科目ナンバリング	U-LAS10 20006 LE55						
授業科目名<英訳>	Advanced Linear Algebra Advanced Linear Algebra			担当者所属職名・氏名	工学研究科　准教授　CHANG, Kai-Chun		
群	自然科学科目群			分野(分類)	数学(発展)	使用言語	英語
旧群	B群	単位数	2単位	週コマ数	1コマ	授業形態	講義（対面授業科目）
開講年度・開講期	2025・前期	曜時限	金2	配当学年	主として2回生	対象学生	理系向

[授業の概要・目的]

Linear Algebra is a fundamental tool commonly used in many fields, not only in mathematics but also in the natural sciences, engineering, and more. This course builds on the contents in "Linear Algebra A/B" courses (majorly provided for 1st-year students) and explores advanced concepts of linear algebra, such as orthogonality, diagonalization, Singular Value Decomposition (SVD) of matrices, Jordan canonical form, and their applications to real-world problems.

[到達目標]

・To acquire an understanding of advanced concepts in linear algebra, such as orthogonality, diagonalization, and SVD of matrices.
・To understand and apply linear algebra concepts to solve real-world problems.

[授業計画と内容]

1. Review of linear algebra [2 weeks]
 - Big picture, rank, dimension, LU/LDU factorization, Gauss-Jordan elimination, etc.
 - vector spaces, subspaces, nullspace, complete solutions, four subspaces and their dimensions and orthogonality, etc.

2. Orthogonality and its applications [4 weeks]
 - Orthogonality and orthogonality complement, projections, least square approximations, orthogonal bases, Gram-Schumidt process, etc.

3. Eigenvalues, eigenvectors, and their applications [4 weeks]
 - Eigenvalues and eigenvectors, diagonalization, matrix power, singular value decomposition (SVD) and their application to difference equations, differential equations and Markov process, etc.

4. Jordan canonical form [3 weeks]
- minimal polynomials, generalized eigenvectors, Jordan canonical form, and their applications.

5. Optional topics [1 week]
 - numerical solutions, complex vectors and matrices, other applications, etc.

6. Feedback [1 week]

[履修要件]

Suggested prerequisites: Calculus A/B and Linear Algebra A/B, or Calculus with Exercises A/B and Linear Algebra with Exercises A/B.

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Advanced Linear Algebra(2)

[成績評価の方法・観点]

Quizzes or assignments (50%); final examination (50%)

[教科書]

Handouts distributed in class or uploaded to PandA

[参考書等]

（参考書）

Strang, G. (2009) 『Introduction to Linear Algebra. 5th ed.』（Wellesley-Cambridge Press）
Lipschutz, S. and Lipson, M. (2012) 『Linear Algebra, 6th ed.』（McGraw-Hill）

[授業外学修（予習・復習）等]

Students are expected to dedicate at least 2 hours per week to preview and review. More than half of this time is spent preparing for class and completing assignments.

[その他（オフィスアワー等）]

Any inquiry to the instructor: chang.kaichun.4z{at}kyoto-u.ac.jp. (replace {at} with @)