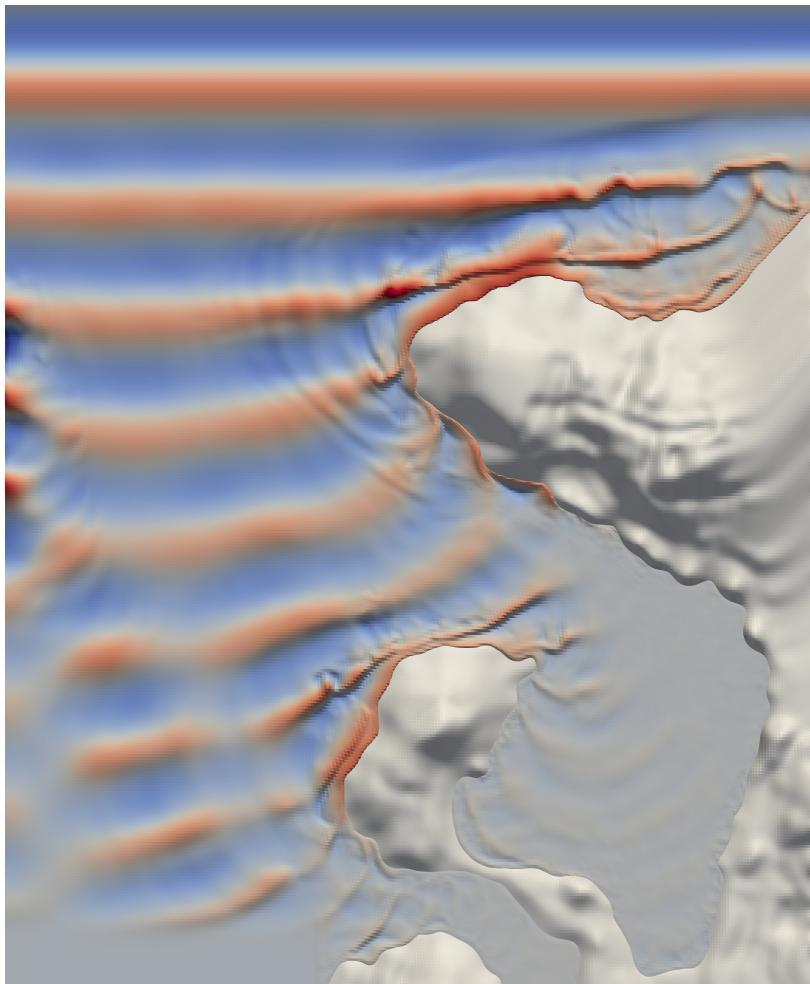


DIVEMesh :: User Guide



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Contents

1	The ‘control.txt’ file	1
1.1	B :: Boundary	1
1.2	C :: Channel	5
1.3	D :: Data Interpolation	7
1.4	F :: Freecoor	8
1.5	G :: Geodat	8
1.6	H :: Hydrodynamic Coupling	11
1.7	M :: MPI	12
1.8	O :: Objects	13
1.9	S :: Solid	13

Chapter 1

The ‘control.txt’ file

1.1 B :: Boundary

B 1 `double` cell size dx

default: 0.0

B 2 `int` number of cells in x-, y- and z-direction

When activated, it will overwrite B 1.

default: 0 0 0

B 10 * `double` rectangular domain; $x_{start}, x_{end}, y_{start}, y_{end}, z_{start}, z_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

B 22 * `double` sphere; $x_{center}, y_{center}, z_{center}, radius$

default: 0.0 ; 0.0 ; 0.0 ; 0.0

B 31 * `double` straight pipe in x-direction; $x_{start}, x_{end}, y_{center}, z_{center}, radius$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

B 32 * `double` straight pipe in y-direction; $y_{start}, y_{end}, x_{center}, z_{center}, radius$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

B 33 * `double` straight pipe in z-direction; $z_{start}, z_{end}, x_{center}, y_{center}, radius$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

B 101 `int` type of grid stretching function in x-direction

0 OFF

1 center focus (sinh, using B111)

2 wall focus (tanh, using B111)

5 point focus using sinh (requires B 114)

6 point focus using exponents (requires B 114)

8 three zones with constant dx (requires B 121)

