2022 International Summer Courses on Analysis Algebra and Computation

Summary Report

China·Nanjing

Aug. 8 Sep.2, 2022

Introduction of SEU

2022 International Summer School Program

東南大學 SOUTHEAST UNIVERSITY

Understanding the Advanced Analysis, Algebra and Computation

Course 1: Selected Topics in Modern Mathematics

- Hours/Credits: 24 hours/ 1 credit
- Lecturer: Professor Alastair Rucklidge (Lee[illegible])
- Objectives: After this course, students should learn how to formulate and analyze variational problems and be able to apply the Calculus of Variations to a range of minimization problems in physics and mechanics.

Course 2: Selected Topics in Advanced Algebra

- Hours/Credits: 32 hours/ 1.5 credit
- Lecturer: Prof. Dragana S. Cvetković-Ilić (University of Niš)
- Objectives: After the course, students will be familiar with the basic knowledge of the theory of generalized inverses and its possible applications, and be able to follow certain [illegible]

[illegible]

Time Period

Aug. 8 –Sept. 2, 2022

Online Teaching

Requirements

Mainly for college sophomore or above with major in science and engineering

Number of Participant

250 SEU students,

50 international studen

[illegible]

Contents

COURSE 1: SELECTED TOPICS IN MODERN MATHEMATICS

Hours/Credits	24 hours (August 8 - September 2, 2022) / 1 credit Tues. 18:30-20:55, Thu. 18:30-20:55 Onsite + Online Platform: Zoom + QQ
Description	After this course, students should learn how to formula variational problems and be able to apply the Calculus of Variations to a range of minimization problems in physics and mechanics The calculus of variations concerns problems in which one wishes to find the extrema (usually the minima) of some quantity over a system that has functional degrees of freedom. Many important problems arise in this way across pure and applied mathematics and physics. In this course it is shown that such variational problems give rise to a system of differential equations, the Euler-Lagrange equations. These equations, which have far reaching applications, and the techniques for their solution, will be studied in detail.
Instructor	Professor Alastair Rucklidge Leeds University Homepage: http://www1.maths.leeds.ac.uk/~alastair/

 Prof. Alastair Rucklidge	50	1

PREREQUISITES

CLASS SCHEDULE

Day	**Contents**
Aug. 9	Introduction；The Euler Lagrange equation；
Aug. 11	The Brachistochrone;
Aug. 16	The Propagation of Light Rays ;
Aug. 18	Extensions of the Basic Theory;
Aug. 23	Calculating the second variation；C e i jZfe kfe；
Aug. 25	Constrained Problems； Isoperimetric problems
Aug. 30	The hanging chain； Local constraints；
Sep. 1	Final exam.

