ode

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Chapter 1

File Index

1.1 File List

Here is a list of all documented files with brief descriptions:

Chapter 2

File Documentation

2.1 ode.hpp File Reference

```
#include <functional>
#include "armadillo"
#include "optimization.hpp"
```

Functions

- template< typename T >
  Col< T > **runge_kutta_explicit** (const function< Col< T >(Col< T >)> &func, const Col< T > &x0, T dt)

  Evolve an ODE using a 4th order explicit Runge-Kutta method Solve a first-order system of ordinary differential equations using the classical 4th-order Runge-Kutta one-step method. Note: this method may not be suitable for stiff systems, though it is much faster than implicit methods.
- template< typename T >
  Col< T > **runge_kutta_implicit** (const function< Col< T >(Col< T >)> &func, const Col< T > &x0, T dt)

  Evolve an ODE system using the implicit 4th order Runge-Kutta-Gauss method Solve a system of ordinary differential equations using the 4th order Runge-Kutta-Gauss method. This method is unconditionally stable and will yield a stable solution for stable ODE's, though it is an implicit method and will be slower than explicit methods.
- template< typename T >
  Col< T > **solve_ode** (const function< Col< T >(Col< T >)> &func, const Col< T > &x0, T dt)

  Solve an ODE system using an explicit method if stable and an unconditionally stable implicit Runge-Kutta method instead. Solve an ODE over a single time step using either an implicit or explicit method without having to worry about the stiffness. Both the implicit and explicit methods are 4th order consistent. This method will determine the stability of the ODE to determine the best solver. If the system is stable, the method will solve with the faster Runge-Kutta method, and will use the slower, yet stable, implicit method if the explicit method is not stable.

2.1.1 Function Documentation

2.1.1.1 runge_kutta_explicit()

```
template<typename T >
Col<T> runge_kutta_explicit (
            const function< Col< T >(Col< T >)> & func,
            const Col< T > & x0,
            T dt )
```

Evolve an ODE using a 4th order explicit Runge-Kutta method Solve a first-order system of ordinary differential equations using the classical 4th-order Runge-Kutta one-step method. Note: this method may not be suitable for stiff systems, though it is much faster than implicit methods.

Template Parameters

T	

Parameters

func	The differential equations to evaulate
x0	The initial state of the system
dt	The time step to simulate the model

Returns

Col<T>

2.1.1.2 runge_kutta_implicit()

```
template<typename T >
Col<T> runge_kutta_implicit (
            const function< Col< T >(Col< T >)> & func,
            const Col< T > & x0,
            T dt )
```

Evolve an ODE system using the implicit 4th order Runge-Kutta-Gauss method Solve a system of ordinary differential equations using the 4th order Runge-Kutta-Gauss method. This method is unconditionally stable and will yield a stable solution for stable ODE's, though it is an implicit method and will be slower than explicit methods.

Template Parameters

T	

Parameters

func	The ODE system
x0	The initial state of the system
dt	The time step

Returns

Col<T>

2.1.1.3 solve_ode()

```
template<typename T >
Col<T> solve_ode (
            const function< Col< T >(Col< T >)> & func,
            const Col< T > & x0,
            T dt )
```

Solve an ODE system using an explicit method if stable and an unconditionally stable implicit Runge-Kutta method instead. Solve an ODE over a single time step using either an implicit or explicit method without having to worry about the stiffness. Both the implicit and explicit methods are 4th order consistent. This method will determine the stability of the ODE to determine the best solver. If the system is stable, the method will solve with the faster Runge-Kutta method, and will use the slower, yet stable, implicit method if the explicit method is not stable.

Template Parameters

T	

Parameters

func	The ODE system
x0	The initial state of the system
dt	The time step

Returns

Col<T>

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