9 three zones with stretching (requires B 124)

10 input from file (requires x-spacing.dat file with grid points between 0 and 1)

11 cell size based (requires B 127)

default: 0

B 102 `int` type of grid stretching function in y-direction

0 OFF

1 center focus (sinh, using B112)

2 wall focus (tanh, using B112)

5 point focus using sinh (requires B 115)

6 point focus using exponents (requires B 115)

8 three zones with constant dx (requires B 122)

9 three zones with stretching (requires B 125)

10 input from file (requires y-spacing.dat file with grid points between 0 and 1)

11 cell size based (requires B 128)

default: 0

B 103 `int` type of grid stretching function in z-direction

0 OFF

1 center focus (sinh, using B113)

2 wall focus (tanh, using B113)

3 lid focus (exponential, using B113)

4 lid focus (sinusoidal)

5 point focus using sinh (requires B 116)

6 point focus using exponents (requires B 116)

8 three zones with constant dx (requires B 123)

9 three zones with stretching (requires B 126)

10 input from file (requires z-spacing.dat file with grid points between 0 and 1)

11 cell size based (requires B 129)

default: 0

B 111 `double` stretching factor in x-direction

default: 1.0

B 112 `double` stretching factor in y-direction

default: 1.0

B 113 `double` stretching factor in z-direction

default: 1.0

B 114 `double` focus point for x-direction stretching B 101 5

default: 0.0

B 115 `double` focus point for y-direction stretching B 102 5

default: 0.0

B 116 `double` focus point for z-direction stretching B 103 5

default: 0.0

B 121 input for the three zones of B 101 8: `int` N1, `double` x1, `int` N2, `double` x2, `int` N3

The sum of the given N1,N2,N3 result in the number of elements in x-direction.

default: na

B 122 input for the three zones of B 101 8: `int` N1, `double` y1, `int` N2, `double` y2, `int` N3

The sum of the given N1,N2,N3 result in the number of elements in y-direction.

default: na

B 123 input for the three zones of B 101 8: `int` N1, `double` z1, `int` N2, `double` z2, `int` N3

The sum of the given N1,N2,N3 result in the number of elements in z-direction.

default: na

B 124 input for the three zones of B 101 9: `int` N1, `double` x1, `double` f1, `int` N2, `double` xf, `double` f2, `int` N3, `double` x2, `double` f3

The sum of the given N1,N2,N3 result in the number of elements in x-direction. The factors f1 and f3 are the linear stretching factors for the layers. The parameter x1 gives the border between the first and second layer, x2 between second and third. The parameter xf gives the location of the stretching focus in the second layer, where sinh stretching based on the factor f2 is used.

default: na

B 125 input for the three zones of B 102 9: `int N1, double y1, double f1, int N2, double yf, double f2, int N3, double y2, double f3`

see B 124.

default: na

B 126 input for the three zones of B 103 9: `int N1, double z1, double f1, int N2, double zf, double f2, int N3, double z2, double f3`

see B 124.

default: na

B 127 input for the cell size based stretching of B 101 11: `double Δxmin, double Δxmax, double xf, double δf, double r`

A constant cell size of Δx_{min} is generated in the focus zone of length δ_f around x_f . The cells are stretched with the cell ratio r between the ends of the focus zone and the domain boundaries until the maximum cell size of Δx_{max} is reached.

default: na

B 128 input for the cell size based stretching of B 102 11: `double Δymin, double Δymax, double yf, double δf, double r`

see B 127

default: na

B 129 input for the cell size based stretching of B 103 11: `double Δzmin, double Δzmax, double zf, double δf, double r`

see B 127

default: na

B 130 `int` print grid to "gridSpacing.vtk"

0 OFF

1 ON

default: 0

1.2 C :: Channel

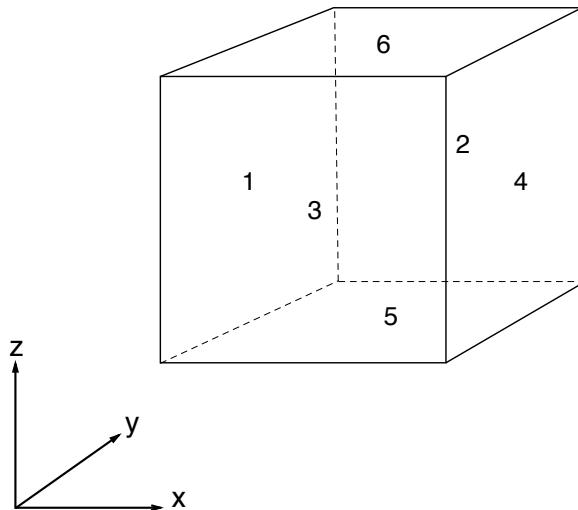


Figure 1.1: Definition of cell sides within DIVEMesh and REEF3D.