FEEDBACK FROM STUDENTS

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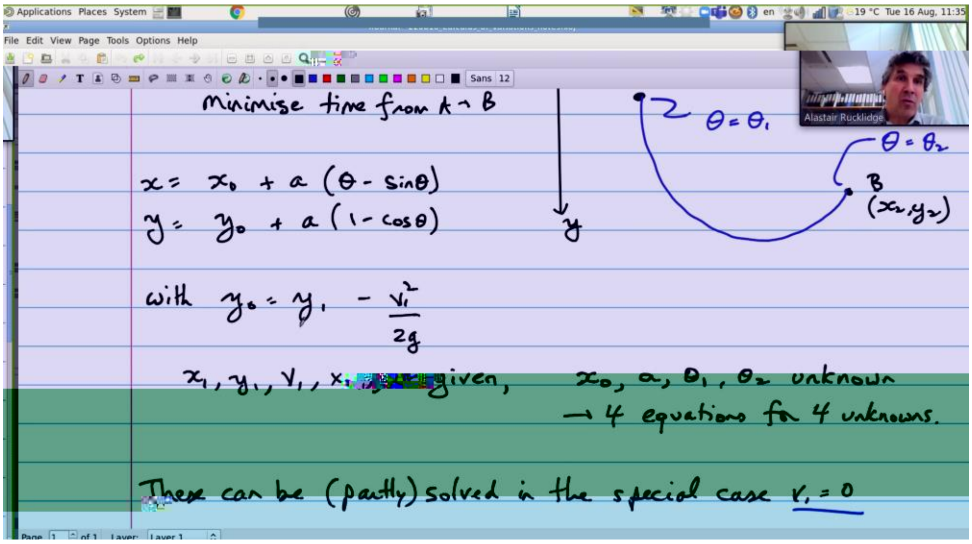
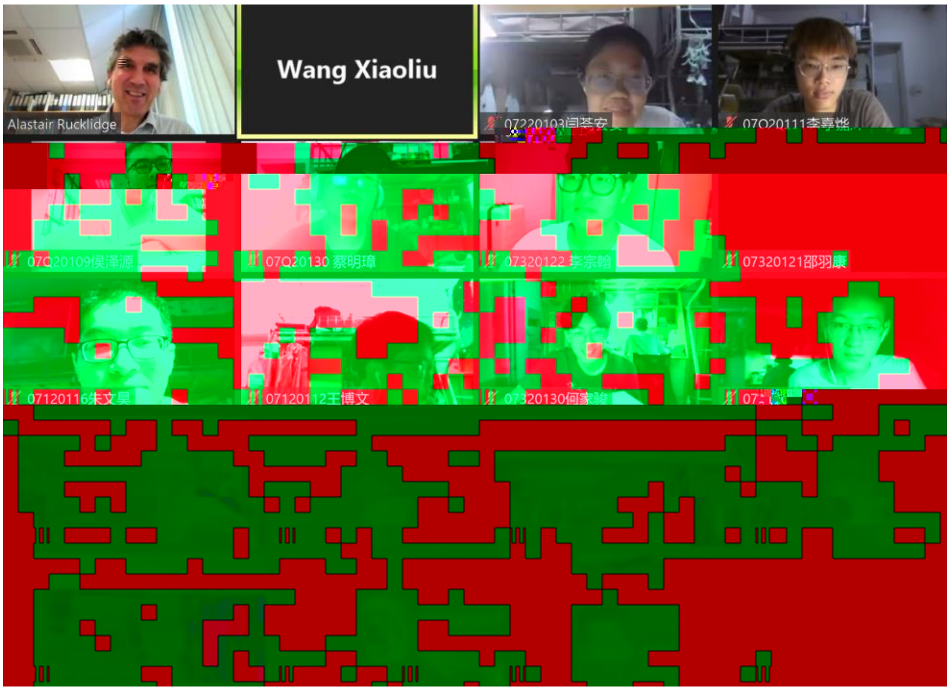
FEEDBACK FROM TEACHERS

