



pyCGNS.PAT/Manual

Release 4.0.1

Marc Poinot

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CONTENTS

1	The Pythonish CGNS lib	3
2	CGNS Types	5
2.1	AdditionalExponents_t	5
2.2	AdditionalUnits_t	5
2.3	ArbitraryGridMotion_t	5
2.4	AreaType_t	6
2.5	Area_t	6
2.6	AverageInterfaceType_t	6
2.7	AverageInterface_t	7
2.8	Axisymmetry_t	7
2.9	BCDataSet_t	7
2.10	BCData_t	8
2.11	BCProperty_t	8
2.12	BC_t	9
2.13	BaseIterativeData_t	9
2.14	CGNSBase_t	10
2.15	CGNSLibraryVersion_t	10
2.16	CGNSTree_t	10
2.17	ChemicalKineticsModel_t	11
2.18	ConvergenceHistory_t	11
2.19	DataArray_t	12
2.20	DataClass_t	12
2.21	DataConversion_t	12
2.22	Descriptor_t	12
2.23	DiffusionModel_t	13
2.24	DimensionalExponents_t	13
2.25	DimensionalUnits_t	13
2.26	DiscreteData_t	13
2.27	EMConductivityModel_t	14
2.28	EMElectricFieldModel_t	14
2.29	EMMagneticFieldModel_t	15
2.30	Elements_t	15
2.31	EquationDimension_t	15
2.32	FamilyBC_t	16
2.33	FamilyName_t	16
2.34	Family_t	16
2.35	FlowEquationSet_t	17
2.36	FlowSolution_t	17
2.37	GasModel_t	18
2.38	GeometryEntity_t	18
2.39	GeometryFile_t	18
2.40	GeometryFormat_t	19

2.41	GeometryReference_t	19
2.42	GoverningEquations_t	19
2.43	Gravity_t	20
2.44	GridConnectivity1to1_t	20
2.45	GridConnectivityProperty_t	20
2.46	GridConnectivityType_t	21
2.47	GridConnectivity_t	21
2.48	GridCoordinates_t	22
2.49	GridLocation_t	22
2.50	IndexArray_t	22
2.51	IndexRange_t	23
2.52	IntegralData_t	23
2.53	InwardNormalIndex_t	23
2.54	Ordinal_t	24
2.55	OversetHoles_t	24
2.56	Periodic_t	24
2.57	ReferenceState_t	25
2.58	RigidGridMotion_t	25
2.59	Rind_t	25
2.60	RotatingCoordinates_t	26
2.61	SimulationType_t	26
2.62	ThermalConductivityModel_t	26
2.63	ThermalRelaxationModel_t	27
2.64	Transform_t”	27
2.65	TurbulenceClosure_t	27
2.66	TurbulenceModel_t	28
2.67	UserDefinedData_t	28
2.68	ViscosityModel_t	29
2.69	WallFunctionType_t	29
2.70	WallFunction_t	29
2.71	ZoneBC_t	30
2.72	ZoneGridConnectivity_t	30
2.73	ZoneIterativeData_t	30
2.74	ZoneType_t	31
2.75	Zone_t	31
3	CGNS.PAT.SIDS	33
4	CGNS Keywords	35
5	CGNS.PAT.cgnserrors	51
	Python Module Index	53

The module to create and manipulate SIDS/Python trees. PAT has a *cgnslib* module with functions to create SIDS/Python compliant data structures. PAT defines all the CGNS types, names, enumerates or any other CGNS keyword.

SIDS PATTERNS

This module contains all the CGNS/SIDS structures using CGNS.PAT as API.

THE PYTHONISH CGNS LIB

The so-called *CGNS lib* or *MLL* or *Mid-level* library, is set of functions for used to read/write/modify a set of nodes matching a CGNS/SIDS type. The Pythonish flavour of this library declares a set of functions with more or less the same interface but with Python values.

CGNS KEYWORDS

Instead of generating a new doc from a file, the file itself is included here. The purpose of *cgnskeywords.py* is to declare all constants as Python variables. This leads to several advantages:

- You cannot make a typo on a name. For example, if you use “ZoneGridConnectivity” as a plain string you may mistype it as “Zonegridconnectivity” or “ZoneGridConectivity” and this may silently produce a bad CGNS tree.
- You can handle enumerate as lists. For example you have lists for units: MassUnits_1, LengthUnits_1, AllDimensionalUnits_1, AllUnits_1
- You can identify what is a CGNS reserved or recommended name or not.

```
# -----
# pyCGNS.PAT - Python package for CFD General Notation System - PATternMaker
# See license.txt file in the root directory of this Python module source
# -----
# $Release: v4.0.1 $
# -----

# -----
# TYPES, ENUMERATES, CONSTANTS, NAMES from CGNS/SIDS v2.5.3
#
# [1] A CGNS/SIDS string constant is postfixed with _s
# 'ZoneType' is ZoneType_s
#
# [2] A CGNS/SIDS string constant repersenting a type has _ts
# 'ZoneType_t' is ZoneType_ts
#
# [3] A list of possible values for a given type has _l
# ZoneType_l is [Structured_s,Unstructured_s,Null_s,UserDefined_s]
# which is same as ["Structured","Unstructured","Null","UserDefined"]
#
# [4] An enumerate mapping of a list of values is not prefixed
# ZoneType is {'Unstructured':3,'Null':0,'Structured':2,'UserDefined':1}
#
# [5] The reverse dictionnary of the previous one is postfixed with _
# ZoneType_ is {0:'Null',1:'UserDefined',2:'Structured',3:'Unstructured'}
#
# -----
#
import CGNS.pyCGNSconfig

# ----- MLL numeric constants
try:
    CGNS_VERSION = int(float(CGNS.pyCGNSconfig.MLL_VERSION))
    CGNS_DOTVERS = CGNS_VERSION/1000.
except TypeError:
    CGNS_VERSION = 2520
    CGNS_DOTVERS = 2.52
```

```
MODE_READ   = 0
MODE_WRITE  = 1

if (CGNS_VERSION<3000):
    MODE_MODIFY = 3
    MODE_CLOSED = 2
else:
    MODE_MODIFY = 2
    MODE_CLOSED = 3

CG_OK          = 0
CG_ERROR       = 1
CG_NODE_NOT_FOUND = 2
CG_INCORRECT_PATH = 3
CG_NO_INDEX_DIM = 4

Null           = 0
UserDefined    = 1

CG_FILE_NONE   = 0
CG_FILE_ADF    = 1
CG_FILE_HDF5   = 2
CG_FILE_XML    = 3

# -----
# --- ADF Datatypes
#
(C1,I4,I8,R4,R8,MT,LK)=( 'C1','I4','I8','R4','R8','MT','LK' )

# ----- (NOT SIDS)
# --- CGNS/Python mapping extensions
#
CGNSTree_ts      = 'CGNSTree_t'
CGNSTree_s       = 'CGNSTree'

# --- Type with weird (coming from outer space) names
#
Transform_ts      = 'Transform_t'
DiffusionModel_ts = 'DiffusionModel_t'
EquationDimension_ts = 'EquationDimension_t'
InwardNormalIndex_ts = 'InwardNormalIndex_t'

# --- Add legacy strings for translation tools
#
Transform_ts2      = '"int[IndexDimension]"'
DiffusionModel_ts2 = '"int[1+...+IndexDimension]"'
EquationDimension_ts2 = '"int"'
InwardNormalIndex_ts2 = '"int[IndexDimension]"'

# ----- (SIDS)
# SIDS
#
Null_s = "Null"
UserDefined_s = "UserDefined"

# -----
Kilogram_s = "Kilogram"
Gram_s     = "Gram"
Slug_s     = "Slug"
PoundMass_s = "PoundMass"
MassUnits_1 = [Kilogram_s, Gram_s, Slug_s, PoundMass_s,
               Null_s, UserDefined_s]
```

```

# -----
Meter_s      = "Meter"
Centimeter_s = "Centimeter"
Millimeter_s = "Millimeter"
Foot_s       = "Foot"
Inch_s       = "Inch"
LengthUnits_1 = [Meter_s, Centimeter_s, Millimeter_s, Foot_s, Inch_s,
                  Null_s, UserDefined_s]

# -----
Second_s     = "Second"
TimeUnits_1  = [Second_s, Null_s, UserDefined_s]

# -----
Kelvin_s     = "Kelvin"
Celcius_s    = "Celcius"
Rankine_s    = "Rankine"
Fahrenheit_s = "Fahrenheit"
TemperatureUnits_1 = [Kelvin_s, Celcius_s, Rankine_s, Fahrenheit_s,
                      Null_s, UserDefined_s]

# -----
Degree_s     = "Degree"
Radian_s     = "Radian"
AngleUnits_1 = [Degree_s, Radian_s, Null_s, UserDefined_s]

# -----
Ampere_s     = "Ampere"
Abampere_s   = "Abampere"
Statampere_s = "Statampere"
Edison_s     = "Edison"
auCurrent_s  = "auCurrent"
ElectricCurrentUnits_1 = [Ampere_s, Abampere_s, Statampere_s, Edison_s, auCurrent_s,
                           Null_s, UserDefined_s]

# -----
Mole_s       = "Mole"
Entities_s    = "Entities"
StandardCubicFoot_s = "StandardCubicFoot"
StandardCubicMeter_s = "StandardCubicMeter"
SubstanceAmountUnits_1 = [Mole_s, Entities_s, StandardCubicFoot_s, StandardCubicMeter_s,
                           Null_s, UserDefined_s]

# -----
Candela_s    = "Candela"
Candle_s     = "Candle"
Carcel_s     = "Carcel"
Hefner_s     = "Hefner"
Violle_s     = "Violle"
LuminousIntensityUnits_1 = [Candela_s, Candle_s, Carcel_s, Hefner_s, Violle_s,
                             Null_s, UserDefined_s]

DimensionalUnits_s = "DimensionalUnits"
AdditionalUnits_s  = "AdditionalUnits"
AdditionalExponents_s = "AdditionalExponents"

AllDimensionalUnits_1 = TimeUnits_1+MassUnits_1+LengthUnits_1\
                        +TemperatureUnits_1+AngleUnits_1
AllAdditionalUnits_1  = LuminousIntensityUnits_1+SubstanceAmountUnits_1\
                        +ElectricCurrentUnits_1
AllUnits_1           = AllDimensionalUnits_1+AllAdditionalUnits_1

