aerospacedesignlab

SU² code structure

Introduction to the SU² Code Structure

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Code structure
SU² C++ Modules

SU2_CFD - Main CFD solver

SU2_PRT - Mesh Partitioning Code

SU2_SOL - Solution Export Code

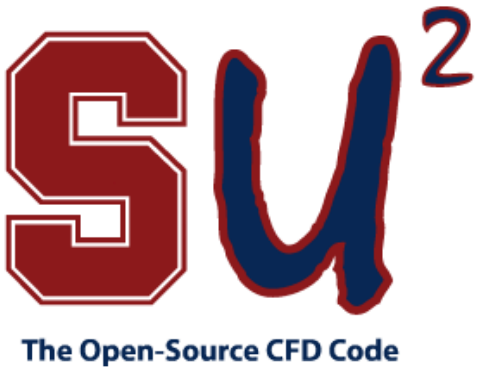
SU2_MSH - Mesh Adaptation Code

SU2_DEF- Mesh Deformation Code

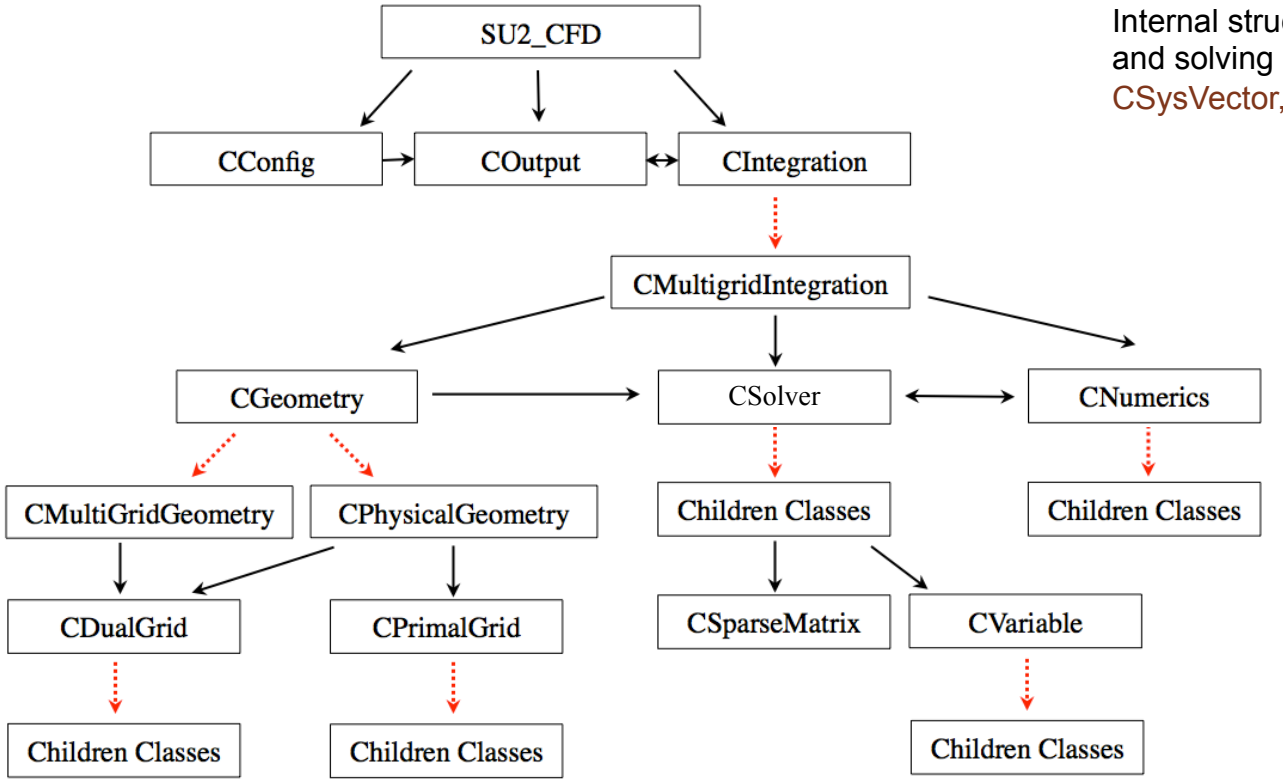
SU2_GEO - Geometry Definition Code

+ Python scripts

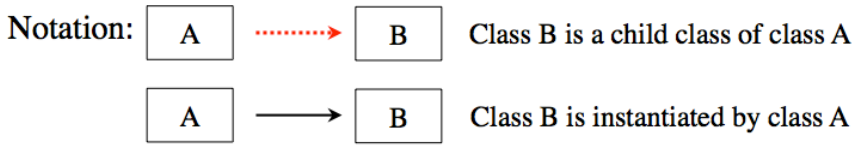
+ SU2_EDU (Educational version)
+ SU2_PHI (Xeon Phi version, on going Intel® collaboration)



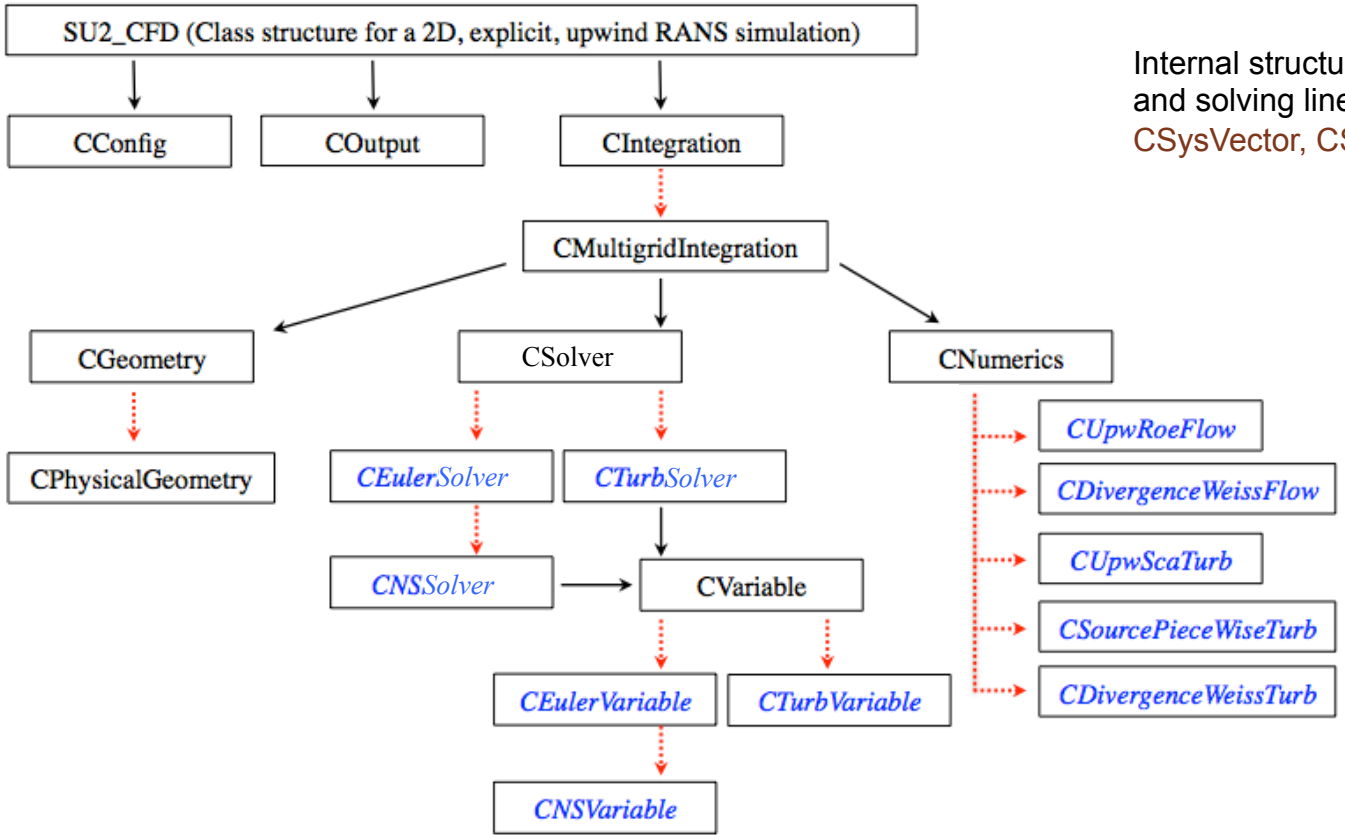
Code structure
Class hierarchy in SU2_CFD



