

## Supplementary Information (ESI) for Soft Matter

### Structure Characterisation Method for Ideal and Non-Ideal Twisted Plywoods

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The following is the supplementary information regarding figure 4 and the visualisation tool Mayavi which is a scientific data visualisation in Python available for Windows and MacOSX as part of the Enthought Python Distribution and packaged in other OS such as Ubuntu or Debian. It provides an easy and interactive visualisation for 3D plotting which is why it was used here. This tool was used to provide the visualisation of the limit cases discussed in the article of  $0^\circ$  and  $90^\circ$ , however any case can be visualised as will be shown here. The full documentation regarding Mayavi can be found in the following link: <http://docs.entthought.com/mayavi/mayavi/>

The visualisation application has a Python command line (figure E1) where the director field can be defined but as an alternative, one can create a Python script including this information, which can be run in the Mayavi application under the file menu. Figure E1 shows the start-up screen when launching the software.

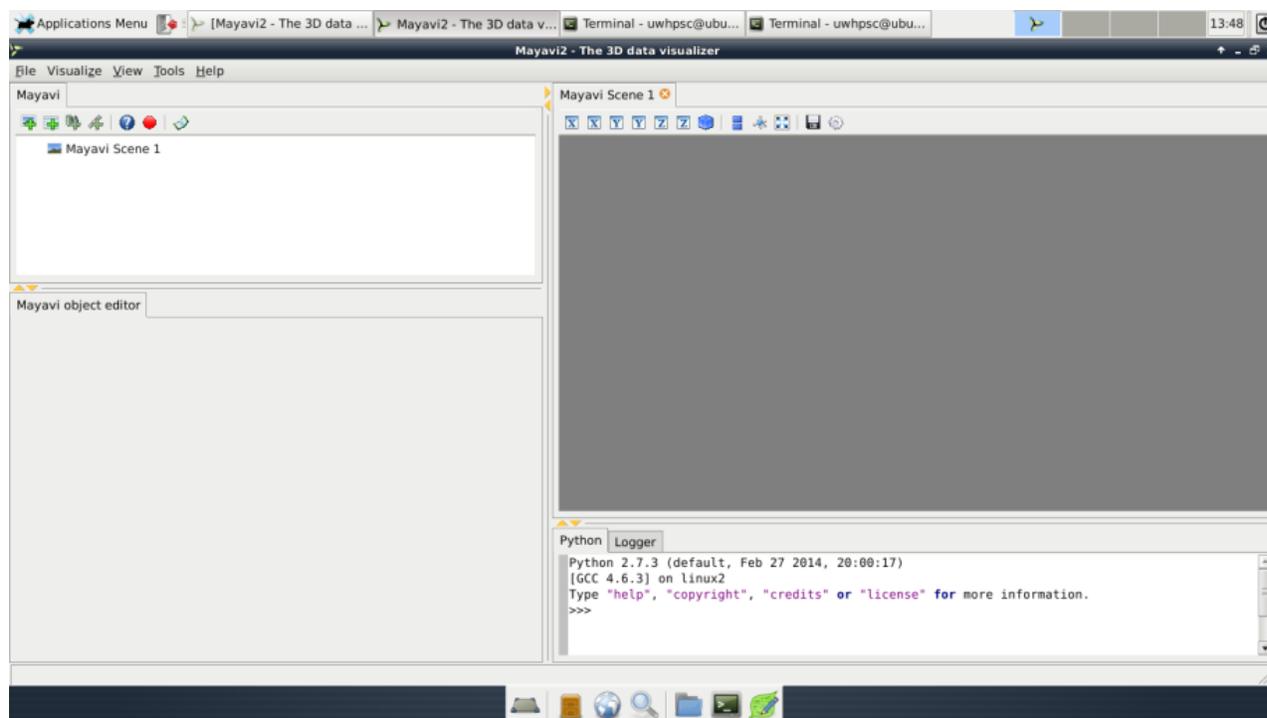


Fig. E1 Start-up screen of the 3D visualisation application Mayavi

Once the director is in the Mayavi, the next step is to hide the vector field and create the incision plane which is achieved by adding a “VectorCutPlane” in the scene. By default this plane will have its origin in the middle of the domain and will have a normal vector which defines its orientation pointing at  $(i, j, k) = (1, 0, 0)$  and arrows will displayed in this plane. To create the visualisations showed in the paper, the vector field is hidden because we are only interested in the oblique cuts and the normal vector is adjusted depending on the oblique angle desired. Further options that can be adjusted are the type of glyph shown (e.g. arrow, dash, hooked arrow, etc.), number of points, type of arrangement (random or non-random), and scale factor. The default options are shown in figure E2 where the incision plane is located in the middle of the domain and the orientation of the normal vector is the x positive direction.