```

```
# -----
Dimensional_s          = "Dimensional"
NormalizedByDimensional_s = "NormalizedByDimensional"
NormalizedByUnknownDimensional_s = "NormalizedByUnknownDimensional"
NondimensionalParameter_s = "NondimensionalParameter"
DimensionlessConstant_s = "DimensionlessConstant"
DataClass_l=[Dimensional_s,NormalizedByDimensional_s,
              NormalizedByUnknownDimensional_s,NondimensionalParameter_s,
              DimensionlessConstant_s,Null_s,UserDefined_s]

DataClass_ts = "DataClass_t"
DataClass_s  = "DataClass"

# -----
Vertex_s      = "Vertex"
CellCenter_s  = "CellCenter"
FaceCenter_s  = "FaceCenter"
IFaceCenter_s = "IFaceCenter"
JFaceCenter_s = "JFaceCenter"
KFaceCenter_s = "KFaceCenter"
EdgeCenter_s  = "EdgeCenter"

GridLocation_s = "GridLocation"

GridLocation_l = [CellCenter_s,Vertex_s,FaceCenter_s,
                  IFaceCenter_s,JFaceCenter_s,KFaceCenter_s,
                  EdgeCenter_s,Null_s,UserDefined_s]

# -----
DirichletData_s = "DirichletData"
NeumannData_s   = "NeumannData"
Dirichlet_s     = "Dirichlet"
Neumann_s       = "Neumann"

PointList_s      = "PointList"
PointListDonor_s = "PointListDonor"
PointRange_s     = "PointRange"
PointRangeDonor_s = "PointRangeDonor"
ElementRange_s   = "ElementRange"
ElementList_s    = "ElementList"
CellListDonor_s  = "CellListDonor"

FullPotential_s  = "FullPotential"
Euler_s          = "Euler"
NSLaminar_s      = "NSLaminar"
NSTurbulent_s    = "NSTurbulent"
NSLaminarIncompressible_s = "NSLaminarIncompressible"
NSTurbulentIncompressible_s = "NSTurbulentIncompressible"

Ideal_s          = "Ideal"
VanderWaals_s    = "VanderWaals"
Constant_s       = "Constant"
PowerLaw_s       = "PowerLaw"
SutherlandLaw_s  = "SutherlandLaw"
ConstantPrandtl_s = "ConstantPrandtl"
EddyViscosity_s  = "EddyViscosity"
ReynoldsStress_s = "ReynoldsStress"
Algebraic_s      = "Algebraic"
BaldwinLomax_s   = "BaldwinLomax"
ReynoldsStressAlgebraic_s = "ReynoldsStressAlgebraic"
Algebraic_BaldwinLomax_s = "Algebraic_BaldwinLomax"
Algebraic_CebeciSmith_s = "Algebraic_CebeciSmith"
HalfEquation_JohnsonKing_s = "HalfEquation_JohnsonKing"
```

```

OneEquation_BaldwinBarth_s      = "OneEquation_BaldwinBarth"
OneEquation_SpalartAllmaras_s   = "OneEquation_SpalartAllmaras"
TwoEquation_JonesLaunder_s      = "TwoEquation_JonesLaunder"
TwoEquation_MenterSST_s         = "TwoEquation_MenterSST"
TwoEquation_Wilcox_s            = "TwoEquation_Wilcox"
CaloricallyPerfect_s           = "CaloricallyPerfect"
ThermallyPerfect_s              = "ThermallyPerfect"
ConstantDensity_s               = "ConstantDensity"
RedlichKwong_s                  = "RedlichKwong"
Frozen_s                         = "Frozen"
ThermalEquilib_s                = "ThermalEquilib"
ThermalNonequilib_s             = "ThermalNonequilib"
ChemicalEquilibCurveFit_s       = "ChemicalEquilibCurveFit"
ChemicalEquilibMinimization_s   = "ChemicalEquilibMinimization"
ChemicalNonequilib_s            = "ChemicalNonequilib"
EMElectricField_s               = "EMElectricField"
EMMagneticField_s               = "EMMagneticField"
EMConductivity_s                = "EMConductivity"
Voltage_s                       = "Voltage"
Interpolated_s                  = "Interpolated"
Equilibrium_LinRessler_s        = "Equilibrium_LinRessler"
Chemistry_LinRessler_s          = "Chemistry_LinRessler"

FamilySpecified_s               = "FamilySpecified"

Integer_s                       = "Integer"
RealSingle_s                    = "RealSingle"
RealDouble_s                    = "RealDouble"
Character_s                      = "Character"

NODE_s                          = "NODE"
BAR_2_s                         = "BAR_2"
BAR_3_s                         = "BAR_3"
TRI_3_s                         = "TRI_3"
TRI_6_s                         = "TRI_6"
QUAD_4_s                        = "QUAD_4"
QUAD_8_s                        = "QUAD_8"
QUAD_9_s                        = "QUAD_9"
TETRA_4_s                       = "TETRA_4"
TETRA_10_s                      = "TETRA_10"
PYRA_5_s                       = "PYRA_5"
PYRA_14_s                      = "PYRA_14"
PENTA_6_s                      = "PENTA_6"
PENTA_15_s                     = "PENTA_15"
PENTA_18_s                     = "PENTA_18"
HEXA_8_s                       = "HEXA_8"
HEXA_20_s                      = "HEXA_20"
HEXA_27_s                      = "HEXA_27"
MIXED_s                        = "MIXED"
NGON_n_s                       = "NGON_n"

# -----
Overset_s                       = "Overset"
Abutting_s                      = "Abutting"
Abutting1tol_s                  = "Abutting1tol"

GridConnectivityType_1 = [Overset_s, Abutting_s, Abutting1tol_s,
                          Null_s, UserDefined_s]

# -----
Structured_s                     = "Structured"
Unstructured_s                  = "Unstructured"
ZoneType_s                      = "ZoneType"