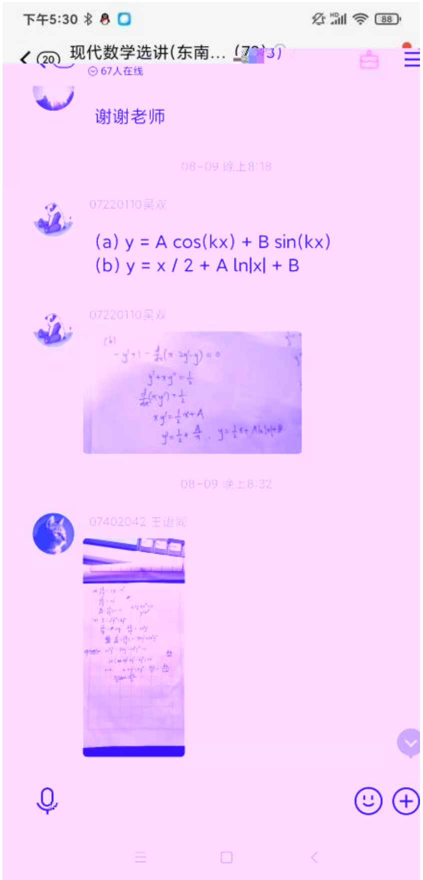
Alastair Rucklidge

Alastair Rucklidge


Minimise time from A → B
x = x₀ + a (θ − sinθ)
y = y₀ + a (1 − cosθ)
with y₀ = y₁ − v₁²/2g
x₁, y₁, v₁, x₂, y₂ given, x₀, a, θ₁, θ₂ unknown
→ 4 equations for 4 unknowns.
These can be (partly) solved in the special case v₁ = 0
θ = θ₁
θ = θ₂
B
(x₂, y₂)
y
Alastair Rucklidge


Alastair Rucklidge
Wang Xiaoliu


下午5:29
现代数学选讲(东南... (78)
67人在线
MATH2650_examples_1.pdf
178.48KB
群文件
群主 xlwang.seu
P12和P13将会在课堂讨论
HcaSD加入了本群，点击欢迎
CTY加入了本群，点击欢迎
08-09 下午12:36
群主 xlwang.seu
这是第一章的视频，供预习使用
群主 xlwang.seu
38分钟
群主 xlwang.seu
MATH2650_Ch1_Introduction_38m...
456.10MB


下午5:30
现代数学选讲(东南...
67人在线
谢谢老师
(a) y = A cos(kx) + B sin(kx)
(b) y = x / 2 + A ln|x| + B

COURSE 2: SELECTED TOPICS IN ADVANCED ALGEBRA

Hours/Credits

32 hours (August 8 - September 2, 2022)/ 1.5 credit

Mon. 14:00-16:35, Wed. 18:30-20:55, Fri.14:00-16:35 (online &

Mon. 14:00-16:35, Wed. 18:30-20:05 for last week)

Platform: Tencent Meeting + QQ

Description

In this course, the students will be introduced to the basics of the theory of generalized inverses, the field that has grown much in the last years and is still growing. A lot of illustrations of the theory will be presented with applications in many areas. We will provide an overview of different classes of generalized inverses, their characterizations, different presentations and properties as well as their applicability to different problems inside and outside of mathematics.

After the course, students will be familiar with the basic knowledge of the theory of generalized inverses and its possible applications, and be able to follow certain more advanced topics from this field.

Instructor

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Homepage: https://www.pmf.ni.ac.rs/Dragana/index.html

Prof. Dragana S.

: m kbf m - c

PREREQUISITES

Only elementary knowledge of linear algebra is assumed.

COURSE OBJECTIVES

After this course, students should

- be familiar with the basic knowledge of the theory of generalized inverses and its possible applications,
- be able to follow certain more advanced topics from this field.

CLASS SCHEDULE

Day	Contents
August 8	Historical note. Preliminaries: vector spaces, linear transformations, matrix representations, full-rank factorization, idempotents and projectors, adjoints
August 10	Different classes of generalized inverses. Construction of {1}-inverses and their properties. Existence and construction of {1, 2} inverses. Existence and construction of {1, 2, 3}, {1, 2, 4} and {1, 2, 3, 4} inverses
August 12	Explicit formula for Moore-Penrose inverse. Construction of {2} inverses of prescribed rank. Diversity of generalized inverses and their different characterizations
August 15	Applications: Solvability of different linear systems and representations of their solutions. An application of {2} inverses in iterative methods for solving nonlinear equations. A {1, 2} inverse for the integral solution of linear equations
August 17	The Bott Duffin inverse. An applicatio

