Modelação e Simulação Inteligente

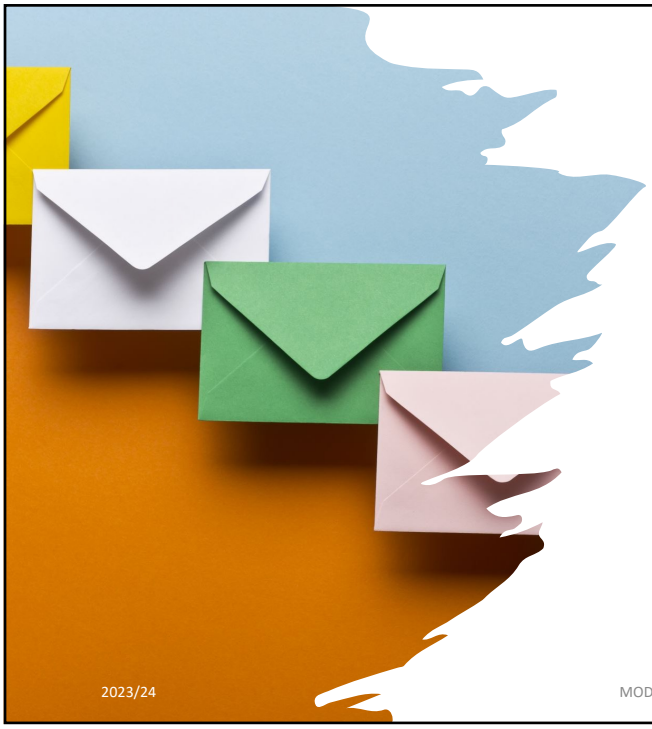
Mestrado em Engenharia Informática

Sistemas de Informação e Conhecimento

Paulo Matos

P.PORTO isep Instituto Superior de Engenharia do Porto INFORMÁTICA

1



Teachers

- Paulo Matos
  - Email: psm@isep.ipp.pt
  - Gabinete: B119

2

Aims

- Provide students with a set of theoretical and practical knowledge in the context of continuous and discrete simulation
- Particularly in the development of simulation studies, and the use of modeling and simulation tools

3

Specific Aims

- By the end of this course, the student must be able to construct complete simulation studies:
  - CO1 - Interpret the system in study through simulation techniques (Bloom level 3)
  - CO2 - Design simulation models for medium complexity systems (Bloom level 4)
  - CO3 - Construct simulation studies by applying the adequate simulation approach and good practices of engineering (Bloom level 6)

4

Specific Aims

- By the end of this course, the student must be able to construct complete simulation studies:
  - CO4 - Validate model and interpret simulation results (Bloom level 5)
  - CO5 - Estimate future system performance (Bloom level 5)
  - CO6 - Describe in syntactic and semantically rigorous form, the processes and results of the previous points, adopting appropriate engineering sciences and best practices (Bloom level 4)

5

Contents

- What is Simulation?
  - The nature of Simulation
  - Advantages, Disadvantages, and Pitfalls of Simulation
  - Steps in a Simulation Study
- Modelling
  - Systems, Models and Simulation
  - Modelling Complex Systems

6

Contents

- Computer Simulation
  - Discrete Systems Simulation: activities, events and processes approach
  - Programming Simulation Studies: basic probability and statistics, random number generators, selecting input probability distributions, output data analysis
  - Simulation studies using General-Purpose Languages
  - Verification and Validation

7

Contents

- Simulation Software
  - Classification of Simulation Software
  - Desirable software features
  - Comparison of Simulation Languages
  - Development of a project in a simulation language
- Distributed and Agent-based simulation
  - Characteristics
  - Development Platforms

8

Main Teaching Material

- Titles (available at the school library)
  - "Simulation, Modelling and Analysis", Averill M. Law, W. David Kelton, McGraw Hill
  - Cláudio Gomes, Casper Thule, David Broman, Peter Gorm Larsen, and Hans Vangheluwe. 2018. Co-Simulation: A Survey. ACM Comput. Surv. 51, 3, Article 49 (May 2019), 33 pages. DOI:https://doi.org/10.1145/3179993
  - B. R. Barricelli, E. Casiraghi and D. Fogli, "A Survey on Digital Twin: Definitions, Characteristics, Applications, and Design Implications," in IEEE Access, vol. 7, pp. 167653-167671, 2019, doi: 10.1109/ACCESS.2019.2953499.
  - Bécue, A.; Maia, E.; Feeken, L.; Borchers, P.; Praça, I. A New Concept of Digital Twin Supporting Optimization and Resilience of Factories of the Future. Appl. Sci. 2020, 10, 4482. https://doi.org/10.3390/app10134482

9

Main Teaching Material

- Moodle
  - Teaching Materials
  - Working documents
  - Project Proposals

10

Teacher's Assessment

EVALUATION DURING THE TERM WITH MANDATORY FINAL EVALUATION

- During the semester
  - 1 Simulation Project with two milestones (groups **of 2 students**)

NFreq = N_P.1*30% + N_P.2*70%

- Exam by the end of the semester
  - **PExam**

⚠ Students evaluation is individual! Different scores may be achieved by diferente members of the same working group

11

Teacher's Assessment

EVALUATION DURING THE TERM AND 1st EXAM

➢ **Nfinal = NFreq*70% + PExam*30%**

- Min NFREQ = 9,5
- Min PExam = 8,0

EVALUATION 2nd EXAM

➢ **Nfinal = NFreq*70% + PExam*30%**

- Min NFREQ = 9,5
- Min PExam = 8,0

12

Teacher's Assessment

Simulation Project with two milestones

- **NProj_P.1** - Analysis of an emergent simulation trend (30%), technical report and slides to present for assessment.
- **NProj_P.2** – Simulation project (70%), based on generic programming language or on the emergent technology studied in **Nproj_P.1**. The system to simulate is to be chosen by students. Students must deliver the implementation, a technical report and discuss the project with the professor.

13

Teacher's Assessment

- Deadlines

Milestones	Deadline	To deliver:
N_P.1	deliver on week 7 (7 April) presentation on week 7 (T classes)	Paper + Slides Presentation
N_P.2	deliver week 15 (14 June) presentation week 16	Source code + technical report Presentation mandatory

14

Supplemental Exams

- Retake the final exam only, keeping the other components obtained previously.

15

Modelação e Simulação de Processos

Mestrado em Engenharia Informática

Sistemas de Informação e Conhecimento

Paulo Matos

P.PORTO isep Instituto Superior de Engenharia do Porto DEPARTAMENTO DE ENGENHARIA INFORMÁTICA

16