```
Activating project at `~/.julia/environments/v1.8`
```

Метод сеток

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + 0.5 * (x^2 - 2t)$$

$$0 \leq x \leq 1, 0 \leq t \leq 0.02$$

$$u(0,t) = 0, u(1,t) = 0.5t$$

$$u(x,0) = 0$$

```
a (generic function with 1 method)
```

```
a(x,t) = 1
```

```
φ (generic function with 1 method)
```

```
φ(x,t) = .5 * (x^2 - 2*t)
```

```
γ₀ (generic function with 1 method)
```

```
γ₀(t) = 0
```

```
γ₁ (generic function with 1 method)
```

```
γ₁(t) = .5*t
```

```
ψ (generic function with 1 method)
```

```
ψ(t) = 0
```

```
h = 0.1
```

```
h = .1
```

```
x =  [0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0]
```

```
x = 0:h:1 |> collect
```

По явной разрастной схеме

```
τ_explicit = 0.005
```

```
τ_explicit = .005
```

```
t_explicit =  [0.0, 0.005, 0.01, 0.015, 0.02]
```

```
t_explicit = 0:τ_explicit:0.02 |> collect
```

```
u_explicit = 5×11 Matrix{Float64}:
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
```

```
u_explicit = zeros((length(t_explicit), length(x)))
```

```
for n in 2:length(t_explicit)-1
    u_explicit[n, 1], u_explicit[n, length(x)] = γ₀(t_explicit[n]), γ₁(t_explicit[n])
end
```

```
for m in 2:length(x)-1
    u_explicit[1, m] = ψ(x[m])
end
```

```
5×11 Matrix{Float64}:
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0025
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.005
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0075
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
```

```
u_explicit
```

```
s_explicit = 0.4999999999999999
```

```
s_explicit = τ_explicit / h^2
```

```
for m in 2:length(x)-1, n in 2:length(t_explicit)-1
    u_explicit[n+1, m] = s_explicit * u_explicit[n, m+1] +
        (1 - 2 * s_explicit) * u_explicit[n, m] +
        s_explicit * u_explicit[n, m-1] + τ_explicit * φ(x[m], t_explicit[n])
end
```

```
5×11 Matrix{Float64}:
 0.0   0.0          0.0      0.0        0.0         …  0.0          0.0        0.0
 0.0   0.0          0.0      0.0        0.0            0.0          0.0        0.0025
 0.0   4.33681e-21  7.5e-5   0.0002     0.000375       0.001575     0.00325    0.005
 0.0  -2.5e-5       5.0e-5   0.0002125  0.00045        0.00215      0.0052625  0.0075
 0.0  -5.0e-5       1.25e-5  0.000175   0.00043125     0.00233125   0.006775   0.0
```

```
u_explicit
```

По неявной разрастной схеме

```
τ_implicit = 0.02
```

```
τ_implicit = .02
```

```
t_implicit =  [0.0, 0.02]
```

```
t_implicit = 0:τ_implicit:0.02 |> collect
```

```
u_implicit = 2×11 Matrix{Float64}:
             0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
             0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
```

```
u_implicit = zeros((length(t_implicit), length(x)))
```

```
for n in 1:length(t_implicit)
    u_implicit[n, 1], u_implicit[n, length(x)] = γ₀(t_implicit[n]), γ₁(t_implicit[n])
end
```

```
for m in 2:length(x)-1
    u_implicit[1, m] = ψ(x[m])
end
```

```
2×11 Matrix{Float64}:
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
 0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.01
```

```
u_implicit
```

```
s_implicit = 1.9999999999999996
```

```
s_implicit = τ_implicit / h^2
```

```
A = 9×11 Matrix{Float64}:
     2.0  -5.0   2.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  0.0
     0.0   2.0  -5.0   2.0   0.0   0.0   0.0   0.0   0.0   0.0  0.0
     0.0   0.0   2.0  -5.0   2.0   0.0   0.0   0.0   0.0   0.0  0.0
     0.0   0.0   0.0   2.0  -5.0   2.0   0.0   0.0   0.0   0.0  0.0
     0.0   0.0   0.0   0.0   2.0  -5.0   2.0   0.0   0.0   0.0  0.0
     0.0   0.0   0.0   0.0   0.0   2.0  -5.0   2.0   0.0   0.0  0.0
     0.0   0.0   0.0   0.0   0.0   0.0   2.0  -5.0   2.0   0.0  0.0
     0.0   0.0   0.0   0.0   0.0   0.0   0.0   2.0  -5.0   2.0  0.0
     0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   2.0  -5.0  2.0
```

```
A = diagm(
    0=>fill(s_implicit, length(x)-2),
    1=>fill(-(1+2*s_implicit), length(x)-2),
    2=>fill(s_implicit, length(x)-2)
)[1:end-2, :]
```

```
b =  [-0.0001, -0.0004, -0.0009, -0.0016, -0.0025, -0.0036, -0.0049, -0.0064, -0.0081]
```

```
b = -u_implicit[1, 2:end-1] -
    [τ_implicit * φ(x[m], t_implicit[1]) for m in 2:length(x)-1]
```

```
Float64[
    1:  -0.000546677
    2:  7.55722e-6
    3:  0.00051557
    4:  0.00108137
    5:  0.00173785
    6:  0.00246326
    7:  0.0031703
    8:  0.00366249
    9:  0.00353592
    10:  0.0019773
    11:  -0.00264266
    ]
```

```
u_implicit[2, :] = A \ b
```

```
2×11 Matrix{Float64}:
  0.0          0.0          0.0          …  0.0          0.0          0.0
 -0.000546677  7.55722e-6   0.00051557      0.00353592   0.0019773   -0.00264266
```

```
u_implicit
```