

Obuda University John von Neumann Faculty of Informatics		Institute of Applied Mathematics		
Name and code: NIMFM1SANK Fundamental Mathematical Methods				Credits: 4
2019/20 year II. semester				
Subject lecturers: Dr Kósi Krisztián				
Prerequisites (with code):				
Weekly hours:	Lecture: 1	Seminar.:	Lab. hours: 1	Consultation:
Way of assessment:	Exam			
Course description:				
Goal: The main aim is to provide the Students with the most important mathematical methods on which the modern nonlinear control applications are based. Besides the purely mathematical point of view actual implementation issues are considered, too.				
Course description: The beginning of the course, concentrates on mathematical methods. It shows the connections between classical math subjects (like calculus, linear algebra), and the modern nonlinear control theory. Then shows detailed examples, from theory to implementation, using two modern methods (VSSM, RFPT). The last part shows some another interesting example, how mathematics is related to computer science, like fractals, genetic algorithms, multidimensional scaling.				

<b>Lecture schedule</b>	
<i>Education week</i>	<i>Topic</i>
1.	Mathematical background
2.	Mathematical background
3.	Introduction to LaTeX and Julia language
4.	Laplace Transform, First Order Differential Equations
5.	Second Order Differential Equations
6.	Series of Functions
7.	1st. Midterm
8.	Metric Space, Numerical Methods
9.	Fixed Point Iteration, Modelling and Simulation
10.	Introduction to non-linear robotics, Lyapunov's stability definitions and theorems
11.	Robust Control, VSSM
12.	Adaptive Control, RFPT
13.	2nd. Midterm
14.	Retake Midterm, Presentations
<b>Midterm requirements</b>	
<i>Education week</i>	<i>Topic</i>
7	<b>Julia, Laplace, ODE, Series of Functions</b>
13	<b>Metric Space, Num. Methods, Fixed point iteration, nonlinear robotics, VSSM, RFPT</b>

### Final grade calculation methods

Achieved result	Grade
88%-100%	excellent (5)
75%-88<%	good (4)
62%-75<%	average (3)
58%-62<%	satisfactory (2)
0%-50<%	failed (1)

Signature requirements: Attend at least four lessons and four labs., write both midterm.

Regular exam.

Can be get Offerd grad:

- The midter result is at least 63%.
- Create a home project: solve a non-trivial problem, code it in Julia, create minimum 5 page paper in IEEE format , and held a 10 min long presentation in the last class.

### Type of exam

written exam

### Type of replacement

The worst midterm can be retaken in the last week.

### References

Mandatory:

Lecuter Notes

Recommended:

System and Control Theory - József K. Tar - László Náday - Imre J. Rudas. TYPOTEX 2012, ISBN 978- 963-279-676-5

Applied Nonlinear Control, Slotine and Li, Prentice-Hall 1991

M. Oberguggenberger, A. Ostermann.: Analysis for Computer Scientists. In: Undergraduate Topics in Computer Science. Springer-Verlag Ltd. London, 2011

Elements of the Theory of Functions and Functional Analysis - A.N. Kolmogorov, S.V. Fomin