FEEDBACK FROM STUDENTS

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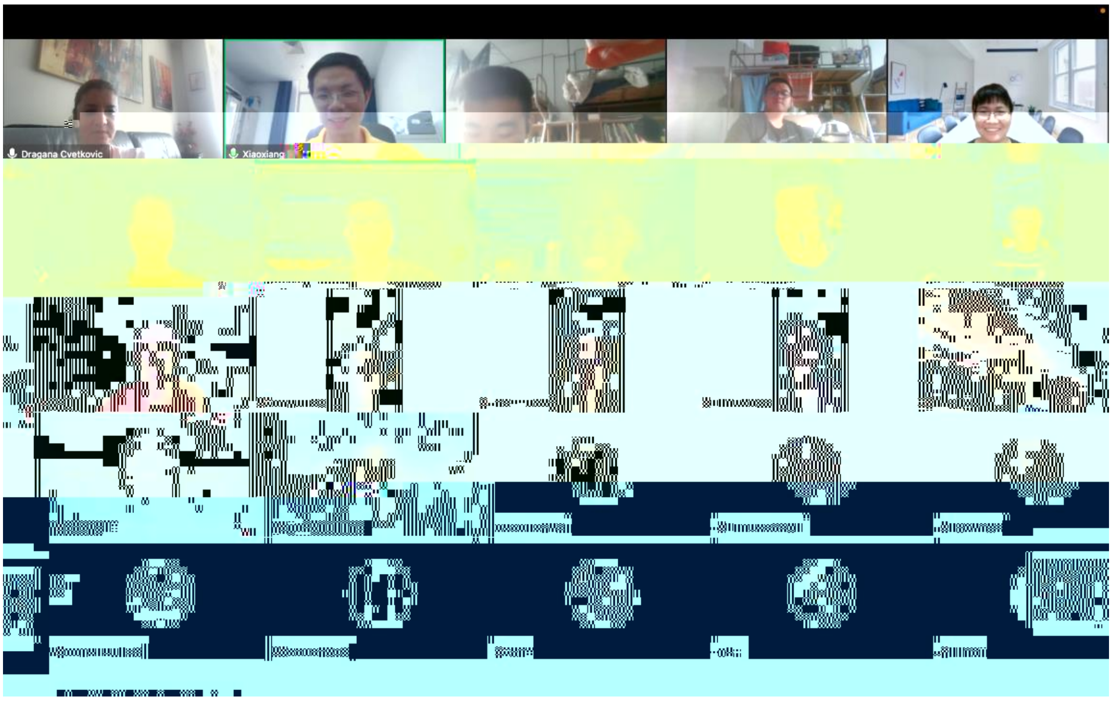
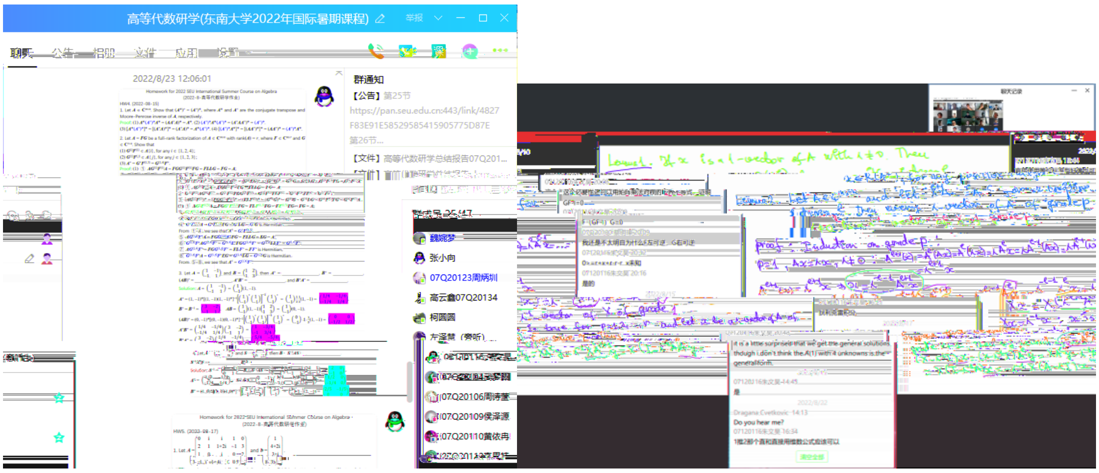
FEEDBACK FROM TEACHERS


Dragana Cvetkovic
Xiaoxiang


高等代数研学(东南大学2022年国际暑期课程)
群通知

COURSE 3: SELECTED TOPICS IN FRONTIER OF SCIENTIFIC COMPUTATION

Hours/Credits	24 hours (August 8 - September 2, 2022) / 1 credit Mon. 9:50 12:15, Wed. 9:50 12:15 Online Platform: Zoom + QQ

Description

The main purpose and characteristic feature of this program is the accessibility of presentation and an attempt to cover the rapidly developing areas of the theory, numerical methods and applications of inverse and ill-posed problems as completely as possible.

