

Stochastic algorithms

UFC/DC
SA (CK0191)
2018.1

Content

Deterministic
Markov functions
Stochastic Markov
functions

Logistic

Evaluation

Stochastic algorithms

Intro

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General content

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General content

The course is an introduction to modelling of dynamic processes

- Deterministic and stochastic state-space models
- Deterministic and random Markov functions

We overview of dynamic system analysis and probability theory

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Deterministic Markov functions

Deterministic Markov systems/models and their classification

- Input-output and state-space representation
- ↪ Focus on state-space models

General properties of deterministic systems

- Dynamical/Instantaneous
- Linear/Nonlinear
- Stationary/Nonstationary
- Proper/improper
- With/Without delay

Deterministic Markov functions (cont.)

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The analysis of state-space models only in the time-domain

↪ Linear and stationary models

A general scheme to determine the state transition matrix

↪ **The Sylvester expansion**

A general procedure to solve the analysis problem

↪ **The Lagrange formula**

Similarity transformations and canonical forms

↪ **Diagonalisation**

↪ **Jordan's form**

The system modes and their interpretation

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Stochastic Markov functions

Stochastic Markov system/models, their classification and their properties

- Continuous-time continuous-state Markov processes
- Continuous-time discrete-state Markov processes
- Discrete-time discrete-state Markov processes

Main focus on discrete-time discrete-state processes

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Stochastic Markov functions

Analysis of discrete-time discrete-state Markov processes (chains)

- General concepts and definitions
- **Classification of states**
- **Irreducibility**

Some important matrices

- **Fundamental matrix**
- **Reachability matrix**
- **Potential matrix**

Some important distributions

- **Steady-state distribution**
- **Stationary distribution**
- **Limiting distribution**

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Stochastic Markov functions (cont.)

Analysis of continuous-time discrete-state Markov processes

- General concepts and definitions
- **Transition probabilities**
- **Transition rates**

Some important distributions

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Stochastic Markov functions (cont.)

Continuous-time continuous-space (general) Markov processes

- **General Markov state density function**
- **Chapman-Kolmogorov equations**
- **Kramers-Moyal equations**
- **The Markov propagator**

Time-integral and time-evolution of Markov processes

- General moment evolution equations

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Stochastic Markov functions (cont.)

The continuous propagator and its characterising functions

- Time-evolution equations

Three important continuous Markov processes

- The Liouville process
- The Wiener process
- Ornstein-Uhlenbeck process

The Fokker-Planck equation and the Langevin equation

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SIGAA doesn't know the course location

- Here, mostly

Timetable, as you have known it

- Friday afternoons
- 14 : 00 → 18 : 00
- SIGAA's wrong

I do not care about presence

- If you deliver

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Two, maybe three, intermediate tests (AP) here in the classroom (70%)

- Train by exercising and participating

One, maybe two, home assignment/project (30%)

To pass the course you need a 5, with 7 you pass earlier (8 I am happy)

- You can have a final test (AF), if you ask