

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	2 回生以上	対象学生	理系向
[授業の概要・目的]									
Linear Algebra is an important tool commonly used in many fields, in not only mathematics but also natural sciences, engineering, etc. This course extends the contents in "Linear Algebra A/B" courses (provided majorly for 1st year students) and discusses advanced concepts of linear algebra, such as orthogonality, diagonalization, Singular Value Decomposition (SVD) of a matrix, Jordan canonical form, and their applications to real-world problems, etc.									
[到達目標]									
<ul style="list-style-type: none"><li>・ To acquire the advanced concepts of linear algebra, such as orthogonality, diagonalization, SVD of matrix.</li><li>・ To understand the applications of linear algebra to real-world problems.</li></ul>									
[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-Schmidt 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 spend at least 2 hours per week on preview and review. More than half of that time is spent preparing for class and doing 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 @)

### [主要授業科目 ( 学部・学科名 ) ]