First publications on inverse and ill-posed problems date back to the first half of the 20th century. Their subjects were related to physics (inverse problems of quantum scattering theory), geophysics (inverse problems of electrical prospecting, seismology, and potential theory), astronomy, and other areas of natural sciences. Since the advent of powerful computers, the area of application for the theory of inverse and ill-posed problems has extended to almost all fields of science that use mathematical methods.

In direct problems of mathematical physics, researchers try to find exact or approximate functions that describe various physical phenomena such as the propagation of sound, heat, seismic waves, electromagnetic waves, etc. In these problems, the media properties (expressed by the equation coefficients) and the initial state of the process under study (in the nonstationary case) or its properties on the boundary (in the case of a bounded domain and/or in the stationary case) are assumed to be known. However, it is precisely the media properties that are often unknown. This leads to inverse problems, in which it is required to determine the equation coefficients from the information about the solution of the direct problem. Most of these problems are ill-posed (unstable with respect to measurement errors). At the same time, the unknown equation coefficients usually represent important media properties such as density, electrical conductivity, heat conductivity, etc. Given such a wide variety of applications, it is no surprise that the theory and numerical methods of inverse and ill-posed problems has become one of the most rapidly developing areas of modern science. Today it is almost impossible to estimate the total number of scientific publications that directly or indirectly deal with inverse and ill-posed problems. However, since the theory, numerical methods are relatively young, there are many terms are still not well-established, many important results are still being discussed and attempts are being made to improve them. New approaches, concepts, theorems, methods, algorithms and practical problems are constantly emerging.

The calculus of variations concerns problems in which one wishes to find the extrema (usually the minima) of some quantity over a system that has functional degrees of freedom. Many important problems arise in this way across pure and applied mathematics and physics. In this course it is shown that such variational problems give rise to a system of differential equations, the Euler-Lagrange equations. These equations, which have far reaching applications, and the techniques for their solution, will be studied in detail.

Instructor

Prof. Maxim A. Shishlenin (Institute of Computational Mathematics and Mathematical Geophysics, RAS)

Homepage: https://icmmg.nsc.ru/ru/content/employees/shishlenin-maksim-aleksandrovich

Prof. Maxim A. Shishlenin

Maxim A. Shishlenin 2003

Journal of Inverse and Ill-posed Problems

Numerical Analysis and Applications, Eurasian Journal of Mathematical and Computer Applications, Siberian Electronic Mathematical Reports

PREREQUISITES

Calculus, Linear Algebra, Differential Equations, Numerical Analysis. Students are strongly encouraged to use MATLAB for programming.

COURSE OBJECTIVES

After this course, students should be able to

- understand the concept of ill-posed and inverse problems;
- master the regularization methods for inverse problems;
- understand the applications of ill-posed and inverse problems.