```

```
ZoneType_1      = [Structured_s,Unstructured_s,Null_s,UserDefined_s]

# -----
TimeAccurate_s  = "TimeAccurate"
NonTimeAccurate_s = "NonTimeAccurate"
SimulationType_ts = "SimulationType_t"
SimulationType_s = "SimulationType"
SimulationType_1 = [TimeAccurate_s,NonTimeAccurate_s,Null_s,UserDefined_s]

# -----
ConstantRate_s      = "ConstantRate"
VariableRate_s      = "VariableRate"
NonDeformingGrid_s  = "NonDeformingGrid"
DeformingGrid_s     = "DeformingGrid"
RigidGridMotionType_1 = [Null_s,ConstantRate_s,VariableRate_s,UserDefined_s]

RigidGridMotionType_s="RigidGridMotionType"
RigidGridMotionType_ts="RigidGridMotionType_t"

Generic_s          = "Generic"
BleedArea_s        = "BleedArea"
CaptureArea_s      = "CaptureArea"
AverageAll_s       = "AverageAll"
AverageCircumferential_s = "AverageCircumferential"
AverageRadial_s    = "AverageRadial"
AverageI_s         = "AverageI"
AverageJ_s         = "AverageJ"
AverageK_s         = "AverageK"
CGNSLibraryVersion_s = "CGNSLibraryVersion"
GridCoordinates_s  = "GridCoordinates"
ZoneGridConnectivity_s = "ZoneGridConnectivity"
CoordinateNames_s  = "CoordinateNames"
CoordinateX_s      = "CoordinateX"
CoordinateY_s      = "CoordinateY"
CoordinateZ_s      = "CoordinateZ"
CoordinateR_s      = "CoordinateR"
CoordinateTheta_s  = "CoordinateTheta"
CoordinatePhi_s    = "CoordinatePhi"
CoordinateNormal_s = "CoordinateNormal"
CoordinateTangential_s = "CoordinateTangential"
CoordinateXi_s     = "CoordinateXi"
CoordinateEta_s    = "CoordinateEta"
CoordinateZeta_s   = "CoordinateZeta"
CoordinateTransform_s = "CoordinateTransform"
InterpolantsDonor_s = "InterpolantsDonor"
ElementConnectivity_s = "ElementConnectivity"
ParentData_s       = "ParentData"
VectorX_ps         = "%sX"
VectorY_ps         = "%sY"
VectorZ_ps         = "%sZ"
VectorTheta_ps     = "%sTheta"
VectorPhi_ps       = "%sPhi"
VectorMagnitude_ps = "%sMagnitude"
VectorNormal_ps    = "%sNormal"
VectorTangential_ps = "%sTangential"
Potential_s        = "Potential"
StreamFunction_s   = "StreamFunction"
Density_s          = "Density"
Pressure_s         = "Pressure"
Temperature_s      = "Temperature"
EnergyInternal_s   = "EnergyInternal"
```

```

Enthalpy_s           = "Enthalpy"
Entropy_s            = "Entropy"
EntropyApprox_s      = "EntropyApprox"
DensityStagnation_s  = "DensityStagnation"
PressureStagnation_s = "PressureStagnation"
TemperatureStagnation_s = "TemperatureStagnation"
EnergyStagnation_s   = "EnergyStagnation"
EnthalpyStagnation_s = "EnthalpyStagnation"
EnergyStagnationDensity_s = "EnergyStagnationDensity"
VelocityX_s          = "VelocityX"
VelocityY_s          = "VelocityY"
VelocityZ_s          = "VelocityZ"
VelocityR_s          = "VelocityR"
VelocityTheta_s      = "VelocityTheta"
VelocityPhi_s        = "VelocityPhi"
VelocityMagnitude_s   = "VelocityMagnitude"
VelocityNormal_s      = "VelocityNormal"
VelocityTangential_s  = "VelocityTangential"
VelocitySound_s       = "VelocitySound"
VelocitySoundStagnation_s = "VelocitySoundStagnation"
MomentumX_s          = "MomentumX"
MomentumY_s          = "MomentumY"
MomentumZ_s          = "MomentumZ"
MomentumMagnitude_s  = "MomentumMagnitude"
RotatingVelocityX_s   = "RotatingVelocityX"
RotatingVelocityY_s   = "RotatingVelocityY"
RotatingVelocityZ_s   = "RotatingVelocityZ"
RotatingMomentumX_s   = "RotatingMomentumX"
RotatingMomentumY_s   = "RotatingMomentumY"
RotatingMomentumZ_s   = "RotatingMomentumZ"
RotatingVelocityMagnitude_s = "RotatingVelocityMagnitude"
RotatingPressureStagnation_s = "RotatingPressureStagnation"
RotatingEnergyStagnation_s = "RotatingEnergyStagnation"
RotatingEnergyStagnationDensity_s = "RotatingEnergyStagnationDensity"
RotatingEnthalpyStagnation_s = "RotatingEnthalpyStagnation"
EnergyKinetic_s       = "EnergyKinetic"
PressureDynamic_s     = "PressureDynamic"
SoundIntensityDB_s    = "SoundIntensityDB"
SoundIntensity_s      = "SoundIntensity"
VorticityX_s          = "VorticityX"
VorticityY_s          = "VorticityY"
VorticityZ_s          = "VorticityZ"
VorticityMagnitude_s  = "VorticityMagnitude"
SkinFrictionX_s       = "SkinFrictionX"
SkinFrictionY_s       = "SkinFrictionY"
SkinFrictionZ_s       = "SkinFrictionZ"
SkinFrictionMagnitude_s = "SkinFrictionMagnitude"
VelocityAngleX_s      = "VelocityAngleX"
VelocityAngleY_s      = "VelocityAngleY"
VelocityAngleZ_s      = "VelocityAngleZ"
VelocityUnitVectorX_s = "VelocityUnitVectorX"
VelocityUnitVectorY_s = "VelocityUnitVectorY"
VelocityUnitVectorZ_s = "VelocityUnitVectorZ"
MassFlow_s            = "MassFlow"
ViscosityKinematic_s  = "ViscosityKinematic"
ViscosityMolecular_s  = "ViscosityMolecular"
ViscosityEddyDynamic_s = "ViscosityEddyDynamic"
ViscosityEddy_s       = "ViscosityEddy"
ThermalConductivity_s = "ThermalConductivity"
PowerLawExponent_s    = "PowerLawExponent"
SutherlandLawConstant_s = "SutherlandLawConstant"
TemperatureReference_s = "TemperatureReference"
ViscosityMolecularReference_s = "ViscosityMolecularReference"

