Example: `RigidGridMotion`, `ArbitraryGridMotion` and `IterativeOrTemporalData`

The following is an example demonstrating the use of the rigid grid motion, arbitrary grid motion, and time-accurate data nodes in CGNS. The example is a 3-zone case. Zone 1 is rigidly rotating about the x-axis at a constant rate (there is no translation). Zone 2 is a deforming zone. Zone 3 is a fixed zone. This is a time-accurate simulation with 2 solutions saved at times 15.5 and 31.0 (corresponding to iteration numbers 1000 and 2000).

No units are given in this example, but a real case would establish them. Also, a real case would give connectivity, boundary condition, and possibly other information as well. Each indentation represents a level down (a child) from the parent node.

```
Base (CGNSBase_t)
  SimulationType  (Descriptor_t) Data=TimeAccurate
  BaseIterativeData (BaseIterativeData_t) Data=NumberOfSteps=2
     TimeValues (DataArray_t) Data=(15.5,31.0)
     IterationValues (DataArray_t) Data=(1000,2000)

  Zone#1 (Zone_t)
     GridCoordinates (GridCoordinates_t)
        CoordinateX (DataArray_t)
        CoordinateY (DataArray_t)
     RigidGridMotion#1(RigidGridMotion_t) Data=RigidGridMotionType=ConstantRate
        OriginLocation (DataArray_t) Data=(0,0,0), (0,0,0)
        RigidRotationAngle  (DataArray_t) Data=(5.,0.,0.)
     RigidGridMotion#2(RigidGridMotion_t) Data=RigidGridMotionType=ConstantRate
        OriginLocation (DataArray_t) Data=(0,0,0), (0,0,0)
        RigidRotationAngle (DataArray_t) Data=(10.,0.,0.)
     ZoneIterativeData (ZoneIterativeData_t)
        RigidGridMotionPointers (DataArray_t) Data=(  RigidGridMotion#1,
                                                      RigidGridMotion#2)
        FlowSolutionPointers (DataArray_t) Data=(Soln#1, Soln#2)
     Soln#1 (FlowSolution_t)
        Density (DataArray_t)
        VelocityX (DataArray_t)
     Soln#2 (FlowSolution_t)
        Density (DataArray_t)
        VelocityX (DataArray_t)

  Zone#2 (Zone_t)
     GridCoordinates (GridCoordinates_t)
        CoordinateX (DataArray_t)
        CoordinateY (DataArray_t)
     GridCoordinates#1 (GridCoordinates_t)
        CoordinateX (DataArray_t)
        CoordinateY (DataArray_t)
     GridCoordinates#2 (GridCoordinates_t)
        CoordinateX (DataArray_t)
        CoordinateY (DataArray_t)
     ArbitraryGridMotion#1 (ArbitraryGridMotion_t)
                                Data=ArbitraryGridMotionType=DeformingGrid
     ArbitraryGridMotion#2 (ArbitraryGridMotion_t)
                                Data=ArbitraryGridMotionType=DeformingGrid
        GridVelocityX (DataArray_t)
        GridVelocityY (DataArray_t)
     ZoneIterativeData (ZoneIterativeData_t)
        ArbitraryGridMotionPointers (DataArray_t)Data=("ArbitraryGridMotion#1",
                                                       "ArbitraryGridMotion#2")
        GridCoordinatesPointers (DataArray_t) Data=("GridCoordinates#1",
```

```
                                                    "GridCoordinates#2")
      FlowSolutionPointers (DataArray_t) Data=("Soln#1","Soln#2")
   Soln#1 (FlowSolution_t)
      Density (DataArray_t)
      VelocityX (DataArray_t)
   Soln#2 (FlowSolution_t)
      Density (DataArray_t)
      VelocityX (DataArray_t)

Zone#3 (Zone_t)
   GridCoordinates (GridCoordinates_t)
      CoordinateX (DataArray_t)
      CoordinateY (DataArray_t)
   ZoneIterativeData (ZoneIterativeData_t)
      FlowSolutionPointers (DataArray_t) Data=("Soln#1","Soln#2")
   Soln#1 (FlowSolution_t)
      Density (DataArray_t)
      VelocityX (DataArray_t)
   Soln#2 (FlowSolution_t)
      Density (DataArray_t)
      VelocityX (DataArray_t)
```

NOTES:

- Under `BaseIterativeData_t`, one can give either `TimeValues`, or `IterationValues`, or both. In the example, both have been given.

- The nodes `NumberOfZones` and `ZonePointers` are not required under the `BaseIterativeData_t` node in this example because all existing zones are used for each time step.

- Under `ArbitraryGridMotion`, the `GridVelocity` data is optional. In the example, it was put under one of the nodes but not under the other. Hence, "`ArbitraryGridMotion#1`" in the example has no children nodes, while "`ArbitraryGridMotion#2`" does.

- The pointers under `ZoneIterativeData_t` point to names of nodes within the same zone. Thus, for example, "`Soln#1`" refers to the flow solution named "`Soln#1`" in the same zone, even though there are flow solution nodes in other zones with the same name.

- The name "`GridCoordinates`" always refers to the ORIGINAL grid. Thus, when a grid is deforming, the deformed values must be put in `GridCoordinates_t` nodes of a different name. In the example, the deformed grids (for `Zone#2`) at the two times of interest were put into "`GridCoordinates#1`" and "`GridCoordinates#2`".

- Because the node "`ArbitraryGridMotion#1`" doesn't really add any information in the current example (since it was decided not to store `GridVelocity` data under it), one has the option of not including this node in the CGNS file. If it is removed, then under `Zone#2`'s "`ZoneIterativeData`", the `ArbitraryGridMotionPointers`" data would be replaced by:

  ```
  Data = (Null, ArbitraryGridMotion#2)
  ```