CLASS SCHEDULE

FEEDBACK FROM STUDENTS

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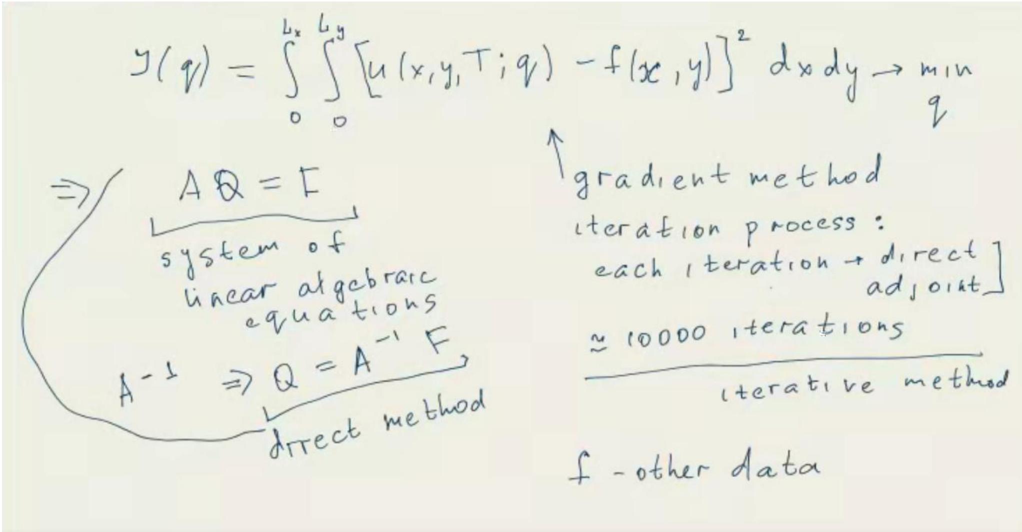
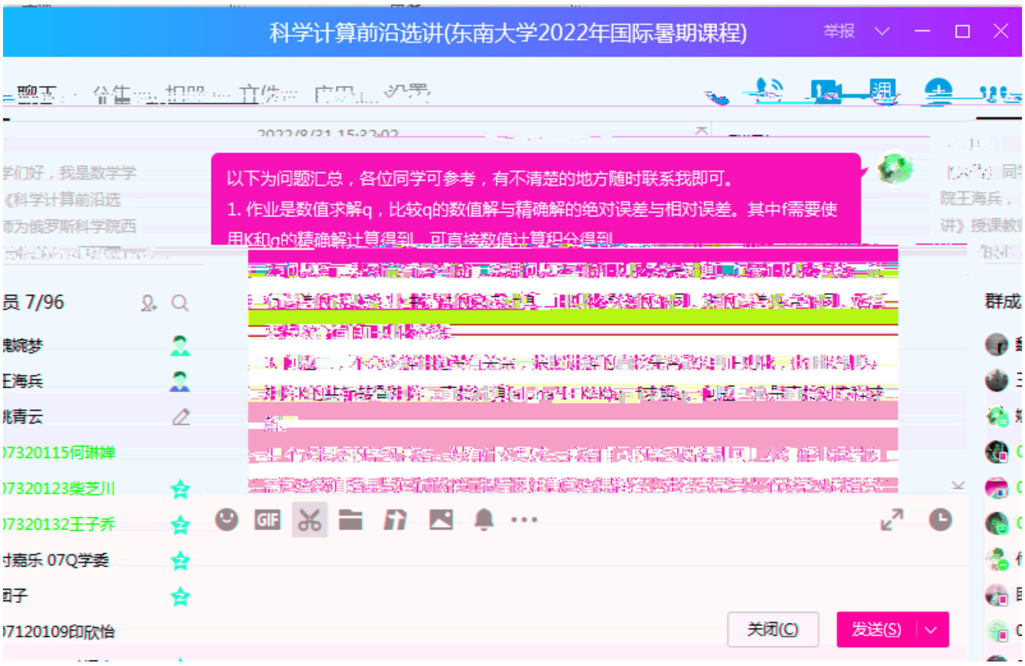

gradient method
iteration process :
each iteration → direct
adjoint
≈ 10000 iterations
iterative method
f - other data
system of
linear algebraic
equations
direct method


科学计算前沿选讲(东南大学2022年国际暑期课程)
以下为问题汇总，各位同学可参考，有不清楚的地方随时联系我即可。
1. 作业是数值求解q，比较q的数值解与精确解的绝对误差与相对误差。其中f需要使
关闭(C)
发送(S)