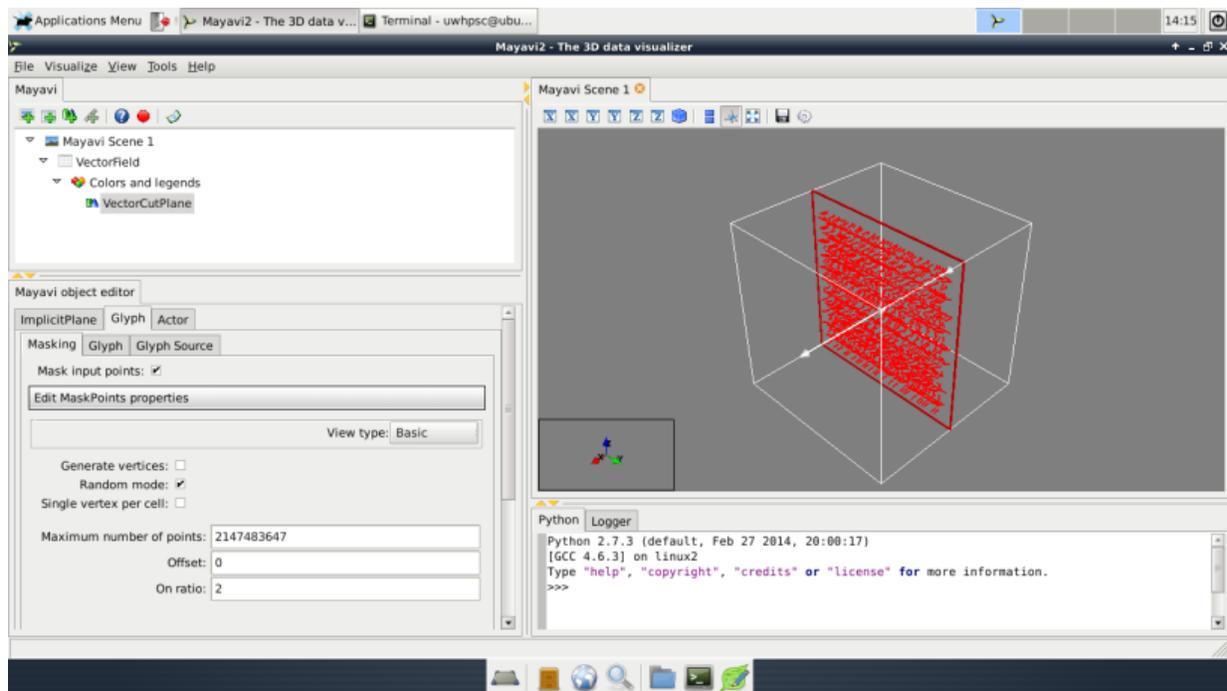


Fig. E2 Default visualisation of the ideal plywood architecture showing arrows with the plane oriented in the positive x direction in with origin in the centre of the computational domain

Adjusting the type of glyph, number of elements, the orientation and origin of the incision plane the following figures (E3 and E4) can be created:

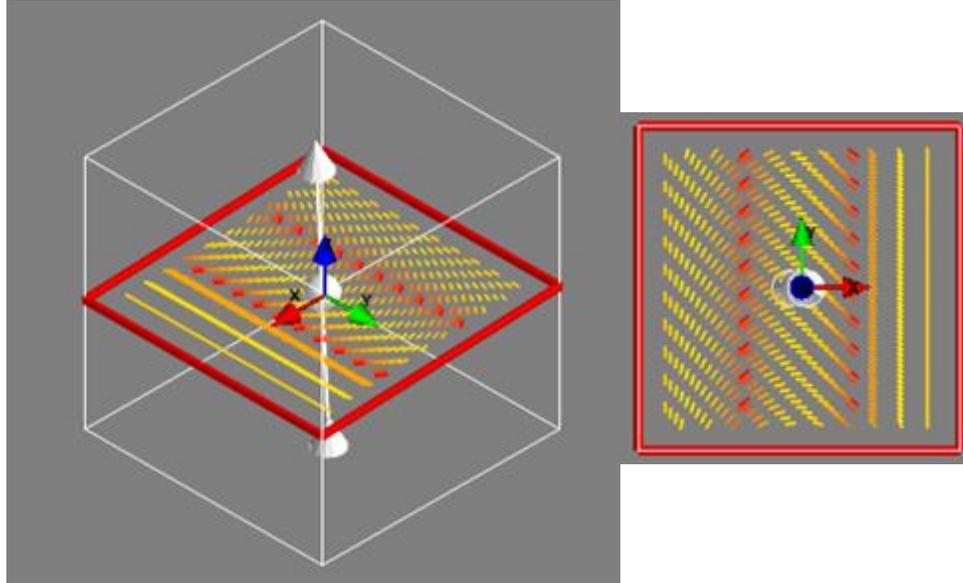


Figure E3. Oblique cut created with Mayavi with  $\alpha = 2.86^\circ$  and  $p_0 = 1$  isometric view (a) and incision plane view (b).

