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

COURSE

Course title	**Numerical methods for solving linear and nonlinear eigenvalues problems**			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
AMAT 625	I	Elective course	10	30
Lecturer	Prof. dr Aleksandra Kostić			
Course Goals	Each mechanical system has a vibrating property. The analog phenomenon also encounters electrical systems in the form of oscillating electric circuits. Vibration conditions are mathematically described in the form of differential equation systems or differential equations. This leads to problems of eigenvalues. Due to the problem of eigenvalues have been arise of a important place in numeric and applied mathematics. The goal is to adopt the attenders of exposition of methods and to operate scientific-research work, especially in the nonlinear problems of eigenvalues, which is currently very actual.			

COURSE CONTENT

- Methods for linear problem of eigenvalues:
- Method of interpolation, Method of Le Verierra
- Method of Krilov, Method of Danilevski
- Gives method of rotation
- Jacobi method
- Householder method
- LR method
- QR method
- Method of arbitrary vector
- Method of scalar product
- Method of trace
- Method of exhausting
- Generalized problem of eigenvalues
- Structured matrices and methods for them. As an example, we take Toeplitz matrix and suitable methods.
- Examples from physics and technics
- Methods for nonlinear problems of eigenvalues:
- Linearization
- Minimax characterization
- Usage of Silvester low of inertia
- Especially quadratic and rational problems of eigenvalues.
- Examples from physics and technics

LITERATURE

[1] Desanka P. Radunović , Numeričke metode, akademska misao, Beograd 2003.

[2] A. Kostić, Applied linear algebra in action, Books on Demand. (2016) 57-83.

[3] F. Tisseur and K. Meerbergen, The quadratic eigenvalue problem, SIAM Review. 43 (2001) 235 - 286.

[4] H. Voss, A minmax principle for nonlinear eigenproblems depending continuously on the eigenparameter, Numer. Linear Algebra Appl. 16 (2009) 899-913.

[5] A. Kostić and H. Voss, On Sylvester's law of inertia for nonlinear eigenvalue problems, Electr. Trans. Numer. Anal. 40 (2013) 82 - 93.

[6] A. Kostić, Verfahren zur Bestimmung einiger extremaler Eigenwerte einer symmetrischen toeplitz Matrix, SHAKER VELLAGB. J. Gardner, R. Wiegandt, Radical Theory of Rings, Pure and Applied Mathematics 261, Marcel Dekker, 2004.

GRADING

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

The 2 homeworks are planed each 5 points. Two projects from the nonlinear problems eigenvalues. Every project is 25 points.