```

```
ThermalConductivityReference_s = "ThermalConductivityReference"
IdealGasConstant_s             = "IdealGasConstant"
SpecificHeatPressure_s         = "SpecificHeatPressure"
SpecificHeatVolume_s           = "SpecificHeatVolume"
ReynoldsStressXX_s             = "ReynoldsStressXX"
ReynoldsStressXY_s             = "ReynoldsStressXY"
ReynoldsStressXZ_s             = "ReynoldsStressXZ"
ReynoldsStressYY_s             = "ReynoldsStressYY"
ReynoldsStressYZ_s             = "ReynoldsStressYZ"
ReynoldsStressZZ_s             = "ReynoldsStressZZ"
LengthReference_s              = "LengthReference"
MolecularWeight_s              = "MolecularWeight"
MolecularWeight_ps             = "MolecularWeight%s"
HeatOfFormation_s              = "HeatOfFormation"
HeatOfFormation_ps             = "HeatOfFormation%s"
FuelAirRatio_s                 = "FuelAirRatio"
ReferenceTemperatureHOF_s      = "ReferenceTemperatureHOF"
MassFraction_s                 = "MassFraction"
MassFraction_ps                = "MassFraction%s"
LaminarViscosity_s             = "LaminarViscosity"
LaminarViscosity_ps            = "LaminarViscosity%s"
ThermalConductivity_ps         = "ThermalConductivity%s"
EnthalpyEnergyRatio_s          = "EnthalpyEnergyRatio"
CompressibilityFactor_s        = "CompressibilityFactor"
VibrationalElectronEnergy_s    = "VibrationalElectronEnergy"
VibrationalElectronTemperature_s = "VibrationalElectronTemperature"
SpeciesDensity_s               = "SpeciesDensity"
SpeciesDensity_ps              = "SpeciesDensity%s"
MoleFraction_s                 = "MoleFraction"
MoleFraction_ps                = "MoleFraction%s"
ElectricFieldX_s               = "ElectricFieldX"
ElectricFieldY_s               = "ElectricFieldY"
ElectricFieldZ_s               = "ElectricFieldZ"
MagneticFieldX_s               = "MagneticFieldX"
MagneticFieldY_s               = "MagneticFieldY"
MagneticFieldZ_s               = "MagneticFieldZ"
CurrentDensityX_s              = "CurrentDensityX"
CurrentDensityY_s              = "CurrentDensityY"
CurrentDensityZ_s              = "CurrentDensityZ"
LorentzForceX_s                = "LorentzForceX"
LorentzForceY_s                = "LorentzForceY"
LorentzForceZ_s                = "LorentzForceZ"
ElectricConductivity_s         = "ElectricConductivity"
JouleHeating_s                 = "JouleHeating"
TurbulentDistance_s            = "TurbulentDistance"
TurbulentEnergyKinetic_s       = "TurbulentEnergyKinetic"
TurbulentDissipation_s         = "TurbulentDissipation"
TurbulentDissipationRate_s     = "TurbulentDissipationRate"
TurbulentBBReynolds_s          = "TurbulentBBReynolds"
TurbulentSANuTilde_s           = "TurbulentSANuTilde"
Mach_s                          = "Mach"
Mach_Velocity_s                = "Mach_Velocity"
Mach_VelocitySound_s           = "Mach_VelocitySound"
Reynolds_s                     = "Reynolds"
Reynolds_Velocity_s            = "Reynolds_Velocity"
Reynolds_Length_s              = "Reynolds_Length"
Reynolds_ViscosityKinematic_s  = "Reynolds_ViscosityKinematic"
Prandtl_s                      = "Prandtl"
Prandtl_ThermalConductivity_s  = "Prandtl_ThermalConductivity"
Prandtl_ViscosityMolecular_s    = "Prandtl_ViscosityMolecular"
Prandtl_SpecificHeatPressure_s = "Prandtl_SpecificHeatPressure"
PrandtlTurbulent_s             = "PrandtlTurbulent"
SpecificHeatRatio_s            = "SpecificHeatRatio"
```

```

SpecificHeatRatio_Pressure_s = "SpecificHeatRatio_Pressure"
SpecificHeatRatio_Volume_s   = "SpecificHeatRatio_Volume"
CoefPressure_s               = "CoefPressure"
CoefSkinFrictionX_s          = "CoefSkinFrictionX"
CoefSkinFrictionY_s          = "CoefSkinFrictionY"
CoefSkinFrictionZ_s          = "CoefSkinFrictionZ"
Coef_PressureDynamic_s       = "Coef_PressureDynamic"
Coef_PressureReference_s     = "Coef_PressureReference"
Vorticity_s                  = "Vorticity"
Acoustic_s                   = "Acoustic"
RiemannInvariantPlus_s       = "RiemannInvariantPlus"
RiemannInvariantMinus_s      = "RiemannInvariantMinus"
CharacteristicEntropy_s       = "CharacteristicEntropy"
CharacteristicVorticity1_s    = "CharacteristicVorticity1"
CharacteristicVorticity2_s    = "CharacteristicVorticity2"
CharacteristicAcousticPlus_s  = "CharacteristicAcousticPlus"
CharacteristicAcousticMinus_s = "CharacteristicAcousticMinus"
ForceX_s                     = "ForceX"
ForceY_s                     = "ForceY"
ForceZ_s                     = "ForceZ"
ForceR_s                     = "ForceR"
ForceTheta_s                 = "ForceTheta"
ForcePhi_s                   = "ForcePhi"
Lift_s                       = "Lift"
Drag_s                       = "Drag"
MomentX_s                    = "MomentX"
MomentY_s                    = "MomentY"
MomentZ_s                    = "MomentZ"
MomentR_s                    = "MomentR"
MomentTheta_s                = "MomentTheta"
MomentPhi_s                  = "MomentPhi"
MomentXi_s                   = "MomentXi"
MomentEta_s                  = "MomentEta"
MomentZeta_s                 = "MomentZeta"
Moment_CenterX_s             = "Moment_CenterX"
Moment_CenterY_s             = "Moment_CenterY"
Moment_CenterZ_s             = "Moment_CenterZ"
CoefLift_s                   = "CoefLift"
CoefDrag_s                   = "CoefDrag"
CoefMomentX_s                = "CoefMomentX"
CoefMomentY_s                = "CoefMomentY"
CoefMomentZ_s                = "CoefMomentZ"
CoefMomentR_s                = "CoefMomentR"
CoefMomentTheta_s            = "CoefMomentTheta"
CoefMomentPhi_s              = "CoefMomentPhi"
CoefMomentXi_s               = "CoefMomentXi"
CoefMomentEta_s              = "CoefMomentEta"
CoefMomentZeta_s             = "CoefMomentZeta"
Coef_PressureDynamic_s       = "Coef_PressureDynamic"
Coef_Area_s                  = "Coef_Area"
Coef_Length_s                = "Coef_Length"
TimeValues_s                 = "TimeValues"
IterationValues_s            = "IterationValues"
NumberOfZones_s              = "NumberOfZones"
NumberOfFamilies_s           = "NumberOfFamilies"
DataConversion_s             = "DataConversion"

ZonePointers_s               = "ZonePointers"
FamilyPointers_s             = "FamilyPointers"
RigidGridMotionPointers_s    = "RigidGridMotionPointers"
ArbitraryGridMotionPointers_s = "ArbitraryGridMotionPointers"
GridCoordinatesPointers_s     = "GridCoordinatesPointers"
FlowSolutionsPointers_s      = "FlowSolutionsPointers"