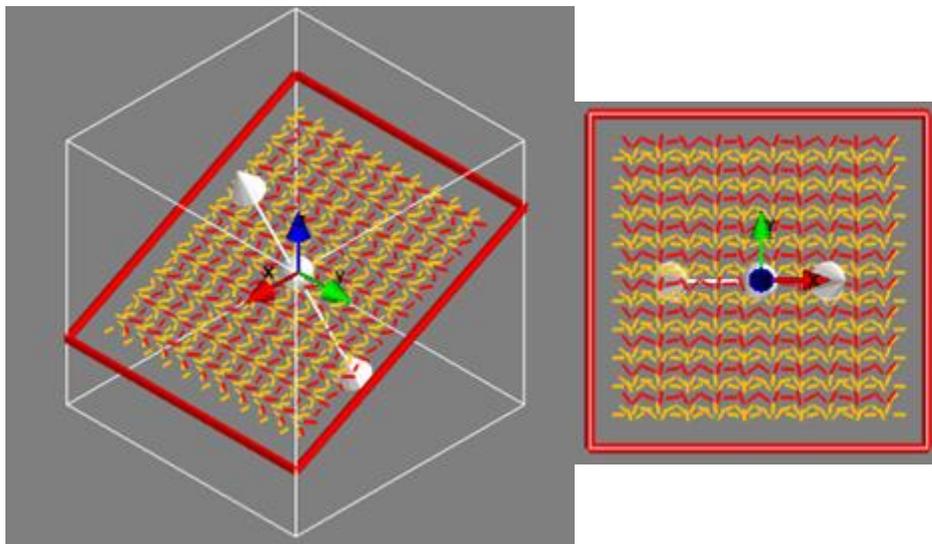


Figure E4. Oblique cut created with Mayavi with  $\alpha = 28.6^\circ$  and  $p_0 = 1$  isometric view (a) and incision plane view (b).

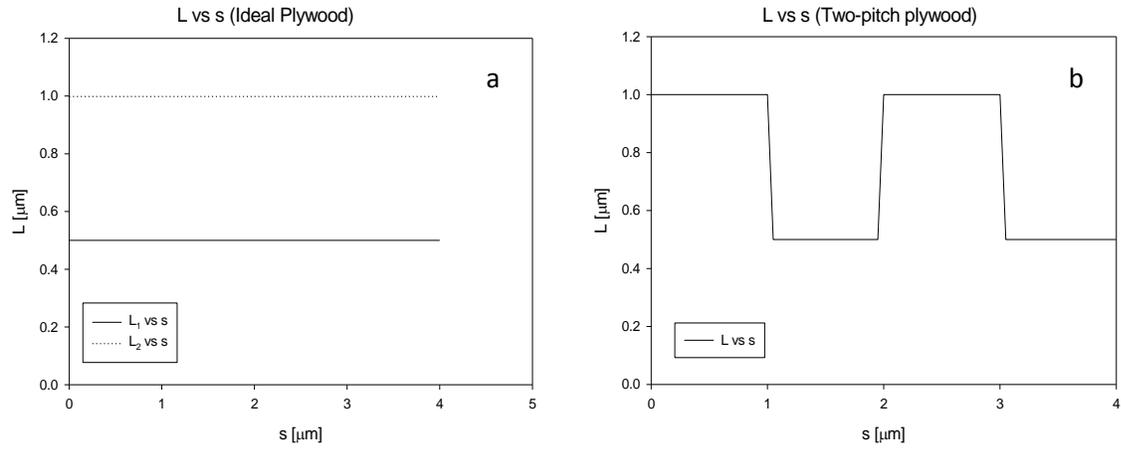


Figure E5. Periodicity  $L$  plotted as a function of the spatial coordinate  $s$  for two ideal plywoods (a) where no variations are observed and for a two-pitch plywood (b) where discrete variations can be identified allowing the system to be treated as ideal in a piecewise fashion.