# Package 'diffeqr'

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**Type** Package

**Title** Solving Differential Equations (ODEs, SDEs, DDEs, DAEs)

**Version** 2.1.0

**Description** An interface to 'DifferentialEquations.jl' <https://diffeq.sciml.ai/dev/> from the R programming language.
It has unique high performance methods for solving ordinary differential equations (ODE), stochastic differential equations (SDE),
delay differential equations (DDE), differential-algebraic equations (DAE), and more. Much of the functionality,
including features like adaptive time stepping in SDEs, are unique and allow for multiple orders of magnitude speedup over more common methods.
Supports GPUs, with support for CUDA (NVIDIA), AMD GPUs, Intel oneAPI GPUs, and Apple's Metal (M-series chip GPUs).
'diffeqr' attaches an R interface onto the package, allowing seamless use of this tooling by R users. For more information,
see Rackauckas and Nie (2017) <doi:10.5334/jors.151>.

**Depends** R (>= 3.4.0)

**Encoding** UTF-8

**License** MIT + file LICENSE

**URL** https://github.com/SciML/diffeqr

**SystemRequirements** Julia (>= 1.6), DifferentialEquations.jl, ModelingToolkit.jl

**Imports** JuliaCall

**RoxygenNote** 7.1.1

**Suggests** testthat, knitr, rmarkdown

**VignetteBuilder** knitr

**NeedsCompilation** no

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**Repository** CRAN

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`diffeqgpu_setup` *Setup DiffEqGPU*

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## Description

This function initializes the DiffEqGPU package for GPU-parallelized ensembles. The first time will be long since it includes precompilation.

## Usage

```
diffeqgpu_setup(backend)
```

## Arguments

| | |
|---|---|
| `backend` | the backend for the GPU computation. Choices are "CUDA", "AMDGPU", "Metal", or "oneAPI" |

## Value

Returns a degpu object which holds the module state of the Julia-side DiffEqGPU package. The core use is to use degpu$EnsembleGPUKernel() for choosing the GPU dispatch in the solve.

## Examples

```
## Not run:  ## diffeqgpu_setup() is time-consuming and requires Julia+DifferentialEquations.jl

degpu <- diffeqr::diffeqgpu_setup(backend)


## End(Not run)
```

## diffeq_setup *Setup diffeqr*

### Description

This function initializes Julia and the DifferentialEquations.jl package. The first time will be long since it includes precompilation. Additionally, this will install Julia and the required packages if they are missing.

### Usage

```
diffeq_setup(pkg_check = TRUE, ...)
```

### Arguments

| | |
|---|---|
| pkg_check | logical, check for DifferentialEquations.jl package and install if necessary |
| ... | Parameters are passed down to JuliaCall::julia_setup |

### Value

Returns the de object which gives R-side calls to DifferentialEquations.jl's functions. For example, de$solve calls the DifferentialEquations.solve function, and de$ODEProblem calls the DifferentialEquations.

### Examples

```
## Not run: ## diffeq_setup() is time-consuming and requires Julia+DifferentialEquations.jl

diffeqr::diffeq_setup()


## End(Not run)
```

## jitoptimize_ode *Jit Optimize an ODEProblem*

### Description

This function JIT Optimizes and ODEProblem utilizing the Julia ModelingToolkit and JIT compiler.

### Usage

```
jitoptimize_ode(de, prob)
```

### Arguments

| | |
|---|---|
| de | the current diffeqr environment |
| prob | an ODEProblem |

### Value

Returns an ODEProblem which has been JIT-optimized by Julia.

### Examples

```
## Not run:  ## diffeq_setup() is time-consuming and requires Julia+DifferentialEquations.jl
de <- diffeqr::diffeq_setup()
f <- function(u,p,t) {
  du1 = p[1]*(u[2]-u[1])
  du2 = u[1]*(p[2]-u[3]) - u[2]
  du3 = u[1]*u[2] - p[3]*u[3]
  return(c(du1,du2,du3))
}
u0 <- c(1.0,0.0,0.0)
tspan <- c(0.0,100.0)
p <- c(10.0,28.0,8/3)
prob <- de$ODEProblem(f, u0, tspan, p)
fastprob <- diffeqr::jitoptimize_ode(de,prob)
sol <- de$solve(fastprob,de$Tsit5())

## End(Not run)
```

---

## jitoptimize_sde *Jit Optimize an SDEProblem*

---

### Description

This function JIT Optimizes and SDEProblem utilizing the Julia ModelingToolkit and JIT compiler.

### Usage

```
jitoptimize_sde(de, prob)
```

### Arguments

| | |
|---|---|
| de | the current diffeqr environment |
| prob | an SDEProblem |

### Value

Returns an SDEProblem which has been JIT-optimized by Julia.

## Examples

```
## Not run:  ## diffeq_setup() is time-consuming and requires Julia+DifferentialEquations.jl

diffeqr::diffeq_setup()


## End(Not run)
```

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