Internal structure for storing and solving linear systems: CSysVector, CSysMatrix

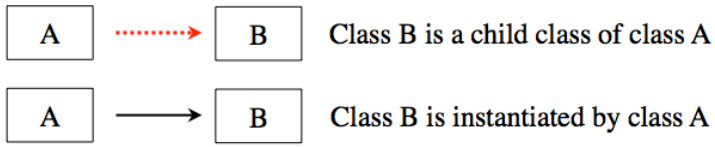


Code structure
Class hierarchy for solving a RANS problem



Internal structure for storing and solving linear systems: CSysVector, CSysMatrix

Notation:



Code structure
Class hierarchy in SU2_CFD

1a) Read Input
Class: CConfig
- Read the config file.

1b) Read Mesh
Class: CGeometry
- Read the mesh file.
- Set up multigrid meshes.

2) Solve Equations
Class: CSolver
- Euler Equations: CEulerSolver
- Plasma Equations: CPlasmaSolver
- Euler Adj. Eq.: CEulerAdjSolver
- Heat Equations: CHeatSolver
- And others…

3) Write Output
Class: COutput
- Print on screen
- Write solution file
- Write restart file
- Write history file

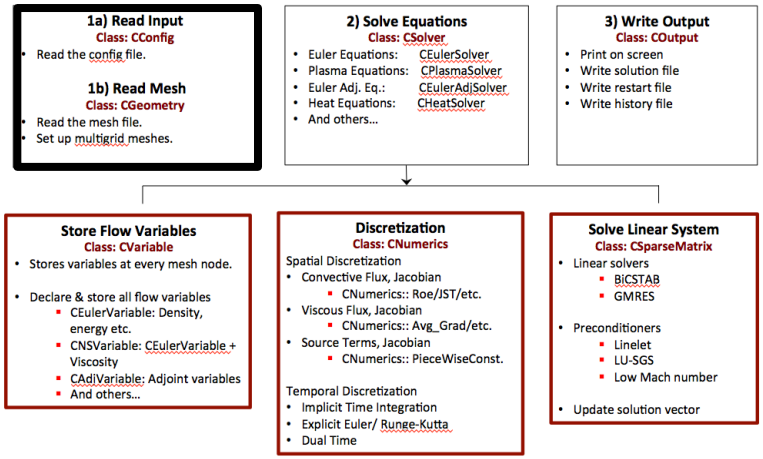
Store Flow Variables
Class: CVariable
- Stores variables at every mesh node.
- Declare & store all flow variables
  - CEulerVariable: Density, energy etc.
  - CNSVariable: CEulerVariable + Viscosity
  - CAdjVariable: Adjoint variables
  - And others…