```

```
PointerNames_l = [ZonePointers_s,FamilyPointers_s,RigidGridMotionPointers_s,
                  ArbitraryGridMotionPointers_s,GridCoordinatesPointers_s,
                  FlowSolutionsPointers_s]

OriginLocation_s           = "OriginLocation"
RigidRotationAngle_s       = "RigidRotationAngle"
Translation_s              = "Translation"
RotationAngle_s            = "RotationAngle"
RigidVelocity_s            = "RigidVelocity"
RigidRotationRate_s        = "RigidRotationRate"
GridVelocityX_s            = "GridVelocityX"
GridVelocityY_s            = "GridVelocityY"
GridVelocityZ_s            = "GridVelocityZ"
GridVelocityR_s            = "GridVelocityR"
GridVelocityTheta_s        = "GridVelocityTheta"
GridVelocityPhi_s          = "GridVelocityPhi"
GridVelocityXi_s           = "GridVelocityXi"
GridVelocityEta_s          = "GridVelocityEta"
GridVelocityZeta_s         = "GridVelocityZeta"

ArbitraryGridMotion_ts     = "ArbitraryGridMotion_t"
ArbitraryGridMotion_s      = "ArbitraryGridMotion"
ArbitraryGridMotionType_l  = [Null_s,NonDeformingGrid_s,
                              DeformingGrid_s,UserDefined_s]

ArbitraryGridMotionType_s  = "ArbitraryGridMotionType"
ArbitraryGridMotionType_ts = "ArbitraryGridMotionType_t"

Area_ts                    = "Area_t"
Area_s                     = "Area"
AreaType_ts                = "AreaType_t"
AreaType_s                 = "AreaType"
SurfaceArea_s              = "SurfaceArea"
RegionName_s               = "RegionName"
AverageInterface_ts        = "AverageInterface_t"
Axisymmetry_ts             = "Axisymmetry_t"
Axisymmetry_s              = "Axisymmetry"
AxisymmetryReferencePoint_s = "AxisymmetryReferencePoint"
AxisymmetryAxisVector_s    = "AxisymmetryAxisVector"
AxisymmetryAngle_s         = "AxisymmetryAngle"
BCDataSet_ts               = "BCDataSet_t"
BCData_ts                  = "BCData_t"
BCData_s                   = "BCData"

BCProperty_ts              = "BCProperty_t"
BCProperty_s               = "BCProperty"
BC_ts                       = "BC_t"

BaseIterativeData_ts       = "BaseIterativeData_t"
BaseIterativeData_s        = "BaseIterativeData"

CGNSBase_ts                = "CGNSBase_t"
CGNSLibraryVersion_ts      = "CGNSLibraryVersion_t"

# -----
ConvergenceHistory_ts       = "ConvergenceHistory_t"
ZoneConvergenceHistory_s    = "ZoneConvergenceHistory"
GlobalConvergenceHistory_s  = "GlobalConvergenceHistory"

ConvergenceHistory_l        = [ZoneConvergenceHistory_s,
                              GlobalConvergenceHistory_s]
```

```

NormDefinitions_s           = "NormDefinitions"

DataArray_ts                = "DataArray_t"
DataConversion_ts           = "DataConversion_t"
Descriptor_ts               = "Descriptor_t"

# -----
DimensionalExponents_ts     = "DimensionalExponents_t"
DimensionalExponents_s     = "DimensionalExponents"
DimensionalUnits_ts        = "DimensionalUnits_t"
AdditionalUnits_ts         = "AdditionalUnits_t"
AdditionalExponents_ts     = "AdditionalExponents_t"

DiscreteData_ts            = "DiscreteData_t"
DiscreteData_s             = "DiscreteData"
Elements_ts                = "Elements_t"

FamilyBC_s                 = "FamilyBC"
FamilyBC_ts                = "FamilyBC_t"

FamilyName_ts              = "FamilyName_t"
FamilyName_s               = "FamilyName"
Family_ts                  = "Family_t"
Family_s                   = "Family"
FlowEquationSet_ts         = "FlowEquationSet_t"
FlowEquationSet_s          = "FlowEquationSet"
FlowSolution_ts            = "FlowSolution_t"
GasModel_ts                = "GasModel_t"
GasModel_s                 = "GasModel"
#
GeometryEntity_ts          = "GeometryEntity_t"
GeometryFile_ts            = "GeometryFile_t"
GeometryFile_s             = "GeometryFile"

#chapter 12.7
GeometryFormat_s           = "GeometryFormat"
GeometryFormat_ts          = "GeometryFormat_t"
# not supported '-'
NASAIGES_s                 = "NASA-IGES"
SDRC_s                     = "SDRC"
Unigraphics_s              = "Unigraphics"
ProEngineer_s              = "ProEngineer"
ICEMCFD_s                  = "ICEM-CFD"
GeometryFormat_l           = [Null_s, NASAIGES_s, SDRC_s, Unigraphics_s,
                              ProEngineer_s, ICEMCFD_s, UserDefined_s]

GeometryReference_ts       = "GeometryReference_t"
GeometryReference_s        = "GeometryReference"

Gravity_ts                 = "Gravity_t"
Gravity_s                  = "Gravity"
GravityVector_s            = "GravityVector"

GridConnectivity1tol_ts    = "GridConnectivity1tol_t"
GridConnectivityProperty_ts = "GridConnectivityProperty_t"
GridConnectivityProperty_s = "GridConnectivityProperty"
GridConnectivityType_ts    = "GridConnectivityType_t"
GridConnectivityType_s     = "GridConnectivityType"
GridConnectivity_ts        = "GridConnectivity_t"

GridCoordinates_ts         = "GridCoordinates_t"
GridLocation_ts            = "GridLocation_t"
IndexArray_ts              = "IndexArray_t"