C 11 int Boundary Condition on Surfside 1

- 1** inflow
- 3** symmetry plane
- 6** wave generation
- 7** numerical beach
- 21** wall
- default:** 21

C 12 int Boundary Condition on Surfside 2

- 3** symmetry plane
- 6** wave generation
- 7** numerical beach
- 21** wall
- default:** 21

C 13 int Boundary Condition on Surfside 3

- 3** symmetry plane
- 6** wave generation
- 7** numerical beach
- 21** wall
- default:** 21

C 14 int Boundary Condition on Surfside 4

2 outflow
3 symmetry plane
6 wave generation
7 numerical beach
21 wall
default: 21

C 15 int Boundary Condition on Surfside 5

3 symmetry plane
21 wall
default: 21

C 16 int Boundary Condition on Surfside 6

3 symmetry plane
21 wall
default: 21

C 21 int Periodic boundary conditions in x-direction

0 OFF
1 ON
default: 0

C 22 int Periodic boundary conditions in y-direction

0 OFF
1 ON
default: 0

C 23 int Periodic boundary conditions in z-direction

0 OFF
1 ON
default: 0

1.3 D :: Data Interpolation

D 10 `int` turn data interpolation on/off

0 OFF

1 ON

default: 0

D 11 `double` Δx , Δy , Δz

default: 0.0 ; 0.0 ; 0.0

D 12 `double` factor x-coordinate, factor y-coordinate, factor z-coordinate,

default: 0.0 ; 0.0 ; 0.0

D 13 `int` Read data every i^{th} iteration

default: 1

D 14 `int` Type of interpolation

1 inverse distance

2 kriging

default: 1

D 15 `int` Number of smoothing iterations

default: 0

D 16 `double` Factor for data smoothing

default: 0.5

D 17 `double` Factor for data inverse distance

default: 16.0

D 18 `double` Range factor for kriging

default: 0.3

D 19 `int` Read dummy letter in front of 3D coordinates

0 OFF

1 ON

default: 0

D 23 `int` reverse sign of data variable in dmdata.dat

0 OFF

1 ON

default: 0

D 24 `double` distance limiter for inverse distance

default: na

1.4 F :: Freecoor

F 3 `double` zstart, zend

default: 0.0

F 11 * `double` left side wall LINE; $x_{start}, x_{end}, y_{start}, y_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ;

F 21 * `double` right side wall LINE; $x_{start}, x_{end}, y_{start}, y_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ;

1.5 G :: Geodat

G 10 `int` turn geodat on/off

0 OFF

1 ON

default: 0

G 11 `double` Δx , Δy , Δz

default: 0.0 ; 0.0 ; 0.0

G 12 `double` factor x-coordinate, factor y-coordinate, factor z-coordinate,

default: 0.0 ; 0.0 ; 0.0

G 13 `double` rotation angle of geo coordinates around vertical axis

default: 0.0

G 14 `double` x-coordinate and y-coordinate of origin for the rotation angle of geo coordinates around vertical axis

default: 0.0 ; 0.0

G 15 `int` interpolation scheme

Global inverse distance interpolation requires long computation times for large geodat sets. The recommended interpolation scheme for relatively homogeneously spaced geodat points is local inverse distance interpolation. Kriging is recommended for inhomogeneously spaced geodat points, e.g. geodat points from digitized map contour lines. Kriging becomes unstable when geodat points are spaced too close to each other, so for this option G 36 is turned on automatically with the default value of 1.0 (that value can be changed). Kriging becomes inefficient for geodat sets larger than 10,000 points, thus G 37 is recommended for kriging.