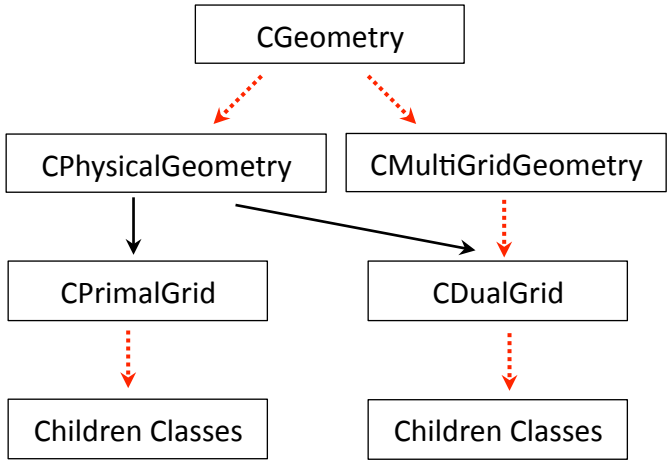
Discretization
Class: CNumerics
Spatial Discretization
- Convective Flux, Jacobian
  - CNumerics:: Roe/JST/etc.
- Viscous Flux, Jacobian
  - CNumerics:: Avg_Grad/etc.
- Source Terms, Jacobian
  - CNumerics:: PieceWiseConst.

Temporal Discretization
- Implicit Time Integration
- Explicit Euler/ Runge-Kutta
- Dual Time

Solve Linear System
Class: CSparseMatrix
- Linear solvers
  - BiCSTAB
  - GMRES
- Preconditioners
  - Linelet
  - LU-SGS
  - Low Mach number
- Update solution vector