```

IndexRange_ts	= "IndexRange_t"
IntegralData_ts	= "IntegralData_t"
InwardNormalList_ts	= "InwardNormalList_t"
InwardNormalList_s	= "InwardNormalList"
InwardNormalIndex_s	= "InwardNormalIndex"
Ordinal_ts	= "Ordinal_t"
Ordinal_s	= "Ordinal"
Transform_s	= "Transform"
OversetHoles_ts	= "OversetHoles_t"
OversetHoles_s	= "OversetHoles"
Periodic_ts	= "Periodic_t"
Periodic_s	= "Periodic"
ReferenceState_ts	= "ReferenceState_t"
ReferenceState_s	= "ReferenceState"
ReferenceStateDescription_s	= "ReferenceStateDescription"
RigidGridMotion_ts	= "RigidGridMotion_t"
RigidGridMotion_s	= "RigidGridMotion"
Rind_s	= "Rind"
Rind_ts	= "Rind_t"
RotatingCoordinates_s	= "RotatingCoordinates"
RotatingCoordinates_ts	= "RotatingCoordinates_t"
RotationRateVector_s	= "RotationRateVector"
RotationCenter_s	= "RotationCenter"
GoverningEquations_s	= "GoverningEquations"
GoverningEquations_ts	= "GoverningEquations_t"
GoverningEquationsType_l	= [Euler_s, NSLaminar_s, NSTurbulent_s]
GoverningEquationsType_s	= "GoverningEquationsType"
GoverningEquationsType_ts	= "GoverningEquationsType_t"
BCType_s	= "BCType"
BCType_ts	= "BCType_t"
BCTypeSimple_s	= "BCTypeSimple"
BCTypeSimple_ts	= "BCTypeSimple_t"
BCAxisymmetricWedge_s	= "BCAxisymmetricWedge"
BCDegenerateLine_s	= "BCDegenerateLine"
BCDegeneratePoint_s	= "BCDegeneratePoint"
BCDirichlet_s	= "BCDirichlet"
BCExtrapolate_s	= "BCExtrapolate"
BCFarfield_s	= "BCFarfield"
BCGeneral_s	= "BCGeneral"
BCInflow_s	= "BCInflow"
BCInflowSubsonic_s	= "BCInflowSubsonic"
BCInflowSupersonic_s	= "BCInflowSupersonic"
BCNeumann_s	= "BCNeumann"
BCOutflow_s	= "BCOutflow"
BCOutflowSubsonic_s	= "BCOutflowSubsonic"
BCOutflowSupersonic_s	= "BCOutflowSupersonic"
BCSymmetryPlane_s	= "BCSymmetryPlane"
BCSymmetryPolar_s	= "BCSymmetryPolar"
BCTunnelInflow_s	= "BCTunnelInflow"
BCTunnelOutflow_s	= "BCTunnelOutflow"
BCWall_s	= "BCWall"
BCWallInviscid_s	= "BCWallInviscid"
BCWallViscous_s	= "BCWallViscous"
BCWallViscousHeatFlux_s	= "BCWallViscousHeatFlux"
BCWallViscousIsothermal_s	= "BCWallViscousIsothermal"
BCTypeSimple_l	= [Null_s, BCGeneral_s, BCDirichlet_s, BCNeumann_s,

```

BCExtrapolate_s,BCWallInviscid_s,BCWallViscousHeatFlux_s,
BCWallViscousIsothermal_s,BCWallViscous_s,BCWall_s,
BCInflowSubsonic_s,BCInflowSupersonic_s,BCOutflowSubsonic_s,
BCOutflowSupersonic_s,BCTunnelInflow_s,BCTunnelOutflow_s,
BCDegenerateLine_s,BCDegeneratePoint_s,BCSymmetryPlane_s,
BCSymmetryPolar_s,BCAxisymmetricWedge_s,FamilySpecified_s,
UserDefined_s]
BCTypeCompound_l = [BCInflow_s,BCOutflow_s,BCFarfield_s,
Null_s,UserDefined_s]
BCType_l = BCTypeSimple_l+BCTypeCompound_l

ThermalConductivityModel_ts = "ThermalConductivityModel_t"
ThermalConductivityModel_s = "ThermalConductivityModel"
ThermalConductivityModelType_l = [Null_s,ConstantPrandtl_s,PowerLaw_s,
SutherlandLaw_s,UserDefined_s]
ThermalConductivityModelType_s = "ThermalConductivityModelType"
ThermalConductivityModelType_ts = "ThermalConductivityModelType_t"
ThermalConductivityModelIdentifier_l = [(Prandtl_s),(PowerLawExponent_s),
(SutherlandLawConstant_s),
(TemperatureReference_s),
(ThermalConductivityReference_s)]

TurbulenceClosure_ts = "TurbulenceClosure_t"
TurbulenceClosure_s = "TurbulenceClosure"
TurbulenceClosureType_l = [Null_s,EddyViscosity_s,ReynoldsStress_s,
ReynoldsStressAlgebraic_s,UserDefined_s]
TurbulenceClosureType_s = "TurbulenceClosureType"
TurbulenceClosureType_ts = "TurbulenceClosureType_t"
TurbulenceClosureIdentifier_l = [PrandtlTurbulent_s]

TurbulenceModel_ts = "TurbulenceModel_t"
TurbulenceModel_s = "TurbulenceModel"
TurbulenceModelType_l = [Null_s,Algebraic_BaldwinLomax_s,
Algebraic_CebeciSmith_s,
HalfEquation_JohnsonKing_s,
OneEquation_BaldwinBarth_s,
OneEquation_SpalartAllmaras_s,
TwoEquation_JonesLaunder_s,
TwoEquation_MenterSST_s,TwoEquation_Wilcox_s]
TurbulenceModelType_s = "TurbulenceModelType"
TurbulenceModelType_ts = "TurbulenceModelType_t"

DiffusionModel_s = 'DiffusionModel'
EquationDimension_s = 'EquationDimension'

ViscosityModel_ts = "ViscosityModel_t"
ViscosityModel_s = "ViscosityModel"
ViscosityModelType_l = [Constant_s,PowerLaw_s,SutherlandLaw_s,
Null_s,UserDefined_s]
ViscosityModelType_s = "ViscosityModelType"
ViscosityModelType_ts = "ViscosityModelType_t"
ViscosityModelIdentifier_l = [(PowerLawExponent_s),(SutherlandLawConstant_s),
(TemperatureReference_s),
(ViscosityMolecularReference_s)]

GasModelType_l = [Null_s,Ideal_s,VanderWaals_s,CaloricallyPerfect_s,
ThermallyPerfect_s,ConstantDensity_s,RedlichKwong_s,
UserDefined_s]
GasModelType_s = "GasModelType"
GasModelType_ts = "GasModelType_t"
GasModelIdentifier_l = [IdealGasConstant_s,SpecificHeatRatio_s,
SpecificHeatVolume_s,SpecificHeatPressure_s]

```

```
ThermalRelaxationModel_ts      = "ThermalRelaxationModel_t"
ThermalRelaxationModel_s      = "ThermalRelaxationModel"
ThermalRelaxationModelType_l  = [Null_s, Frozen_s, ThermalEquilib_s,
                                ThermalNonequilib_s, UserDefined_s]
ThermalRelaxationModelType_s  = "ThermalRelaxationModelType"
ThermalRelaxationModelType_ts = "ThermalRelaxationModelType_t"

ChemicalKineticsModel_ts      = "ChemicalKineticsModel_t"
ChemicalKineticsModel_s      = "ChemicalKineticsModel"
ChemicalKineticsModelType_l  = [Null_s, Frozen_s, ChemicalEquilibCurveFit_s,
                                ChemicalEquilibMinimization_s,
                                ChemicalNonequilib_s,
                                UserDefined_s]
ChemicalKineticsModelType_s  = "ChemicalKineticsModelType"
ChemicalKineticsModelType_ts = "ChemicalKineticsModelType_t"
ChemicalKineticsModelIdentifier_l = [FuelAirRatio_s, ReferenceTemperatureHOF_s]

EMElectricFieldModel_s        = "EMElectricFieldModel"
EMElectricFieldModel_ts      = "EMElectricFieldModel_t"
EMElectricFieldModelType_l  = [Null_s, Constant_s, Frozen_s,
                                Interpolated_s, Voltage_s, UserDefined_s]
EMElectricFieldModelType_s  = "EMElectricFieldModelType"
EMElectricFieldModelType_ts = "EMElectricFieldModelType_t"

EMMagneticFieldModel_s        = "EMMagneticFieldModel"
EMMagneticFieldModel_ts      = "EMMagneticFieldModel_t"
EMMagneticFieldModelType_l  = [Null_s, Constant_s, Frozen_s,
                                Interpolated_s, UserDefined_s]
EMMagneticFieldModelType_s  = "EMMagneticFieldModelType"
EMMagneticFieldModelType_ts = "EMMagneticFieldModelType_t"

EMConductivityModel_s        = "EMConductivityModel"
EMConductivityModel_ts      = "EMConductivityModel_t"
EMConductivityModelType_l  = [Null_s, Constant_s, Frozen_s,
                                Equilibrium_LinRessler_s,
                                Chemistry_LinRessler_s, UserDefined_s]
EMConductivityModelType_s  = "EMConductivityModelType"
EMConductivityModelType_ts = "EMConductivityModelType_t"
EMConductivityModelIdentifier_l = [ElectricFieldX_s, ElectricFieldY_s,
                                    ElectricFieldZ_s, MagneticFieldX_s,
                                    MagneticFieldY_s, MagneticFieldZ_s,
                                    CurrentDensityX_s, CurrentDensityY_s,
                                    CurrentDensityZ_s, ElectricConductivity_s,
                                    LorentzForceX_s, LorentzForceY_s,
                                    LorentzForceZ_s, JouleHeating_s]

AverageInterfaceType_s      = "AverageInterfaceType"
AverageInterfaceType_ts    = "AverageInterfaceType_t"
AverageInterfaceType_l    = [Null_s, AverageAll_s, AverageCircumferential_s,
                              AverageRadial_s, AverageI_s, AverageJ_s, AverageK_s,
                              UserDefined_s]
AverageInterface_s        = "AverageInterface"
AverageInterface_ts      = "AverageInterface_t"

Element_ts                = "Element_t"
ElementType_ts           = "ElementType_t"
ElementType_s            = "ElementType"
Element_s                = "Element"
ElementType_l            = [Null_s, NODE_s, BAR_2_s, BAR_3_s,
                            TRI_3_s, TRI_6_s, QUAD_4_s, QUAD_8_s, QUAD_9_s,
                            TETRA_4_s, TETRA_10_s, PYRA_5_s, PYRA_14_s,
                            PENTA_6_s, PENTA_15_s, PENTA_18_s,
                            HEXA_8_s, HEXA_20_s, HEXA_27_s, MIXED_s, NGON_n_s,
```



```
        UserDefined_s]

#

WallFunction_ts           = "WallFunction_t"
WallFunction_s           = "WallFunction"
WallFunctionType_ts      = "WallFunctionType_t"
WallFunctionType_s       = "WallFunctionType"
ZoneBC_ts                = "ZoneBC_t"
ZoneBC_s                 = "ZoneBC"
ZoneGridConnectivity_ts  = "ZoneGridConnectivity_t"
ZoneIterativeData_ts     = "ZoneIterativeData_t"
ZoneIterativeData_s      = "ZoneIterativeData"
ZoneType_ts              = "ZoneType_t"
Zone_ts                  = "Zone_t"

UserDefinedData_ts       = "UserDefinedData_t"

# ---
cgnsnames=[k for k in dir() if (k[-2:]=='_s')]
cgnstypes=[k for k in dir() if (k[-3:]=='_ts')]
cgnsenums=[k for k in dir() if (k[-2:]=='_l')]
#
# --- last line
```