- 1** global inverse distance interpolation
- 2** local inverse distance interpolation
- 3** kriging

default: 2

G 16 `double` base topography value for local inverse distance interpolation

default: 0.0

G 17 `int` d_{ij} lower limit for local inverse distance interpolation

default:

G 19 `int` read a letter in front of the coordinates in the geo.dat file

0 OFF

1 ON

default: 0

G 20 `int` use automatic grid size

0 OFF

1 ON

default: 0

G 21 `double` Margins for automatic grid size $x_{start}, y_{start}, z_{start}$

default: 0.0 ; 0.0 ; 0.0

G 22 `double` Margins for automatic grid size $x_{end}, y_{end}, z_{end}$

default: 0.0 ; 0.0 ; 0.0

G 23 `int` reverse sign of vertical coordinate in geo.dat file

0 OFF

1 ON

default: 0

G 24 `double` raise topography above the level h by dz

default: 0.0 ; 0.0

G 25 `double` multiply topography above the level h by factor fz

default: 0.0 ; 0.0

G 31 `int` Number of smoothing iterations

default: 0

G 32 `double` Factor for topography data smoothing

default: 0.5

G 35 `double` Factor for data inverse distance

default: 16.0

G 36 `double` sampling geodat points: factor times horizontal average mesh size for duplicate geodat point identification

default: 1.0

G 37 `int` sampling geodat points: maximum number of geodat after random removal

default: 1e8

G 38 `int` skip horizontal cells for geodat interpolation algorithm

default: 1

G 39 `int` remove out-of-bounds geodata points

0 OFF

1 ON

default: 1

G 41 **int** print SWAN bottom file from interpolated geo points

0 OFF

1 ON

default: 0

1.6 H :: Hydrodynamic Coupling

H 10 **int** Turn on hydrodynamic coupling procedure

This option requires the presence of the corresponding state files and state file folders.

0 OFF

4 FNPF to CFD (WCP)

default: 0

H 21 **double** X-location in FNPF NWT which is origin in CFD NWT

default: 0.0

H 22 **double** Y-location in FNPF NWT which is origin in CFD NWT

default: 0.0

H 23 **double** Z-location in FNPF NWT which is origin in CFD NWT

default: 0.0

H 31 **double** start time coupling time series

default: -10.0^{19}

H 32 **double** end time coupling time series

default: 10.0^{19}

H 33 **int** start iteration coupling time series

default: -21^8

H 34 `int` end iteration coupling time series

default: 21^8

1.7 M :: MPI

M 10 `int` Number of processes

default: 1

M 11 `int` Partition in x-direction

0 OFF

1 ON

default: 1

M 12 `int` Partition in y-direction

0 OFF

1 ON

default: 1

M 13 `int` Partition in z-direction

0 OFF

1 ON

default: 0

M 20 `int` Decomposition method

1 Standard rectangular base domain

2 Improved rectangular base domain

default: 1

M 31 `double` Variance parameter for decomposition method 2

default: 0.1

1.8 O :: Objects

O 10 * `double` rectangular object; $x_{start}, x_{end}, y_{start}, y_{end}, z_{start}, z_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

O 32 * `double` cylinder in y-direction; $x_{center}, z_{center}, radius$

default: 0.0 ; 0.0 ; 0.0

O 33 * `double` cylinder in z-direction; $x_{center}, y_{center}, radius$

default: 0.0 ; 0.0 ; 0.0

O 61 * `double` wedge object; $x_{start}, x_{end}, y_{start}, y_{end}, z_{start}, z_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

1.9 S :: Solid

S 1 `int` read STL file and generate solid. Name the file as 'solid.stl'

IMPORTANT: the STL file needs to be in ASCII format! Most CAD programs export to a binary STL file. It is possible to use e.g. Paraview for STL conversion from binary to ASCII.

