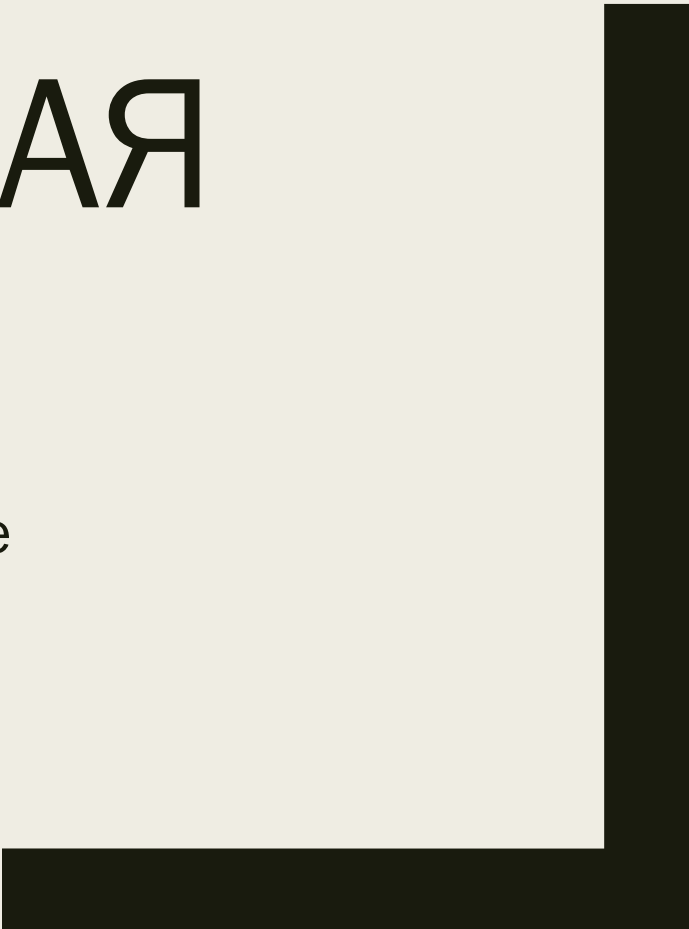




ЛАБОРАТОРНАЯ РАБОТА 2

Математическое моделирование
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Цель работы

- Решить задачу о погоне и изучить основы языка программирования Julia.

Input
$1\ 132\ 221\ 815 \bmod 70 + 1$
Result
26

Рис. 1: Получение нужного номера варианта

$$t = \frac{x}{v}$$

$$t = \frac{15.5 - x}{4.5v}$$

$$\frac{x}{v} = \frac{15.5 - x}{4.5v}$$

$$x = \frac{15.5 - x}{4.5}$$

$$4.5x = 15.5 - x$$

$$5.5x = 15.5$$

$$x = \frac{15.5}{5.5} = 2.818$$

$$v_r = \sqrt{(4.5v)^2 - v^2}$$

$$v_r = \sqrt{20.25v^2 - v^2} = \sqrt{19.25v^2} = \sqrt{19.25} \cdot v$$

$$\frac{dr}{dt} = v$$

$$r \frac{d\theta}{dt} = \frac{\sqrt{651}}{5} \cdot v$$

$$\frac{r \frac{d\theta}{dt}}{\frac{dr}{dt}} = \frac{\frac{\sqrt{651}}{5} \cdot v}{v}$$

$$\frac{r \frac{d\theta}{dt}}{\frac{dr}{dt}} = \frac{\sqrt{651}}{5}$$

$$\frac{dr}{d\theta} = \frac{5r}{\sqrt{651}}$$

$$\frac{dr}{d\theta} = \frac{5r}{\sqrt{651}}$$

$$\int \frac{dr}{r} = \int \frac{5}{\sqrt{651}} d\theta$$

$$\ln |r| = \frac{5}{\sqrt{651}} \theta + C$$

$$r = e^{\frac{5}{\sqrt{651}} \theta + C} = e^C \cdot e^{\frac{5}{\sqrt{651}} \theta}$$

$$r = r_0 \cdot e^{\frac{5}{\sqrt{651}} \theta}$$

```
Installing Julia 1.10.1+0.x64.w64.mingw32

  Documentation: https://docs.julialang.org
  Type "?" for help, "]?" for Pkg help.
  Version 1.10.1 (2024-02-13)
  Official https://julialang.org/ release

julia>
```

