulae
  - o B.2. Differentiability w.r.t. parameters
- Appendix C. Interpolation of tabulated sensitivity coefficients
  - o C.1. Interpolation for functions of one variable
    - o C.2. Tricubic spline interpolation
- Appendix D. Differentials of Section 4.2.3
  - o D.1. Derivation of formula (4.50)
  - o D.2. Derivation of formula (4.53)
- Bibliography