

Course JULIA LANGUAGE FOR SCIENTIFIC RESEARCH

Basic Information

This is a course, which contributes to MSc award in Mathematics

Duration	72 hours (2 ECTS)
Starting date	February 1st
Study credits	2 ECTS credits
Language of instruction	English level B1(European Framework of Reference of Communicative Skills)
Academic requirements	<ul style="list-style-type: none">– BSc degree in Mathematics, Physics, Computer Science, Engineering or equivalent (a copy of your diplomas from previous university studies and transcripts of completed courses and grades)– Skype interview

Course Description

Julia Programming Language for Scientific Computing is an optional discipline designed to familiarize yourself with a high-level, high-performance programming language with dynamic typing for mathematical calculations. The discipline discusses the use of the main functions of the Julia language for solving various mathematical problems.

Special Features of the Course

Julia language is quite young among programmers. The creators tried to solve the problem of two languages: to combine the convenience of R and Python and the productivity of C. Julia is able to work with a large amount of computing and at the same time guarantee maximum performance. Since a large amount of computing is performed in cloud environments, the language implements support for clouds and parallel programming as a replacement for the MPI mechanism. A feature of Julia is the support of libraries written in C and Python, which means that hundreds of official and custom add-on packages are at the disposal of programmers.

Course Aim

- Learn the basic functions of the Julia language used for scientific computing.
- To develop skills for solving applied problems by Julia language.

Course Objectives

- Explore the OpenBLAS linear algebra library and the LAPACK package.
- Explore ODE packages and Sundials solving differential equations.
- Explore JuMP, NLOpt and Optim packages to solve optimization problems.
- Explore the SimJulia library to solve stochastic problems.
- Explore graphic work packages in Julia.

Learning Outcomes of the Course

By the end of the course, students will be able to:

- use the graphic functions of Julia;
- apply linear algebra techniques in Julia;
- use built-in packages to solve differential equations and optimization problems;
- solve stochastic problems using Julia tools.

Course (module) Structure

Learning Activities	Hours
Practice sessions / Seminars,	18
Self-study Assignments	54
Total study hours	72

Course Outline

Week	Practice session / Assignments	Hours ¹
1-3	<ul style="list-style-type: none">- Linear algebra in Julia- Library of linear algebra OpenBLAS- LAPACK Package- Home assignment No 1	12
4-6	<ul style="list-style-type: none">- Differential equations in Julia- ODE package- Package Sundials- Home assignment No 2	12
7-10	<ul style="list-style-type: none">- Optimization Tasks in Julia- JuMP Package- NLOpt Package- Optim Package- Home assignment No 3	16
11-14	<ul style="list-style-type: none">- Stochastic modeling in Julia- Bayesian and Markov processes- Home assignment No 4	16
15-18	<ul style="list-style-type: none">- Basic graphics in Julia- 2d graphics of Cairo and Winston- Visualization Gadfly- Home assignment No 5	16

¹ Hours designed for Classroom sessions, Web-sessions, Home Assignments etc.

Assessment

Grade policy for home assignments is:

- A (excellent work) 91–100 points
- B (above average work) 81–90 points
- C (average work) 71–80 points
- D (below average work) 50–70 points
- F (failed work) < 50 points

Final standings are conducted in the form of an interview on sections of the discipline
The final grade includes grade for homework and interview in a ratio of 50:50.

Lecturer(s) and Tutors, Contact Information



Roman ESIN

Senior Lecturer at Institute of Space and Information Technologies, Siberian Federal University
(room 311) 26-1, Kirensky st, Krasnoyarsk, Russia
Tel: +7 391 291 2790,
resin@sfu-kras.ru, <http://ikit.sfu-kras.ru/e/207>

Core Reading

All the books are available on-line in Elsevier at SFU library.

Petre Caraiani, Introduction to Quantitative Macroeconomics Using Julia, 1st Edition, From Basic to State-of-the-Art Computational Techniques, Paperback ISBN: 9780128122198, eBook ISBN: 9780128135129, Imprint: Academic Press, Published Date: 29th August 2018, Page Count: 238