0 OFF

1 ON

default: 0

S 2 `int` auto-generate mesh extend based on STL max/min coordinates

0 OFF

1 ON

default: 0

S 3 `double` margins for auto-generated mesh $xm_{start}, xm_{end}, ym_{start}, ym_{end}, zm_{start}, zm_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 4 `double` Scale STL geometry

default: 1.0

S 5 `double` 3D rotation; $x_{origin}, y_{origin}, z_{origin}, \phi, \theta, \psi$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 6 `int` print transformed STL model to "REEF3D_Solid.stl"

0 OFF

1 ON

default: 0

S 7 `double` translation / change origin of STL model dx, dy, dz

default: 0.0 ; 0.0 ; 0.0

S 8 `double` Turn STL geometry in horizontal xy-plane in degree $^{\circ}$

default: 0.0

S 9 `int` Invert inside/outside for STL geometry

1 regular

2 invert

default: 1

S 10 * `double` rectangular object; $x_{start}, x_{end}, y_{start}, y_{end}, z_{start}, z_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 11 * `double` rectangular object array; $x_{origin}, y_{origin}, z_{origin}$, box length L, gap G, number of objects in each direction n_i, n_j, n_k

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 32 * `double` cylinder in y-direction; $x_{center}, z_{center}, radius$

default: 0.0 ; 0.0 ; 0.0

S 33 * `double` cylinder in z-direction; $x_{center}, y_{center}, radius$

default: 0.0 ; 0.0 ; 0.0

S 34 * `double` cylinder with flexible orientation and front face orthogonal to x-plane

$x_{start}, y_{start}, z_{start}, radius_{start}, x_{end}, y_{end}, z_{end}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 35 * `double` cylinder with flexible orientation and front face orthogonal to y-plane

$x_{start}, y_{start}, z_{start}, radius_{start}, x_{end}, y_{end}, z_{end}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 36 * `double` cylinder with flexible orientation and front face orthogonal to z-plane

$x_{start}, y_{start}, z_{start}, radius_{start}, x_{end}, y_{end}, z_{end}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 37 * `double` cylinder with flexible orientation and front face orthogonal to the cylinder axis

$x_{start}, y_{start}, z_{start}, radius_{start}, x_{end}, y_{end}, z_{end}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 38 * `double` cylinder with flexible orientation and a vertical front face in line with the cylinder axis

$x_{start}, y_{start}, z_{start}, radius_{start}, x_{end}, y_{end}, z_{end}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 41 * `double` cone in x-direction; $y_{center}, z_{center}, x_{start}, x_{end}, radius_{start}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 42 * `double` cone in y-direction; $x_{center}, z_{center}, y_{start}, y_{end}, radius_{start}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 43 * `double` cone in z-direction; $x_{center}, y_{center}, z_{start}, z_{end}, radius_{start}, radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 51 * `double` sphere; $x_{center}, y_{center}, z_{center}, radius$

default: 0.0 ; 0.0 ; 0.0 ; 0.0

S 52 * `double` ellipsoid; $x_{center}, y_{center}, z_{center}, a_{axis}, b_{axis}, c_{axis}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 53 * `double` semi ellipsoid with vertical base; $x_{center}, y_{center}, z_{center}, a_{axis}, b_{axis}, c_{axis}, h_{base}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 54 * `double` semi ellipsoid with vertical base with rotation around the center;

$x_{center}, y_{center}, z_{center}, a_{axis}, b_{axis}, c_{axis}, h_{base}, \phi, \theta, \psi$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 61 * `double` wedge object in x-direction; $x_{start}, x_{end}, y_{start}, y_{end}, z_{start}, z_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 62 * `double` wedge object in y-direction; $x_{start}, x_{end}, y_{start}, y_{end}, z_{start}, z_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 63 * `double` wedge object in z-direction; $x_{start}, x_{end}, y_{start}, y_{end}, z_{start}, z_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 81 * `double` tetrahedon object, each of the 4 points is given by the coordinates $x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4$

default: [4x] 0.0 ; 0.0 ; 0.0

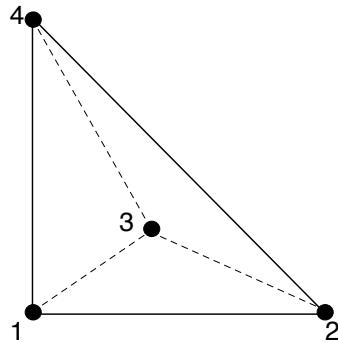


Figure 1.2: Definition of the tetrahedon points.