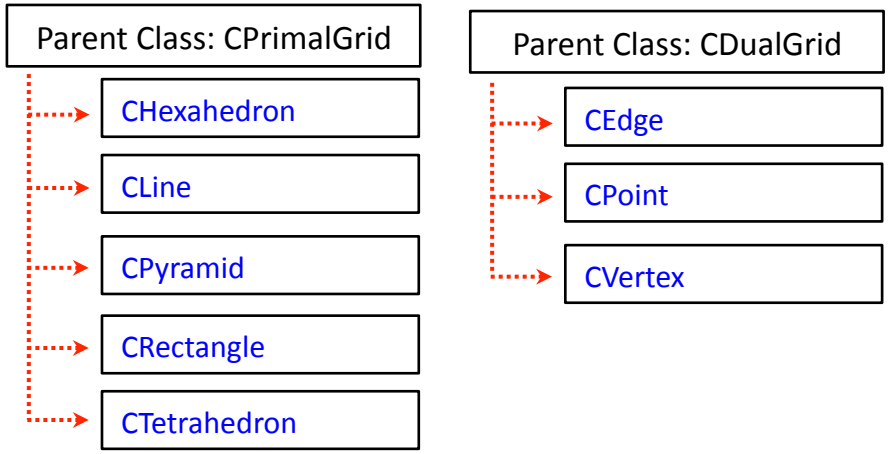
Code structure
CGeometry Class



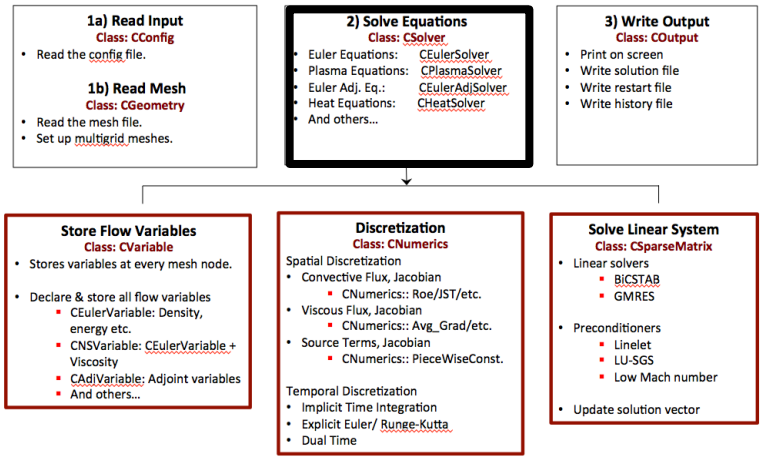


Files in Common/include:
- geometry_structure.hpp
- geometry_structure.inl

In Common/src
- geometry_structure.cpp



Code structure
CSolver Class

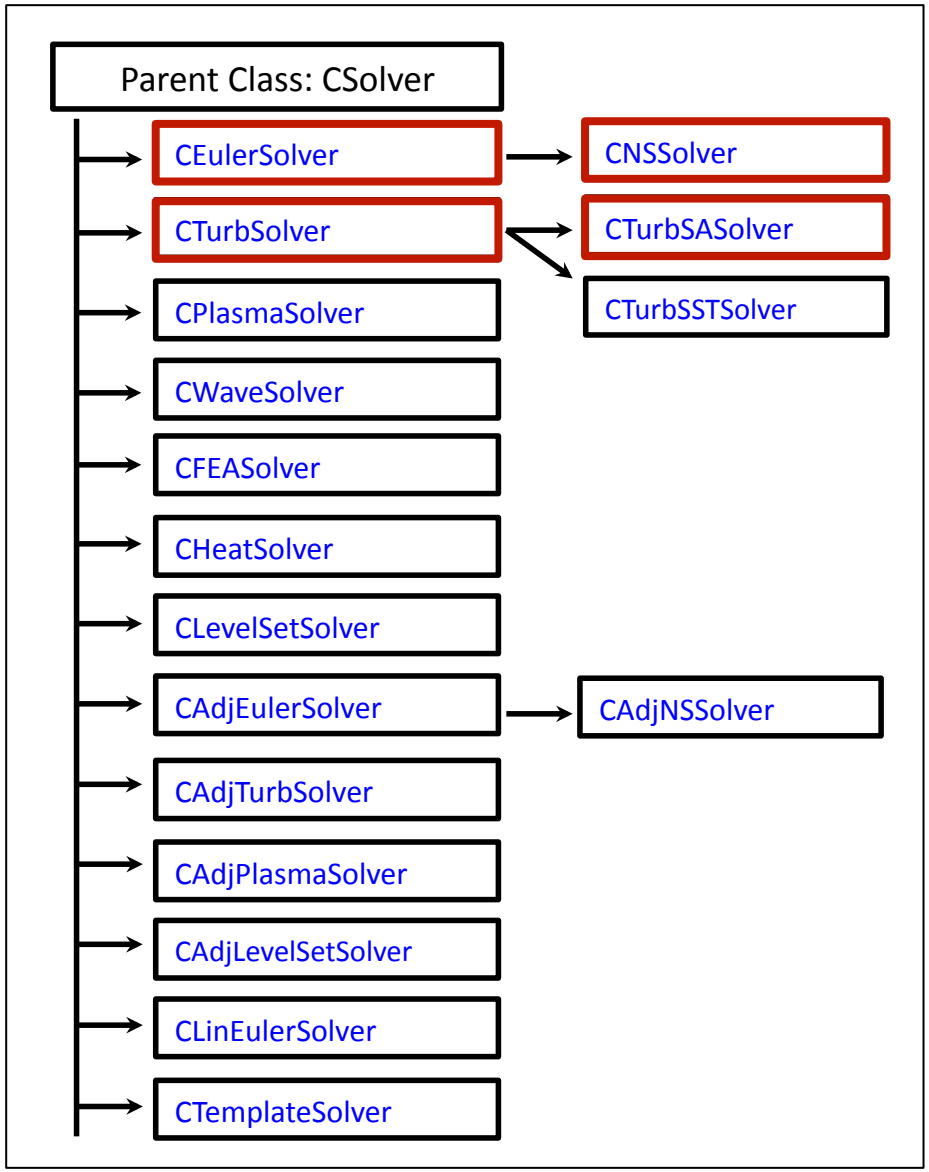


Files in SU2_CFD/include:

