Mathematical Methods of Automation and Robotics

exam issues

1. Inverse function theorem
2. Implicit function theorem
3. Equivalence of functions
4. Theorem on immersions and submersions
5. Local and global diffeomorphism
6. Morse theorem
7. Contraction functions theorem
8. Dynamic system, flow: theorem on existence and uniqueness of solution
9. Stability: Ważewski inequality
10. Stability: Lyapunov function
11. Equivalence of dynamic systems
12. Linearization of dynamic systems: theorem of Hartmann-Grobman
13. Linearization of dynamic systems: theorem of Poincare'-Siegel-Sternberg
14. Lie brackets of vector fields, definition and properties
15. Theorems of straightening out a vector field and a family of vector fields
16. Distributions and Frobenius theorem
17. Controllability of nonlinear systems: definitions and criteria
18. Equivalence of control affine systems
19. Feedback linearization: theorem of Jakubczyk-Respondek
20. Input-output decoupling, system structure, zero dynamics
21. Dynamic feedback linearization: theorem of Charlet-Levine-Marino
22. Differentially flat systems

Please, have a copy of these issues on the exam.

BASIC REFERENCES

[1] M. Golubitsky, V. Guillemin „Stable Mappings and Their Singularities”, Springer-Verlag, New York, 1974

[2] R. Abraham, J. E. Marsden, T. Ratiu „Manifolds, Tensor Analysis, and Applications”, Springer-Verlag, New York, 1988

[3] V. I. Arnold „Geometrical Methods in the Theory of Ordinary Differential Equations”, Springer-Verlag, New York, 1983

[4] S. S. Sastry „Nonlinear Systems”, Springer-Verlag, New York, 1999

[5] A. M. Bloch „Nonholonomic Mechanics and Control”, Springer-Verlag, New York, 2003

[6] H. Nijmeijer, A. J. van der Schaft „Nonlinear Dynamical Control Systems”, Springer-Verlag, New York, 1990

[7] J. Levine „Analysis and Control of Nonlinear Systems”, Springer, New York, 2009

[8] K. Tchoń, R. Muszyński „MMAR, Lecture Notes”, Wrocław, 2019.

COMPLEMENTARY REFERENCES

[1] Ph. Hartman „Ordinary Differential Equations”, J. Wiley, New York, 1964

[2] H. K. Khalil „Nonlinear Systems”, Prentice-Hall, New Jersey, 2000

[3] R. Murray, Z. Li, S. S. Sastry „A Mathematical Introduction to Robotic Manipulation”, CRC Press, Boca Raton, 1994

[4] A. Isidori „Nonlinear Control Systems”, Springer-Verlag, New York, 1995

[5] V. Jurdjevic „Geometric Control Theory”, Cambridge Univ. Press, Cambrigde, 1997