S 82 * `double` pyramid object, each of the 5 points is given by the coordinates $x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4, x_5, y_5, z_5$

default: [5x] 0.0 ; 0.0 ; 0.0

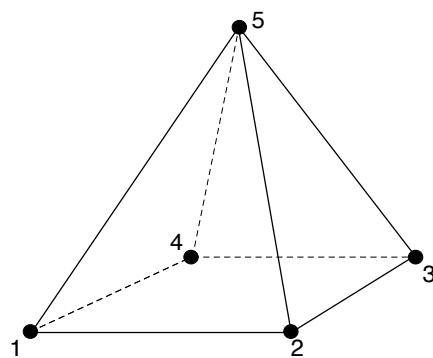


Figure 1.3: Definition of the pyramid points.

S 83 * `double` wedge object, each of the 6 points is given by the coordinates $x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4, x_5, y_5, z_5, x_6, y_6, z_6$

default: [6x] 0.0 ; 0.0 ; 0.0

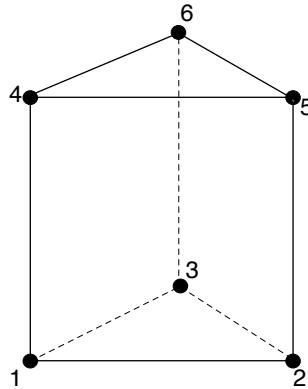


Figure 1.4: Definition of the wedge points.

S 84 * `double` hexahedron object, each of the 8 points is given by the coordinates $x_1, y_1, z_1, x_2, y_2, z_2, x_3, y_3, z_3, x_4, y_4, z_4, x_5, y_5, z_5, x_6, y_6, z_6, x_7, y_7, z_7, x_8, y_8, z_8$

default: [8x] 0.0 ; 0.0 ; 0.0

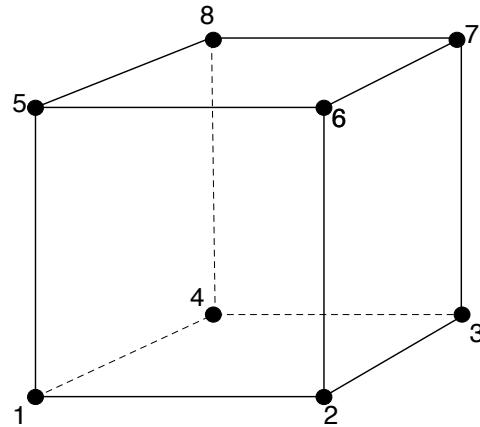


Figure 1.5: Definition of the hexahedron points.

S 121 * `double` vertical ogee weir, coordinates of upstream bottom corner, width, downstream height and hydraulic head x, y, z, b, P_d, H_0

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 122 * `double` vertical ogee weir, K , n , x_c and y_c

default: 0.5 ; 1.85 ; 0.22 ; 0.075

S 123 * double vertical ogee weir, R_1 and R_2

default: 0.45 ; 0.2

S 131 * double semi-circular cylinder in y-direction, x_c , z_c , y_{start} , y_{end} , $radius_{start}$, $radius_{end}$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 141 * double arch bridge; x_{start} , x_{end} , y_{start} , y_{end} , z_{start} , z_{end} , $radius$

default: 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0 ; 0.0

S 301 int fluvial box geometry.

The inverted fluvial box geometry only works for special cases, where the inflow is on side 1 and the outflow is on side 4.

1 regular

2 inverted

default: 1

S 305 double fluvial box resolution, factor time dx results in ds (smaller values gives higher resolution);
factor

default: 0.5

S 306 double fluvial box width; *b*

default: 1.0

S 307 double fluvial box flow height; *fh*, bed height *bh*

default: 0.5 ; 0.2

S 308 double fluvial box move origin; Δx , Δy , Δz ,

default: 0.0 ; 0.0 ; 0.0

S 309 double fluvial box margins; Δx , Δy , Δz ,

default: 0.0 ; 0.0 ; 0.0

S 310 * double fluvial box: straight segment; *length*

default: 0.0

S 320 * double fluvial box: left bend; *radius, angle* ϕ

default: 0.0

S 330 * double fluvial box: right bend; *radius, angle* ϕ

default: 0.0

S 340 * double fluvial box: meander (sine-generated curve); θ, L, N, ds

default: 0.0 ; 0.0 ; 0.0 ; 0.0