AstroFV

FV Solver for RSTP problem

View On GitHub

This project is maintained by njase

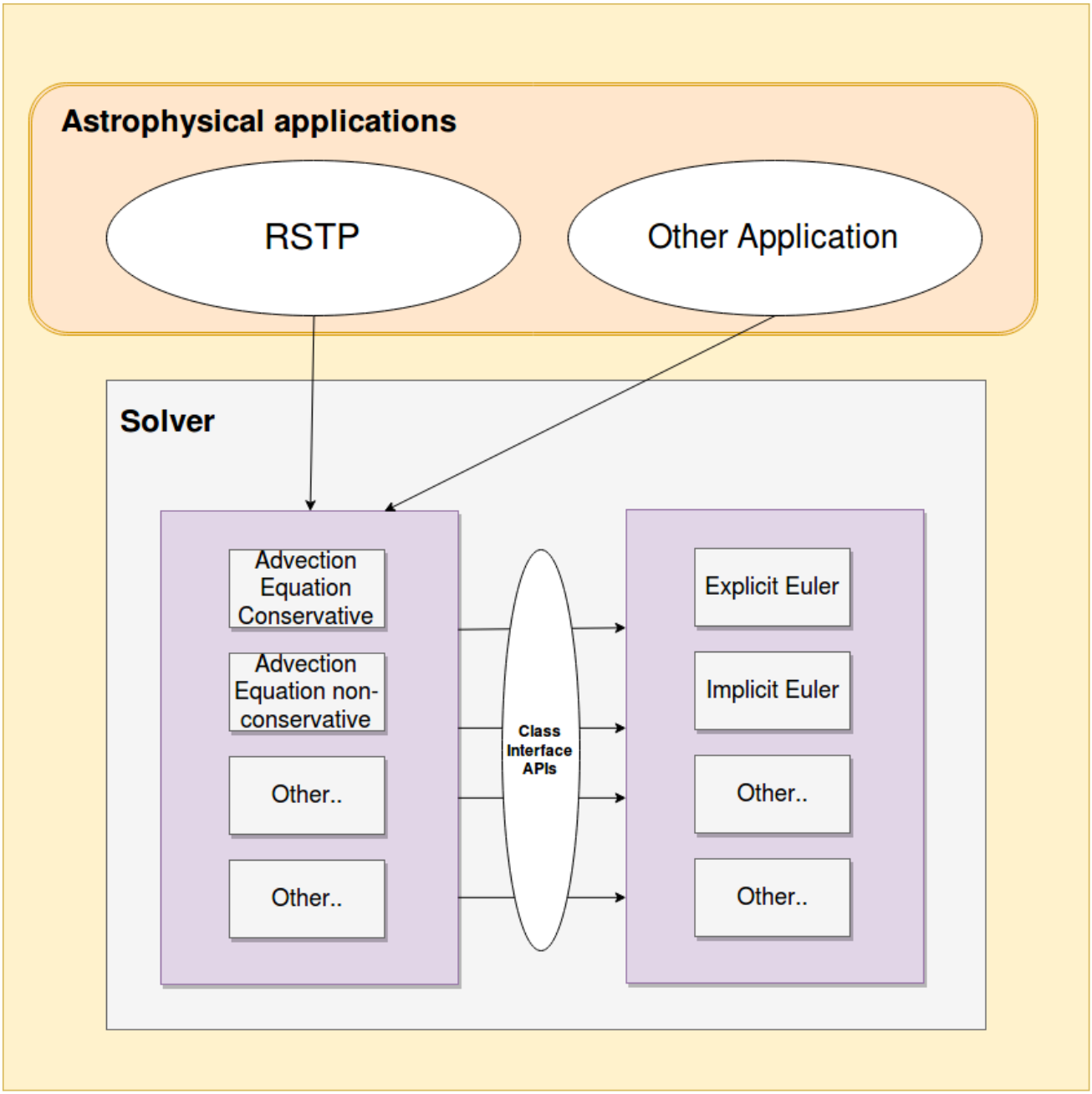
# AstroFV

AstroFV is a Finite Volume Solver for Astrophysical applications written in Python

## Current Features

- Solver
  - 1-D solver
  - Time integration using Explicit Euler and Implicit Euler techniques
  - Finite Volume Method with first-order upwind discretization
  - Structured mesh
- Equations
  - (Nonlinear) Advection Equation in conservative form with space dependent velocity
- Available Astrophysical applications
  - 1-D RSTP (Relativistic Shock Tube Problem)
- General characteristics
  - Aimed at simple to use for user and easily extensible for developer
  - Object oriented, well modular design
  - no GPU support

## High level view




The AstoFV is divided into two modules:

- Solver: This is further divided into two submodules:
  - One submodule defines the set of equations which are supported by the solver
  - Another submodule implements the actual numerical techniques

  Abstract interfaces are used to allow equations to use any numerical methods in a generic manner

- Astrophysical applications: This implements the respective application whose solution is needed by solving a system of equations

  Abstract interfaces are used to allow applications to easily define and use the Solver equations

# Example usage

## Code to solve RSTP with Explicit Euler technique

```
eparams = RSTPExplicitParams(1000,4/3,0.25)
eparams.set_fig_path('./figs/')
eparams.fv_boundary_strategy = FVTransverse #Default
eiv = RSTPIV(Vx=[0,0],Mx=[0,0],D=[1,10**-2],Rho=[1,10**-2])
ebv = RSTPBV()
test_explicit = RSTPTest(1,eparams,eiv,ebv,ode_strategy=ODEExplicit)
test_explicit.solve()
```

## Code to solve RSTP with Implicit Euler technique

```
iparams = RSTPImplicitParams(1000,1.0,4/3,2,0.7)
iparams.set_fig_path('./figs/')
iparams.fv_boundary_strategy = FVTransverse #Default
iiv = RSTPIV(Vx=[0,0],Mx=[0,0],D=[1,10**-2],Rho=[1,10**-2])
ibv = RSTPBV()
test_implicit = RSTPTest(2,iparams,iiv,ibv,ode_strategy=ODEImplicit)
test_implicit.solve()
```

See more at User manual and Developer manual