ICADA - Note 2010-001:

Specification of spline patch topology to SIM

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1   Assumptions

We only allow for completely matching blocks for now. That is, two adjacent blocks are topologically connected with a common surface if, and only if, all control points (nodes) defining the geometry of the surface are identical for the two blocks. Otherwise, they are assumed not connected (we have a "crack").

2   Input description, topology

The simulation module must generate a unique global node number for all control points in the model. The input to this process should be as compact as possible, but should contain sufficient information such that the node number generation can be carried out locally within each patch in arbitrary order or in parallel. Only topology information is included, all geometry data goes via the g2-files from GoTools.
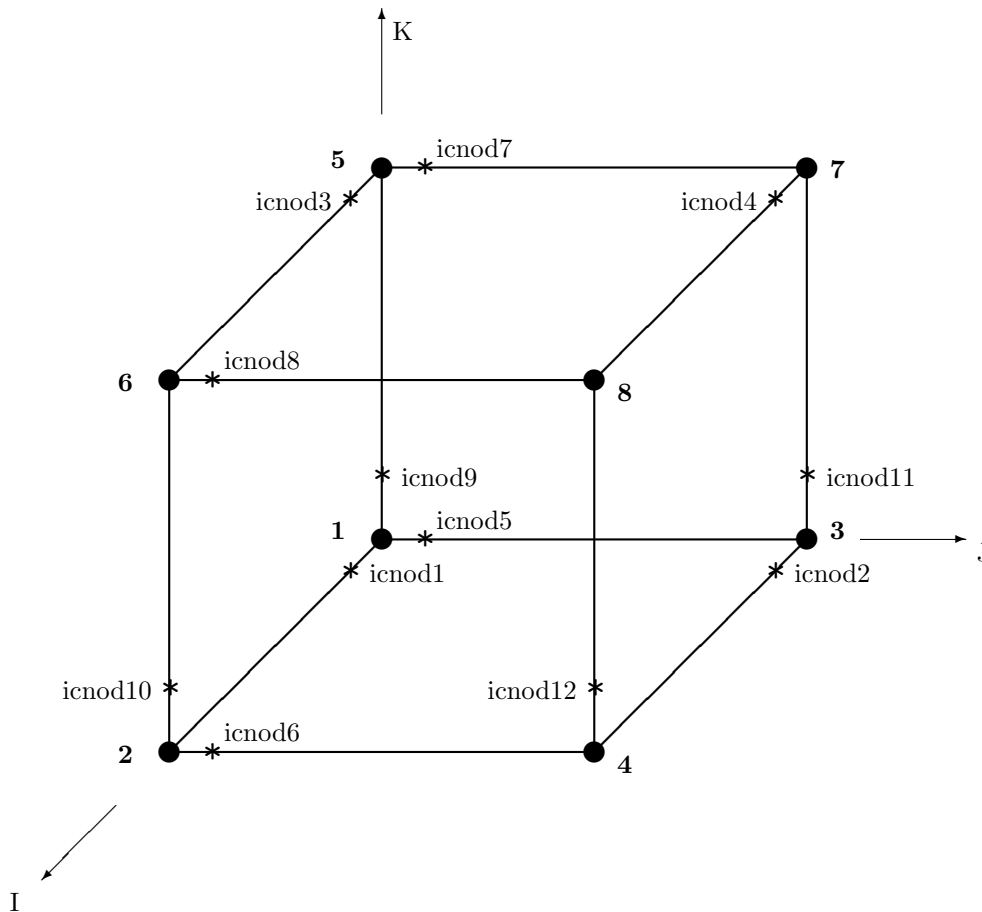

Figure 1: Local vertex numbering convention (•) and the first node along each edge (⋆).

For each patch, the input is as follows (see Figures 1, 2 and 3 for the interpretation of the variables ICNODi, ISNODi and IINODi):

```
IBLOCK
IBNOD1   IBNOD2   ...      IBNOD8
ICNOD1   INCR1
ICNOD2   INCR2
...
ICNOD12 INCR12
ISNOD1   INCI1      INCJ1
ISNOD2   INCI2      INCJ2
...
ISNOD6   INCI6      INCJ6
IINOD1
```
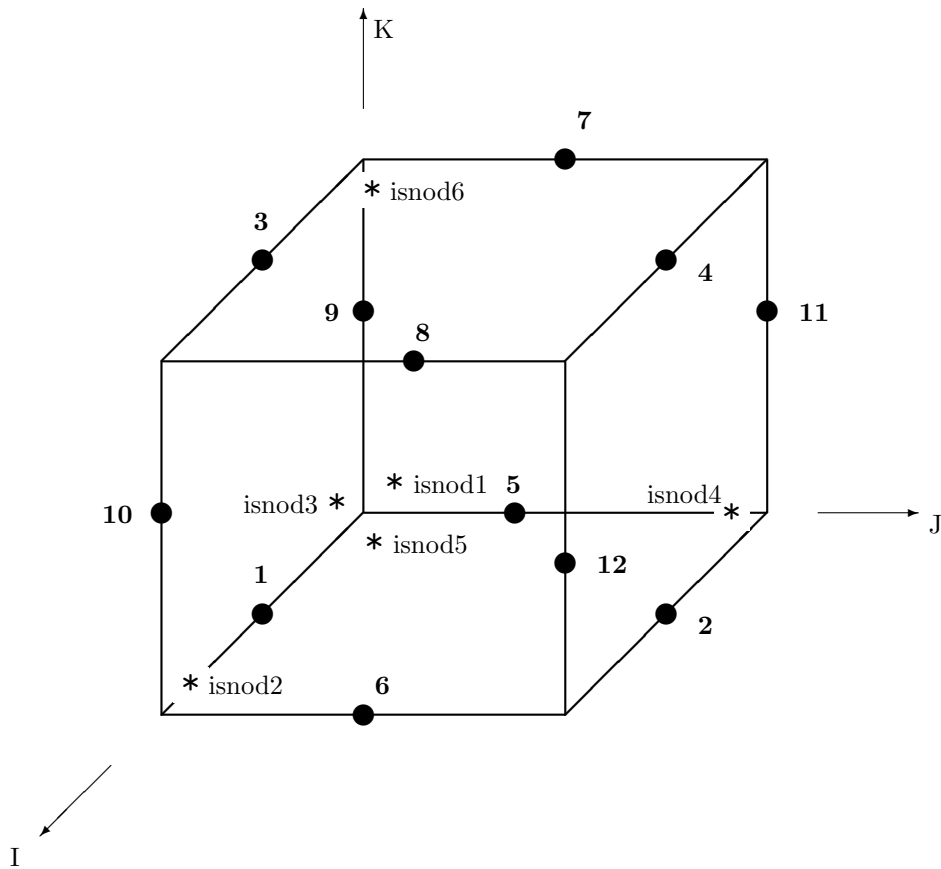