CGNS TYPES

4.1 AdditionalExponents_t

- Name
 - AdditionalExponents
 - Data-Type: R4 R8
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.2 AdditionalUnits_t

- Name
 - AdditionalUnits
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.3 ArbitraryGridMotion_t

- Name
 - {UserDefined}
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
-

- *UserDefinedData_t* ({UserDefined})
 - *GridLocation_t* (GridLocation)
 - *Rind_t* (Rind)
 - *dataArray_t* ({UserDefined})
-

4.4 AreaType_t

- Name
 - AreaType
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.5 Area_t

- Name
 - Area
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *AreaType_t* (AreaType)
 - *dataArray_t* (SurfaceArea)
 - *dataArray_t* (RegionName)
-

4.6 AverageInterfaceType_t

- Name
 - AverageInterfaceType
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.7 AverageInterface_t

- Name
 - AverageInterface
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *AverageInterfaceType_t* (AverageInterfaceType)
-

4.8 Axisymmetry_t

- Name
 - Axisymmetry
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *DataArray_t* (AxisymmetryReferencePoint)
 - *DataArray_t* (AxisymmetryAxisVector)
 - *DataArray_t* (AxisymmetryAngle)
 - *DataArray_t* (CoordinateNames)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.9 BCDataSet_t

- Name
 - {UserDefined}
- Data-Type: C1
- Dimensions/DimensionValues
- Cardinality: Zero/N
- Child Nodes
 - *BCData_t* (NeumannData)

- *BCData_t* (DirichletData)
 - *GridLocation_t* (GridLocation)
 - *IndexRange_t* (PointRange)
 - *IndexArray_t* (PointList)
 - *Descriptor_t* ({UserDefined})
 - *ReferenceState_t* (ReferenceState)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *UserDefinedData_t* ({UserDefined})
-

4.10 BCData_t

- Name
 - DirichletData
 - NeumannData
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *dataArray_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.11 BCProperty_t

- Name
 - BCProperty
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *WallFunction_t* (WallFunction)
 - *Area_t* (Area)
-

4.12 BC_t

- Name
 - {UserDefined}
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *ReferenceState_t* (ReferenceState)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *Ordinal_t* (Ordinal)
 - *FamilyName_t* (FamilyName)
 - *IndexArray_t* (InwardNormalList)
 - *BCDataSet_t* ({UserDefined})
 - *InwardNormalIndex_t* (InwardNormalIndex)
 - *IndexArray_t* (ElementList)
 - *IndexArray_t* (PointList)
 - *IndexRange_t* (ElementRange)
 - *IndexRange_t* (PointRange)
 - *GridLocation_t* (GridLocation)
 - *BCProperty_t* (BCProperty)
-

4.13 BaseltrativeData_t

- Name
 - {UserDefined}
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *DataArray_t* ({UserDefined})
-

4.14 CGNSBase_t

- Name
 - {UserDefined}
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *Zone_t* ({UserDefined})
 - *SimulationType_t* (SimulationType)
 - *BaseIterativeData_t* ({UserDefined})
 - *IntegralData_t* ({UserDefined})
 - *ConvergenceHistory_t* (GlobalConvergenceHistory)
 - *Family_t* ({UserDefined})
 - *FlowEquationSet_t* (FlowEquationSet)
 - *ReferenceState_t* (ReferenceState)
 - *Axisymmetry_t* (Axisymmetry)
 - *RotatingCoordinates_t* (RotatingCoordinates)
 - *Gravity_t* (Gravity)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.15 CGNSLibraryVersion_t

- Name
 - CGNSLibraryVersion
 - Data-Type: R4
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.16 CGNSTree_t

- Name
 - CGNSTree
 - {UserDefined}
- Data-Type: M T

- Dimensions/DimensionValues
 - Cardinality: One/One
 - Child Nodes
 - *CGNSLibraryVersion_t* (CGNSLibraryVersion)
 - *CGNSBase_t* ({UserDefined})
-

4.17 ChemicalKineticsModel_t

- Name
 - ChemicalKineticsModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.18 ConvergenceHistory_t

- Name
 - GlobalConvergenceHistory
 - ZoneConvergenceHistory
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *Descriptor_t* (NormDefinitions)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.19 DataArray_t

- Name
 - {UserDefined}
 - Data-Type: C1 MT I4 I8 R4 R8 LK
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *DimensionalExponents_t* (DimensionalExponents)
 - *DataConversion_t* (DataConversion)
 - *DataClass_t* (DataClass)
 - *Descriptor_t* ({UserDefined})
 - *DimensionalUnits_t* (DimensionalUnits)
-

4.20 DataClass_t

- Name
 - DataClass
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.21 DataConversion_t

- Name
 - DataConversion
 - Data-Type: R4 R8
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.22 Descriptor_t

- Name
 - {UserDefined}
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
-

4.23 DiffusionModel_t

- Name
 - DiffusionModel
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.24 DimensionalExponents_t

- Name
 - DimensionalExponents
 - Data-Type: R4 R8
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.25 DimensionalUnits_t

- Name
 - DimensionalUnits
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *AdditionalUnits_t* (AdditionalUnits)
-

4.26 DiscreteData_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *GridLocation_t* (GridLocation)
 - *dataArray_t* ({UserDefined})
 - *Rind_t* (Rind)
-

- *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.27 EMConductivityModel_t

- Name
 - EMConductivityModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.28 EMElectricFieldModel_t

- Name
 - EMElectricFieldModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.29 EMMagneticFieldModel_t

- Name
 - EMMagneticFieldModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.30 Elements_t

- Name
 - {UserDefined}
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *IndexRange_t* (ElementRange)
 - *DataArray_t* (ElementConnectivity)
 - *DataArray_t* (ParentData)
 - *Rind_t* (Rind)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.31 EquationDimension_t

- Name
 - EquationDimension
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.32 FamilyBC_t

- Name
 - FamilyBC
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *BCDataSet_t* ({UserDefined})
-

4.33 FamilyName_t

- Name
 - FamilyName
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.34 Family_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *Ordinal_t* (Ordinal)
 - *FamilyBC_t* ({UserDefined})
 - *GeometryReference_t* ({UserDefined})
 - *RotatingCoordinates_t* (RotatingCoordinates)
 - *UserDefinedData_t* ({UserDefined})
-

4.35 FlowEquationSet_t

- Name
 - FlowEquationSet
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *GoverningEquations_t* (GoverningEquations)
 - *EquationDimension_t* (EquationDimension)
 - *GasModel_t* (GasModel)
 - *ViscosityModel_t* (ViscosityModel)
 - *ThermalRelaxationModel_t* (ThermalRelaxationModel)
 - *ThermalConductivityModel_t* (ThermalConductivityModel)
 - *TurbulenceModel_t* (TurbulenceModel)
 - *TurbulenceClosure_t* (TurbulenceClosure)
 - *ChemicalKineticsModel_t* (ChemicalKineticsModel)
 - *EMMagneticFieldModel_t* (EMMagneticFieldModel)
 - *EMElectricFieldModel_t* (EMElectricFieldModel)
 - *EMConductivityModel_t* (EMConductivityModel)
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *UserDefinedData_t* ({UserDefined})
-

