Linear algebra

Winter semester 2023/2024

Goals of course

Learning basic concepts and methods of linear algebra and their applications in solving standard examples.

Course content

1. Vector spaces and subspaces (linear combinations, linear independence, linear dependence, union of spaces, intersection of spaces, spanning set, properties of spanning set, dimension, basis, canonical basis, coordinates).

2. Matrices and operations (equal matrices, sum of matrices, matrix multiplication by scalars, matrix multiplication, commute matrices, elementary row operations, rank of matrix, diagonal matrix, transpose matrix, symmetric matrix, skew-symmetric matrix, triangular matrix, upper triangular matrix, lower triangular matrix, stairstep matrix, regular matrix, inverse matrix).

3. Systems of linear equations and their solvability, homogeneous systems of linear equations, non-homogeneous systems of linear equations, necessary and sufficient conditions for the existence of solution, structure of solutions, effective methods of solving. Matrix equations.

4. Determinants, methods of calculation, Laplace expansion, calculation of inverse matrix, Cramer's rule. Determinants and their applications in algebra and geometry. Dot product, area and volume.

5. Similarity of matrices, eigenvalues, eigenvectors, eigenspace, generalized eigenvectors, Jordan block matrix, Jordan canonical form, transformations.

6. Quadratic forms, analytic expression, polar expression, polar basis, normal expression, canonical basis, classification of quadratic forms, methods of classification, signature of quadratic forms, Sylvester's rule.

Prague, 10. 9. 2023   Prof. RNDr. Martina Bečvářová, Ph.D.