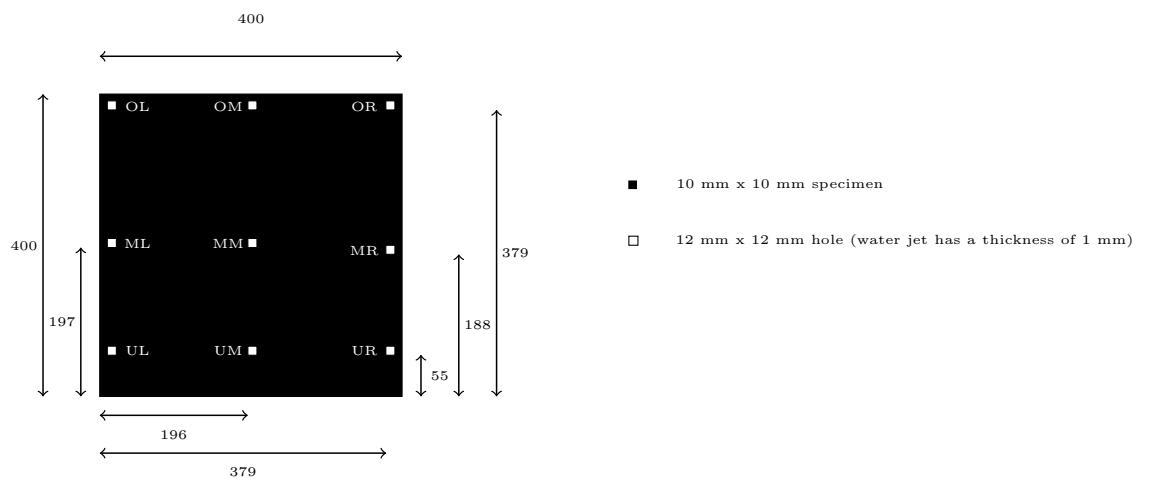


Interpolation samples

Juliane Blarr

July 2021

1 Cutting plan



2 Results of each specimen

[a_3333 a_3332 a_3322 a_3222 a_2222 a_3331 a_3321 a_3221 a_2221
a_3311 a_3211 a_2211 a_3111 a_2111 a_1111]

Figure 1: Nomenclature for depiction of 4th order orientation tensor

2.1 OL

Resolution: 0.00858373 mm/voxel

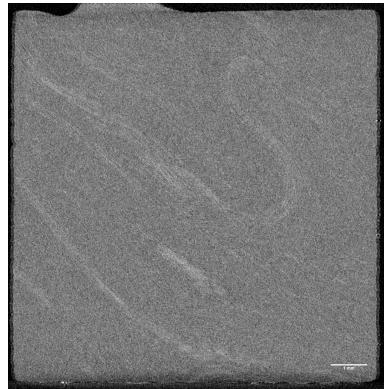


Figure 2: Section of the volumetric image of the OL PA6/CF sample

$$\begin{bmatrix} 0.039019 & 0.000565 & 0.001542 \\ 0.000565 & 0.949269 & 0.002303 \\ 0.001542 & 0.002303 & 0.011712 \end{bmatrix}$$

Figure 3: Orientation tensor of 2nd order of OL

$$\begin{bmatrix} 0.003296 & 0.000092 & 0.006512 & 0.002221 & 0.915144 & 0.001595 & 0.000051 \\ -0.001031 & -0.001815 & 0.001904 & -0.000009 & 0.027613 & 0.000978 & 0.002330 \\ 0.009502 \end{bmatrix}$$

Figure 4: 4th order orientation tensor of OL

2.2 ML

Resolution: 0.00858373 mm/voxel

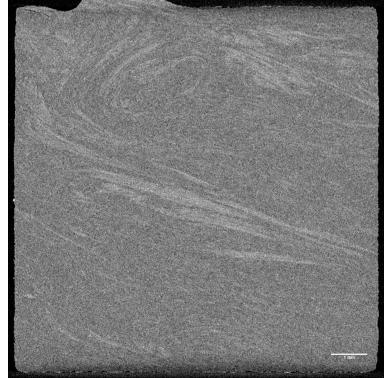


Figure 5: Section of the volumetric image of the ML PA6/CF sample

$$\begin{bmatrix} 0.091657 & -0.012547 & 0.002165 \\ -0.012547 & 0.892490 & 0.015488 \\ 0.002165 & 0.015488 & 0.015853 \end{bmatrix}$$

