1 Casx files (networks)

This chapter outlines a simple file format for storing 1D network structures (like vasculature) in 3-dimensional space. The format holds point coordinates (the point section), a connectivity matrix (C_1) and a diameter vector. All examples in this document will relate to the case study below:

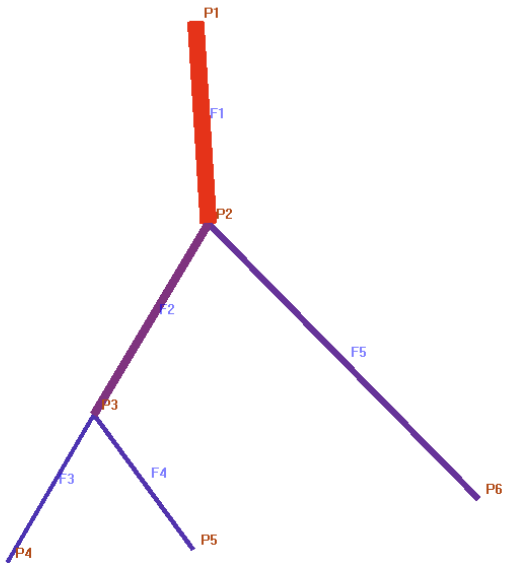

Figure 1.1. The connectivity and diameter information from the representative dataset stored in a casx file.

1.1 Header section

The top of the file has header information relating the date the file format was created, the date the file was created and the location of creation. This section is not relevant for visualization purposes, but gives context for the source of the data.

```
//"3d vascular network generation" author="A.Linninger" date="2007-2011"
//File format designed by GHartung and ALinninger 10/9/2018
//This file was created by LPPD in Chicago,US on: 11/13/2018
```

1.1 Point coordinate section

The point coordinate section is the next section of the file. It has a header detailing the total number of points in the network that contains the tag "*//point coordinates;*" and the number of points in the matrix. Each point is defined by a 3-dimensional coordinate system where the first column is the x-coordinate, the second is the y-coordinate and the third column is the z-coordinate of the point. The points are indexed by row, meaning the first row (-4.080000000E+001

1.746000000E+002 0.000000000E+000) is the point coordinates (x, y, z) of the first point. Note, this implies the number of points is also the number of rows in the matrix. The final line of this section contains the tag "*// end point coordinates*" that signifies the section is complete.

```
//point coordinates;   nPoints=6
   -4.080000000E+001    1.746000000E+002    0.000000000E+000
   -3.780000000E+001    1.272000000E+002    0.000000000E+000
...
//end point coordinates
```

1.2 Arc connectivity section

The second section explains the connectivity between the points. The first line contains the tag "*//arc connectivity matrix;*" and a signifier of how many arcs are in the matrix, and thus the number of row entries. Every arc is defined by the start and end point of the straight line. The matrix has 2 columns, the first column is the index of the first point in the arc and the second column is the second point in the arc. The final line of the section has the signifier "*//end arc connectivity matrix*". Note, the arcs are indexed by the respective row in the matrix, so the first row (1 2) that connects point 1 to point 2 (points are defined in Section 1.1) is known as arc 1.

```
//arc connectivity matrix;   nArcs=5
1 2
…
//end arc connectivity matrix
```

1.3 Diameter section

Each arc is endowed with a specific diameter. This diameter is stored in a vector signified with the tag of "*//diameter: vector on arc;*" and another signifier to how many arcs are in the vector. The row index of the vector corresponds to the arc index, meaning the first diameter (value of 4) is the diameter of the first face (row 1 from Section 1.2).

```
//diameter: vector on arc;   nArcs=5
4
...
//end diameter
```