Figure 2: Local edge numbering convention (●) and the first node on each surface (⋆).

IBLOCK   Spline patch index

IBNODi Global node number of vertex i

ICNODi Global node number of second point along edge i

INCRi Increment in global numbering along the edge (± 1)

ISNODi Global node number of first interior point on face i

INCIi Increment in global numbering in local I-direction on the face (± 1)

INCJi Increment in global numbering in local J-direction on the face (± 1)

IINOD1   Global node number of the first interior point of the patch

The local I and J directions for a face are defined as the two remaining directions when removing the index defining the normal direction of that face from the $I - J - K$ triplet. That is, for local faces 1 and 2, the local $I - J$ directions correspond the "global" $J - K$ directions (depicted in Figure 3). For local faces 3 and 4, the local $I - J$ directions correspond to the "global" $I - K$ directions, respectively, whereas for local faces 5 and 6 they coincide with the global $I - J$ directions.
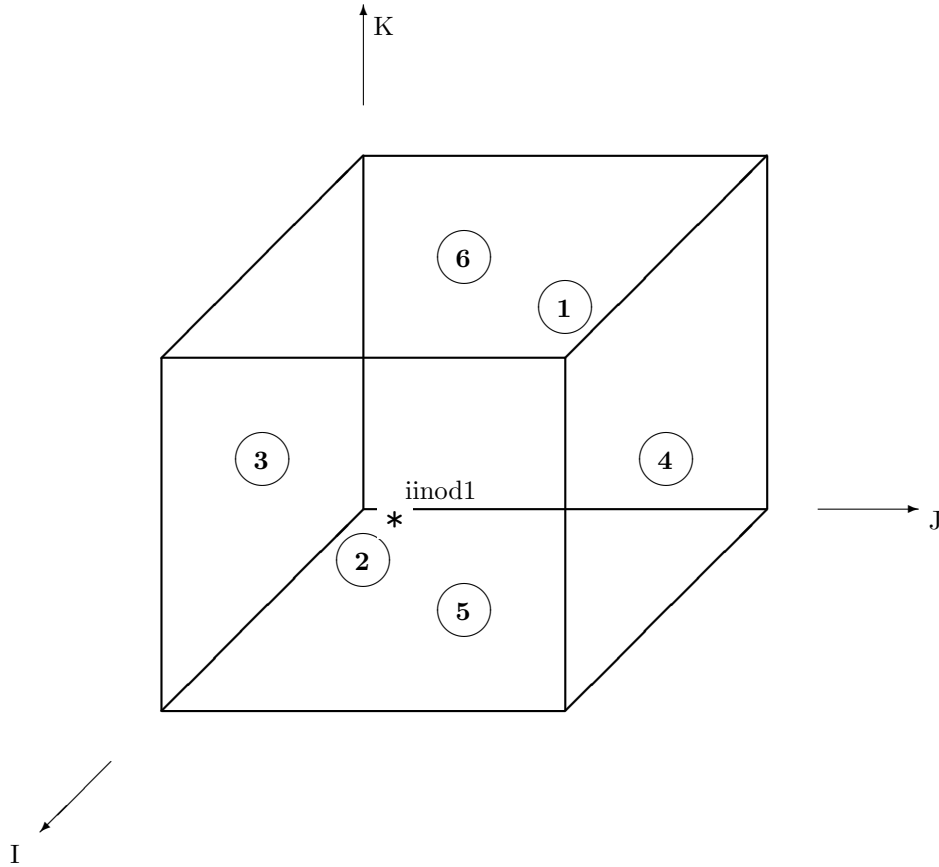

Figure 3: Local face numbering convention ($\circ$) and the first interior node ($\star$).

3 Properties and boundary conditions

All physical properties defined in the GPM-module are mapped onto the spline model through a set of user-defined codes. The actual interpretation of each code is defined within SIM itself, via a separate input file. The property codes are specified through the following syntax:

| PCODE | IBLOCK | LDIM | LINDEX |

PCODE   Property or boundary condition code (either a string or an integer value)

IBLOCK Spline patch index

LDIM   Local entity dimension flag (0, 1, 2, or 3)

LINDEX Local entity index which is assigned the property

- Local vertex if LDIM = 0
- Local edge if LDIM = 1
- Local face if LDIM = 2
- Not referenced if LDIM = 3

The local ordering of the vertices, edges and faces follows the convention defined in Figures 1, 2 and 3, respectively.