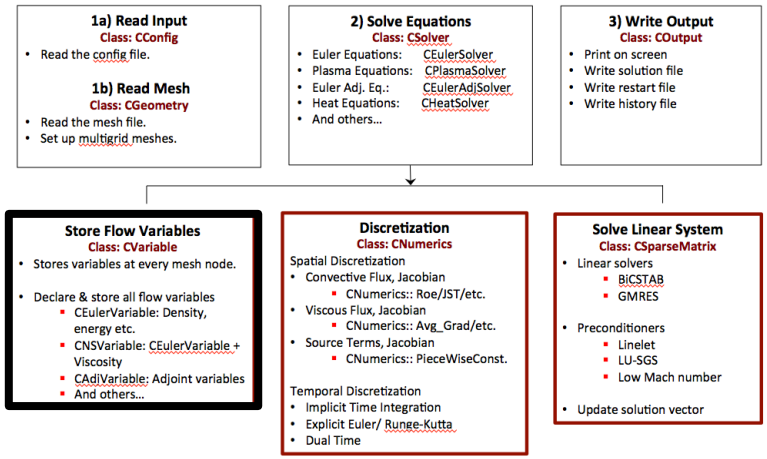
- solver_structure.hpp
- solver_structure.inl

In SU2_CFD/src

- solver_direct_mean.cpp
- solver_adjoint_mean.cpp
- solver_direct_template.cpp
- etc.

