Program	Level	Third cycle
	Name of the program	SEE Doctoral Studies in Mathematical Science

COURSE

Course title	**Numerical methods for large nonlinear systems**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
AMAT 685	I	**Elective course**	10	30
Lecturer	**prof. dr Aleksandra Kostić**			
Course Goals	The main goal of the course is to enable students to effectively solve large nonlinear equation systems in MATLAB. This includes - unlike the pure application of numeric software - also understanding the mathematical basics of algorithms. At the same time, minimal knowledge of MATLAB is needed. Finally, the basics of the occurrence of large systems should be presented, because the essential properties of the system (and thus the nature of their numerical treatment) depend on their origin			

COURSE CONTENT

- Occurrence of large systems
- Solution of linear and nonlinear equation systems from small to moderate dimensions (Banach fixed point theorems, Newton type methods, moderate dimension parameter systems, Newton methods for non-quadruple systems, Newton methods based on finite differences.
- Directly solving large linear systems (reducing the SPD's dimensions, dissolution structures of the systems, Sherman-Morrison-Woodbury algorithms)
- Iterative methods to solve large linear system (stationary methods, Nonstationary methods 1-acceleration of the convergence, nonstationary methods 2 CG type methods, nonstationary methods 3 for nonsymmetric problems, nonstationary methods 4 :Kazcmarzov-type method, further examples of some methods, substructures and iterative processes, new analysis for Kazcmarz type of iteration)
- Iterative methods for large nonlinear systems (nonlinear m Jacobi methods, Newton-mix methods, update methods)
- Reduction (Shooting Method, Master-Slave method, ABS method, method based on dissolution of the spectrum)
- Recursive projections (CNSP: Condensed Newton/Supported Picard, CNSP for parameter equations, Shroff and Keller's recursive projection)
- Methods of base reduction (general idea, tangent oriented base reduction)
- Basic principles for large systems.

LITERATURE

[1] Wolfgang Mackens, Numeričke metode za velike nelinearne sustave skripta Tehničkog univerziteta Hamburg-Harburg
[2] http://people.inf.ethz.ch/arbenz/MatlabKurs/matlabintro.pdf
[3] Eugene L. Allgower und Kurt Georg: Numerical continuation methods: an introduction, Springer 1990
[4] L. A. Hageman and D. M. Young. Applied Iterative Methods. Academic Press, New York, 1981. Unabridged republication of the 1981 original: Dover, Mineola, NY, 2004.

GRADING

	Criterion	Maximum points	Minimum points
1.	Assignments	10	5
2.	Projects	40	20
3.	Final exam	50	30
	Total	100	55