Methods and techniques of simulation

Docente: Anna Maria Perdon
Corso di studio Laurea Magistrale in Ingegneria Informatica e dell’Automazione
CFU: 9 pari a ore 72 di didattica frontale del docente suddivisa in:
Ore lezioni: 36 Ore laboratorio: 36

Previous Requirements:
The student should know the basic notions of calculus, linear algebra, numerical analysis, and the basic notions of Control Engineering: state space representations of linear, time invariant, finite dimensional dynamical systems, both discrete time and continuous time. He should be able to compute the response to standard inputs. He should be able to analyze stability and existence of steady-state response. He should be able to analyze control problems and to synthesize possible solutions. He should be able to apply identification techniques in order to derive models from experimental data and to validate the models.

Topics:
1. Analysis of the error. Representations of the numbers in the computer.
5. Norms of vectors and matrices. Condition index. Estimate \( k(A) \). Reachable accuracy.
9. Modelling of linear and nonlinear dynamical systems.
10. Modelling of discrete event dynamical systems.
11. Simulation environments and software (Matlab/Simulink, , Virtual Reality Toolbox,...)
12. Design and realization of software simulators.

Textbooks:
Analisi Numerica, A.M. Perdon Pitagora Editrice 2006
Lectures slides and exercises can be found on the web site http://lms.univpm.it
Or at http://leibniz.diiga.univpm.it/~perdon/didattica/metsim_LM.html

Tutorial sessions:
Monday and Thursday 14:30 to 16:30

Learning Evaluation Methods:
The learning evaluation will consist of a written test divided into two parts, each one to be completed in an hour. The first part consists of four questions of a theoretical nature, on the topics discussed in class and contained in the materials provided to the students. The second part, that takes place immediately after the first, consists of three problems to be solved with the use of Matlab. It Each student must also complete a practical project on one of the topics discussed in class and present a report on this activity. The project can also worked out with another student. In this case, the discussion of the project must take place with both students. In the case of a negative result of one of the tests, the student can repeat only that part, provided this is done within the same academic year.

Learning Evaluation Criteria:
Correctness, completeness and clarity in answering the questions in the theory test. Accuracy and completeness in solving the exercises. As for the project, the student must prove that he can apply the concepts learned in the course, to properly use the tools and appropriate technologies and to write a clear technical report.

**Learning Measurement Criteria:**
The first test consists of 4 groups of questions on the various parts of the program, each group contains a question which is assigned a score between 0 and 10, and a question which is assigned a score between 0 and 6. The student must answer a question in each group, choosing two questions for 10 points and two for 6 points. The second test consists of three questions, each of which is assigned a score between 0 and 10. A test is considered “sufficient” if the score is greater or equal to 15. The practical project is assigned a score from 0 to 30 and is “sufficient” only if the score is greater or equal to 18.

**Final Mark Allocation Criteria:**
The overall grade is given by the arithmetic mean, rounded up to the whole, the sum of the scores obtained respectively in the test and in the project if all are sufficient. The overall grade required to pass the exam is 18 points. Otherwise the overall grade is “Not sufficient”. The student who in addition to getting a score greater than or equal to 30 has demonstrated complete mastery of the topics addressed, and clarity of exposition will have a “30 e lode”.