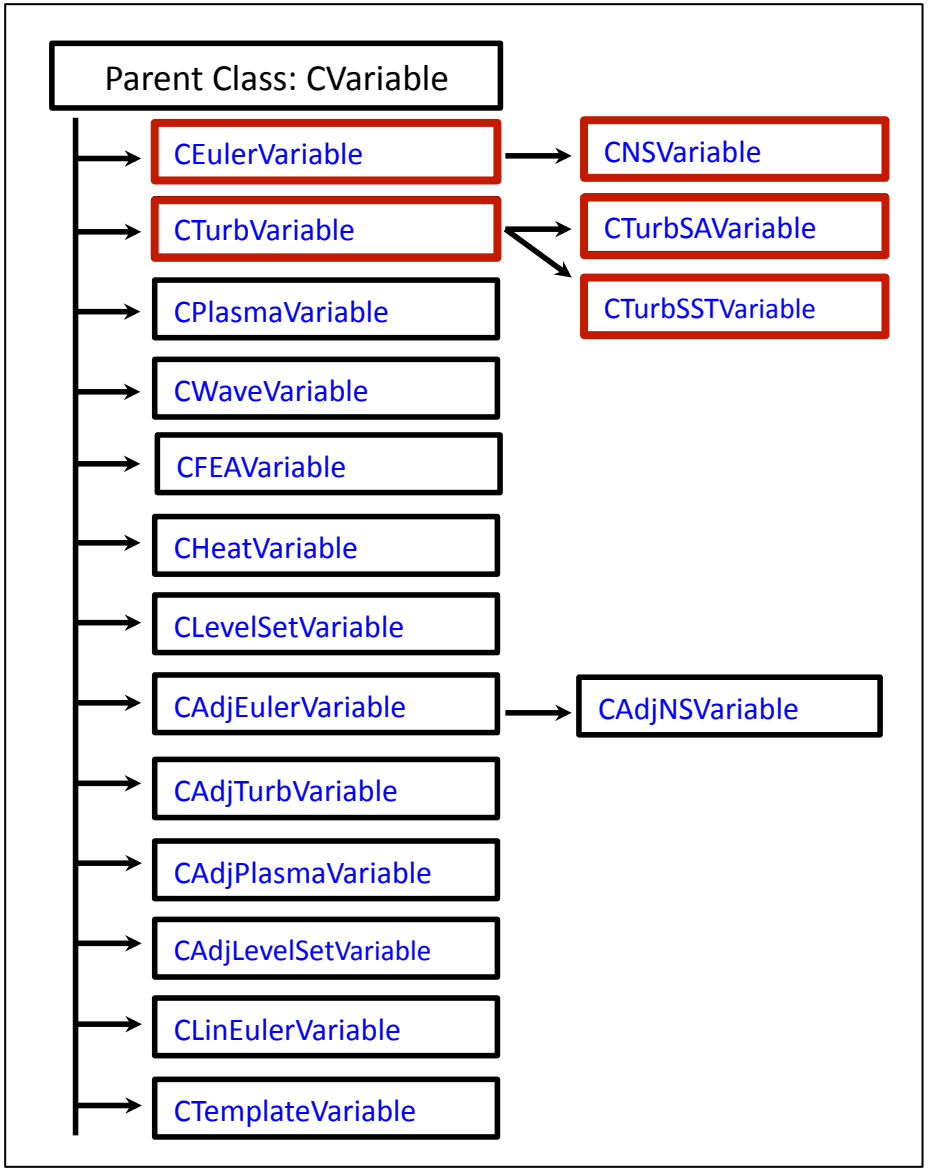


Code structure
CVariable Class

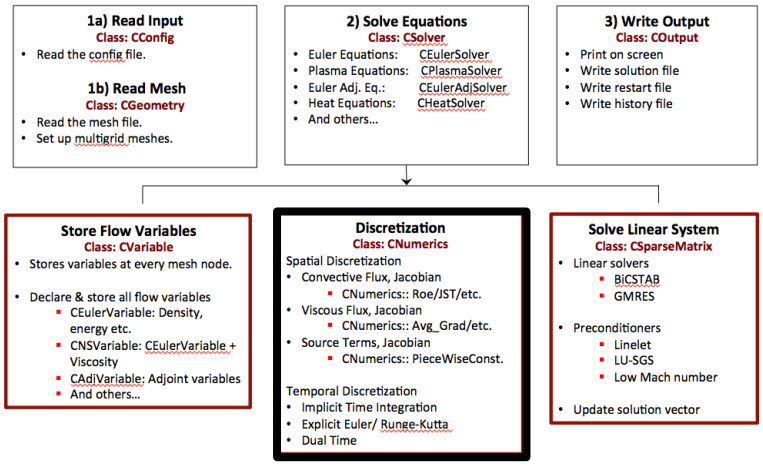


Files in SU2_CFD/include
- variable_structure.hpp
- variable_structure.inl

SU2_CFD/src
- variable_direct.cpp
- variable_adjoint.cpp
- variable_template.cpp
- etc.