Рис. 1: Процесс запуска Julia

```

import Plg
Plg.add("Plots")
Plg.add("DifferentialEquations")

using Plots
using DifferentialEquations

const a = 15.5
const n = 4.5

const r0 = a/(n + 1)
const r0_2 = a/(n - 1)

const T = (0, 2*pi)
const T_2 = (-pi, pi)

function F(u, p, t)
    return u / sqrt(n*n - 1)
end

problem = ODEProblem(F, r0, T)

result = solve(problem, abstol=1e-8, reltol=1e-8)
@show result.u
@show result.t

dxR = rand(1:size(result.t)[1])
rAngles = [result.t[dxR] for i in 1:size(result.t)[1]]

plt = plot(proj=:polar, aspect_ratio=:equal, dpi = 1000, legend=true, bg=:white)

plot!(plt, xlabel="theta", ylabel="r(t)", title="Случай номер 1", legend=:outerbottom)
plot!(plt, [rAngles[1], rAngles[2]], [0.0, result.u[size(result.u)[1]]], label="Путь лодки", color=:blue, lw=1)
scatter!(plt, rAngles, result.u, label="", mc=:blue, ms=0.0005)
plot!(plt, result.t, result.u, xlabel="theta", ylabel="r(t)", label="Путь катера", color=:green, lw=1)
scatter!(plt, result.t, result.u, label="", mc=:green, ms=0.0005)

savefig(plt, "lab2_01.png")

problem = ODEProblem(F, r0_2, T_2)
result = solve(problem, abstol=1e-8, reltol=1e-8)
dxR = rand(1:size(result.t)[1])
rAngles = [result.t[dxR] for i in 1:size(result.t)[1]]

plt1 = plot(proj=:polar, aspect_ratio=:equal, dpi = 1000, legend=true, bg=:white)

plot!(plt1, xlabel="theta", ylabel="r(t)", title="Случай номер 2", legend=:outerbottom)
plot!(plt1, [rAngles[1], rAngles[2]], [0.0, result.u[size(result.u)[1]]], label="Путь лодки", color=:blue, lw=1)
scatter!(plt1, rAngles, result.u, label="", mc=:blue, ms=0.0005)
plot!(plt1, result.t, result.u, xlabel="theta", ylabel="r(t)", label="Путь катера", color=:green, lw=1)
scatter!(plt1, result.t, result.u, label="", mc=:green, ms=0.0005)

savefig(plt1, "lab2_02.png")

```

Рис. 2: Процесс запуска Julia

```
julia> include("C:/Users/sym/Downloads/lab2.jl")
Updating registry at `C:\Users\sym\.julia\registries\General.toml`
Resolving package versions...
No Changes to `C:\Users\sym\.julia\environments\v1.11\Project.toml`
No Changes to `C:\Users\sym\.julia\environments\v1.11\Manifest.toml`
Resolving package versions...
No Changes to `C:\Users\sym\.julia\environments\v1.11\Project.toml`
No Changes to `C:\Users\sym\.julia\environments\v1.11\Manifest.toml`
result.u = [2.8181818181818183, 2.8492381670520786, 3.0308116584540947, 3.393570527457541, 3.885798873359639, 4.52303698
2071468, 5.354513681616794, 6.42454772005501, 7.802307093301427, 9.568951152756823, 11.800746248948537]
result.t = [0.0, 0.04808556342176138, 0.3191389877957858, 0.8151533369392614, 1.4094201309869998, 2.0756815642745, 2.816
0964619113606, 3.6154358307500667, 4.46789394675377, 5.363397186698492, 6.283185307179586]
"C:\Users\sym\lab2_02.png"
```

Рис. 3: Запуск кода



Рис. 4: Случай 1



Рис. 5: Случай 2

Вывод

- Были изучены основы языка программирования Julia и его библиотеки, которые используются для построения графиков и решения дифференциальных уравнений. А также решили задачу о погоне