Proposal for the addition of rigid body grid motion to the CGNS

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RigidGridMotion_t Data Structure

Adding the rigid body motion information to the CGNS file enables an application code to determine the mesh location without the need to alter the original mesh definition recorded under `GridCoordinates_t`. A new data structure named `RigidGridMotion_t` is created to record the necessary data defining a rigid translation and/or rotation of the grid coordinates.

It is proposed that the rigid grid motion be recorded independently for each zone of the CGNS base. Therefore the `RigidGridMotion_t` data structure would be added under each the zone data structure (`Zone_t`). There may be zero to several `RigidGridMotion_t` nodes under a `Zone_t` node. The multiple rigid grid motion definitions may be associated to different iteration or time step in the computation. This association is recorded under the `ZoneIterativeData_t` data structure.

SIDS definition of the RegionGridMotion_t data structure:

The RigidGridMotion_t under the Zone_t data structure:

```
Zone_t<int CellDimension, int PhysicalDimension > :=
  {
  List(RigidGridMotion_t RigidGridMotion1...
                         RigidGridMotionN) ;                    (o)
  ...
  }
```

The RigidGridMotion_t data structure:

```
RigidGridMotion_t :=
  {
  List( Descriptor_t Descriptor1 ... DescriptorN ) ;            (o)
  RigidGridMotionType_t RigidGridMotionType ;                   (r)
  DataArray_t<real,2,PhysicalDimension, 2>OriginLocation ;      (r)
  DataArray_t<real,1,PhysicalDimension>RigidRotationAngle ;     (o/d)
  DataArray_t<real,1,PhysicalDimension>RigidVelocity ;          (o)
  DataArray_t<real,1,PhysicalDimension>RigidRotationRate ;      (o)
  List(DataArray_t DataArray1 ... DataArrayN ) ;                (o)
  DataClass_t DataClass ;                                       (o)
  DimensionalUnits_t DimensionalUnits ;                         (o)
  }
```

Definitions:

- `RigidGridMotionType_t`: enumeration type that describes the type of rigid grid motion.

```
RigidGridMotionType_t := Enumeration(
   None,
   ConstantRate,
   VariableRate ) ;
```

- `OriginLocation`: Physical coordinates of the origin before and after the rigid body motion.

- `RigidRotationAngle`: Rotation angles of about each axis of the translated coordinate system.

- `RigidVelocity`: Grid velocity vector of the origin translation.

- `RigidRotationRate`: Rotation rate vector about the about the axis of the translated coordinate system.

Notes:

- The `DataClass_t`, `DimensionalUnits_t` and `Descriptor_t` nodes may optionally be specified under the `RigidGridMotion_t` nodes.

- `RigidGridMotionType`, `OriginLocation` and `RigidRotationAngle` are the only three required data under `RigidGridMotion_t`. All other elements are optional.

- Any numbers of `DataArray_t` nodes are allowed. These should be used to record data not covered by this specification.

- `RigidGridMotion_t` implies relative motion of grid zones or blocks. However, no attempt is made here to require that the `ZoneGridConnectivity_t` information be updated to be consistent with the new grid locations. The user is responsible to ensure that any `ZoneGridConnectivity_t` information is kept up to date.

Proposed CGNS Library extensions:

- Add a new routine to the CGNS API that would return the grid coordinates with the transformation (defined under the `RigidGridMotion_t` data structure) performed automatically, if desired.

ADF file mapping definition of the RegionGridMotion_t data structure