4.36 FlowSolution_t

- Name
 - {UserDefined}
- Data-Type: M T
- Dimensions/DimensionValues
- Cardinality: Zero/N
- Child Nodes
 - *GridLocation_t* (GridLocation)
 - *DataArray_t* ({UserDefined})
 - *Rind_t* (Rind)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)

- *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.37 GasModel_t

- Name
 - GasModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.38 GeometryEntity_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
-

4.39 GeometryFile_t

- Name
 - GeometryFile
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.40 GeometryFormat_t

- Name
 - GeometryFormat
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.41 GeometryReference_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *GeometryFile_t* (GeometryFile)
 - *GeometryFormat_t* (GeometryFormat)
 - *GeometryEntity_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.42 GoverningEquations_t

- Name
 - GoverningEquations
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DiffusionModel_t* (DiffusionModel)
 - *UserDefinedData_t* ({UserDefined})
-

4.43 Gravity_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *DataArray_t* (GravityVector)
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *UserDefinedData_t* ({UserDefined})
-

4.44 GridConnectivity1to1_t

- Name
 - {UserDefined}
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *Transform_t* (Transform)
 - *IndexRange_t* (PointRange)
 - *IndexRange_t* (PointRangeDonor)
 - *Ordinal_t* (Ordinal)
 - *GridConnectivityProperty_t* (GridConnectivityProperty)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.45 GridConnectivityProperty_t

- Name
 - GridConnectivityProperty
- Data-Type: M T
- Dimensions/DimensionValues
- Cardinality: Zero/One
- Child Nodes

- *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *Periodic_t* (Periodic)
 - *AverageInterface_t* (AverageInterface)
-

4.46 GridConnectivityType_t

- Name
 - GridConnectivityType
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.47 GridConnectivity_t

- Name
 - {UserDefined}
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *GridLocation_t* (GridLocation)
 - *Ordinal_t* (Ordinal)
 - *Descriptor_t* ({UserDefined})
 - *IndexRange_t* (PointRange)
 - *IndexArray_t* (PointList)
 - *IndexArray_t* (PointListDonor)
 - *IndexArray_t* (CellListDonor)
 - *GridConnectivityProperty_t* (GridConnectivityProperty)
 - *GridConnectivityType_t* (GridConnectivityType)
 - *DataArray_t* (InterpolantsDonor)
-

4.48 GridCoordinates_t

- Name
 - GridCoordinates
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *DataArray_t* ({UserDefined})
 - *Rind_t* (Rind)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.49 GridLocation_t

- Name
 - GridLocation
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.50 IndexArray_t

- Name
 - PointList
 - PointListDonor
 - CellListDonor
 - InwardNormalList
 - Data-Type: I4 R4 R8
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.51 IndexRange_t

- Name
 - PointRange
 - PointRangeDonor
 - ElementRange
 - {UserDefined}
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.52 IntegralData_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.53 InwardNormalIndex_t

- Name
 - InwardNormalIndex
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.54 Ordinal_t

- Name
 - Ordinal
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.55 OversightHoles_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *IndexArray_t* (PointList)
 - *GridLocation_t* (GridLocation)
 - *IndexRange_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.56 Periodic_t

- Name
 - Periodic
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *DataArray_t* (RotationCenter)
 - *DataArray_t* (RotationAngle)
 - *DataArray_t* (Translation)
-

4.57 ReferenceState_t

- Name
 - ReferenceState
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *Descriptor_t* (ReferenceStateDescription)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.58 RigidGridMotion_t

- Name
 - {UserDefined}
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *DataArray_t* ({UserDefined})
-

4.59 Rind_t

- Name
 - Rind
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.60 RotatingCoordinates_t

- Name
 - RotatingCoordinates
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *DataArray_t* (RotationCenter)
 - *DataArray_t* (RotationRateVector)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.61 SimulationType_t

- Name
 - SimulationType
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.62 ThermalConductivityModel_t

- Name
 - ThermalConductivityModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.63 ThermalRelaxationModel_t

- Name
 - ThermalRelaxationModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.64 Transform_t

- Name
 - Transform
 - Data-Type: I4
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
-

4.65 TurbulenceClosure_t

- Name
 - TurbulenceClosure
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.66 TurbulenceModel_t

- Name
 - {UserDefined}
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *dataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DiffusionModel_t* (DiffusionModel)
-

4.67 UserDefinedData_t

- Name
 - {UserDefined}
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/N
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *GridLocation_t* (GridLocation)
 - *IndexRange_t* (PointRange)
 - *IndexArray_t* (PointList)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *dataArray_t* ({UserDefined})
 - *FamilyName_t* (FamilyName)
 - *UserDefinedData_t* ({UserDefined})
 - *Ordinal_t* (Ordinal)
-

4.68 ViscosityModel_t

- Name
 - ViscosityModel
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *DataArray_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.69 WallFunctionType_t

- Name
 - WallFunctionType
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.70 WallFunction_t

- Name
 - WallFunction
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *WallFunctionType_t* (WallFunctionType)
-

4.71 ZoneBC_t

- Name
 - ZoneBC
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *BC_t* ({UserDefined})
 - *ReferenceState_t* (ReferenceState)
 - *DataClass_t* (DataClass)
 - *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.72 ZoneGridConnectivity_t

- Name
 - ZoneGridConnectivity
 - Data-Type: M T
 - Dimensions/DimensionValues
 - Cardinality: Zero/One
 - Child Nodes
 - *GridConnectivityItoI_t* ({UserDefined})
 - *GridConnectivity_t* ({UserDefined})
 - *OversetHoles_t* ({UserDefined})
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
-

4.73 ZoneliterativeData_t

- Name
 - {UserDefined}
- Data-Type: M T
- Dimensions/DimensionValues
- Cardinality: Zero/One
- Child Nodes
 - *DataClass_t* (DataClass)

- *DimensionalUnits_t* (DimensionalUnits)
 - *Descriptor_t* ({UserDefined})
 - *UserDefinedData_t* ({UserDefined})
 - *DataArray_t* ({UserDefined})
-

4.74 ZoneType_t

- Name
 - ZoneType
 - Data-Type: C1
 - Dimensions/DimensionValues
 - Cardinality: One/One
-

4.75 Zone_t

- Name
 - {UserDefined}
- Data-Type: I4
- Dimensions/DimensionValues
- Cardinality: Zero/N
- Child Nodes
 - *GridCoordinates_t* (GridCoordinates)
 - *GridCoordinates_t* ({UserDefined})
 - *DiscreteData_t* ({UserDefined})
 - *Elements_t* ({UserDefined})
 - *ZoneBC_t* (ZoneBC)
 - *FlowSolution_t* ({UserDefined})
 - *ZoneType_t* (ZoneType)
 - *Ordinal_t* (Ordinal)
 - *ZoneGridConnectivity_t* (ZoneGridConnectivity)
 - *ZoneIterativeData_t* ({UserDefined})
 - *RigidGridMotion_t* ({UserDefined})
 - *ReferenceState_t* (ReferenceState)
 - *IntegralData_t* ({UserDefined})
 - *ArbitraryGridMotion_t* ({UserDefined})
 - *FamilyName_t* (FamilyName)
 - *FlowEquationSet_t* (FlowEquationSet)

- *ConvergenceHistory_t* (ZoneConvergenceHistory)
- *RotatingCoordinates_t* (RotatingCoordinates)
- *DataClass_t* (DataClass)
- *DimensionalUnits_t* (DimensionalUnits)
- *Descriptor_t* ({UserDefined})
- *UserDefinedData_t* ({UserDefined})

CGNS.PAT.CGNSERRORS

- *genindex*