Semigroup theory with applications in Control

Professor

Carsten Trunk, Prof. Dr. rer. nat. habil.
Professor für Angewandte Funktionalanalysis (W2)
Date of birth: 24. June 1969, nationality: German

Technische Universität Ilmenau
Fakultät für Mathematik und Naturwissenschaften, Institut für Mathematik

Postfach 10 05 65, 98684 Ilmenau
Telefon: +49 3677 69-3253 , Fax: +49 3677 69-3270
E-Mail: carsten.trunk@tu-ilmenau.de

Summary

This is an introduction to infinite dimensional system theory. Here we follow quite closely the famous book of R. Curtain and H. Zwart. But we give a more detailed exposition of unbounded operators and Bochner's integration. The key problem is the abstract inhomogeneous Cauchy problem which will be approached with the help of the theory of semi groups. Moreover, adding input and output will lead to a full control theoretic approach to parameter distributed systems. We will discuss various stabilizability, controllability, observability, and detectability concepts.

Contents

Bounded perturbations, perturbations of contractive and analytic semigroups, Desch-Schappacher theorem, Trotter-Kato approximation theorem.

- **Chapter 5: The Cauchy Problem**

  The abstract Cauchy problem, perturbations and composite systems, boundary control systems.

- **Chapter 6: Inputs and Outputs**

  Controllability and observability, tests for approximate controllability and observability, input-output maps.

- **Chapter 7: Stability, Stabilizability, and Detectability**

  Exponential stability, exponential stabilizability and detectability, compensator design.

References

[1] R. Curtain and H. Zwart, *An Introduction to Infinite-Dimensional Linear Systems Theory*, Springer, 1995.

[2] K. Engel and R. Nagel, *One-Parameter Semigroups for Linear Evolution Equations*, Springer, 2000.

[3] B. Jacob and H. Zwart, *Linear Port-Hamiltonian Systems on Infinite-dimensional Spaces*, Springer, 2012.

[4] T. Kato, *Perturbation Theory for Linear Operators*, Springer, New York, 1966.