Code structure
CNumerics Class



Files in SU2_CFD/include

- numerics_structure.hpp
- numerics_structure.inl

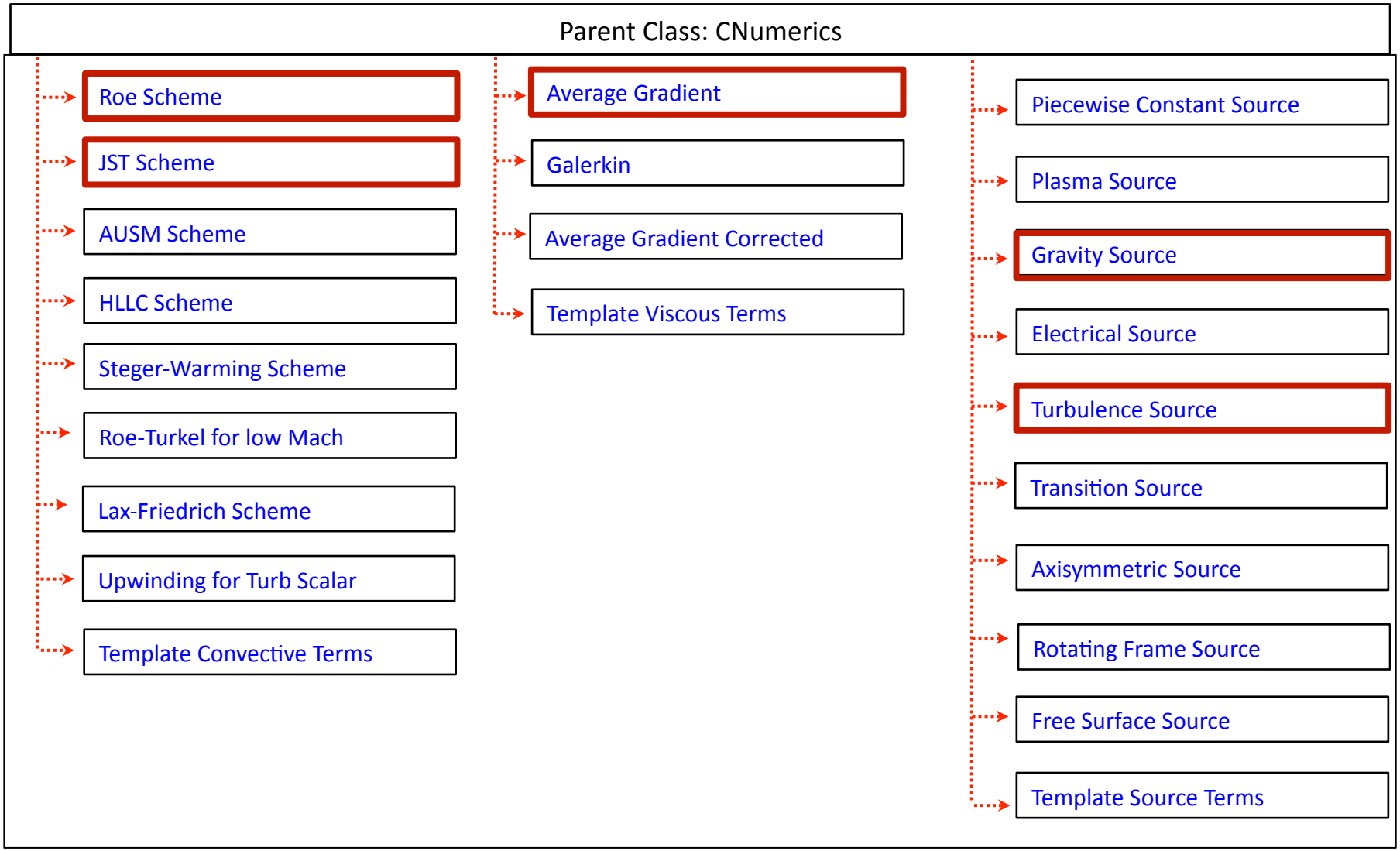
In SU2_CFD/src:

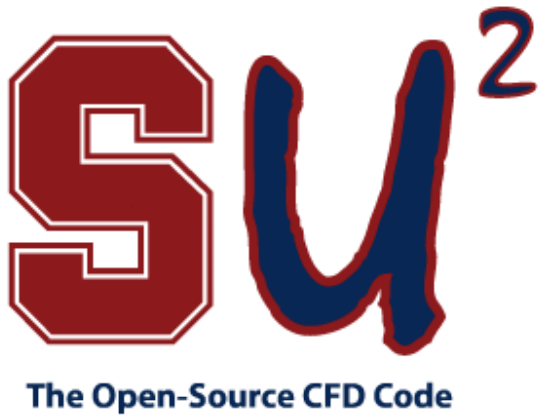
- numerics_structure.cpp
- numerics_convective.cpp
- numerics_viscous.cpp
- numerics_source.cpp

Child Classes for:

- Convective Flux Discretization + Jacobian
- Viscous Flux Discretization + Jacobian
- Source Terms Discretization + Jacobian

Code structure
CNumerics Class





Thanks a lot for your attention!

Questions & Answers

More details in http://su2.stanford.edu/