Figure 6: Orientation tensor of 2nd order of ML

$$\begin{bmatrix} 0.002893 & 0.000659 & 0.010383 & 0.013727 & 0.833610 & 0.000504 & 0.000078 \\ 0.000589 & -0.013123 & 0.002578 & 0.001102 & 0.048497 & 0.001072 & 0.000499 \\ & & & & 0.040581 \end{bmatrix}$$

Figure 7: 4th order orientation tensor of ML

2.3 UL

Resolution: 0.00858373 mm/voxel

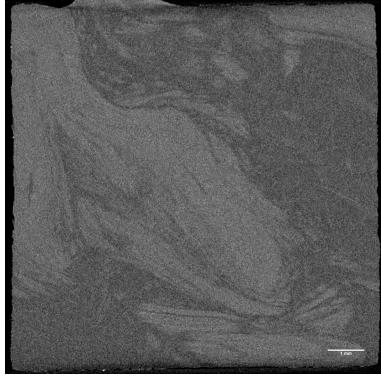


Figure 8: Section of the volumetric image of the UL PA6/CF sample

$$\begin{bmatrix} 0.073140 & -0.026562 & 0.002841 \\ -0.026562 & 0.908407 & 0.028146 \\ 0.002841 & 0.028146 & 0.018454 \end{bmatrix}$$

Figure 9: Orientation tensor of 2nd order of UL

$$\begin{bmatrix} 0.005808 & 0.001180 & 0.010091 & 0.025979 & 0.859864 & 0.000539 & -0.000338 \\ -0.000019 & -0.022238 & 0.002554 & 0.000988 & 0.038452 & 0.002321 & -0.003986 \\ & & & & 0.032133 \end{bmatrix}$$

Figure 10: 4th order orientation tensor of UL

2.4 OM

Resolution: 0.00858373 mm/voxel

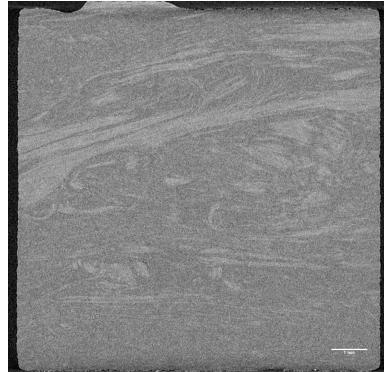


Figure 11: Section of the volumetric image of the OM PA6/CF sample

$$\begin{bmatrix} 0.105635 & -0.093760 & 0.008141 \\ -0.093760 & 0.859305 & -0.104421 \\ 0.008141 & -0.104421 & 0.035060 \end{bmatrix}$$

Figure 12: Orientation tensor of 2nd order of OM

$$\begin{bmatrix} 0.008971 & -0.006648 & 0.021664 & -0.089966 & 0.775592 & -0.000547 & -0.001941 \\ 0.009507 & -0.074687 & 0.004425 & -0.007808 & 0.062049 & -0.000818 & -0.017133 \\ & & & & 0.039161 \end{bmatrix}$$

Figure 13: 4th order orientation tensor of OM

2.5 MM

Resolution: 0.01440456 mm/voxel



Figure 14: Section of the volumetric image of the MM PA6/CF sample

$$\begin{bmatrix} 0.657207 & -0.138266 & 0.014728 \\ -0.138266 & 0.278636 & -0.007545 \\ 0.014728 & -0.007545 & 0.064157 \end{bmatrix}$$

Figure 15: Orientation tensor of 2nd order of MM

$$\begin{bmatrix} 0.030225 & -0.001571 & 0.016631 & -0.002910 & 0.147614 & 0.001720 & -0.002315 \\ 0.001423 & -0.047813 & 0.017300 & -0.003064 & 0.114391 & 0.011586 & -0.088138 \\ & & & & 0.525516 \end{bmatrix}$$

Figure 16: 4th order orientation tensor of MM

2.6 UM

Resolution: 0.01440456 mm/voxel

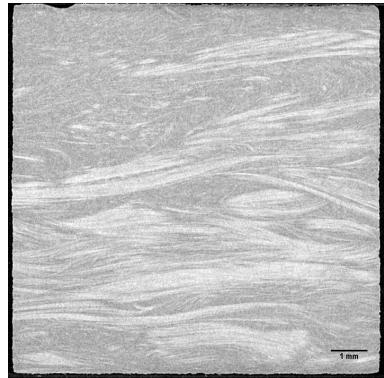


Figure 17: Section of the volumetric image of the UM PA6/CF sample

$$\begin{bmatrix} 0.812019 & -0.053106 & -0.003032 \\ -0.053106 & 0.147797 & -0.022115 \\ -0.003032 & -0.022115 & 0.040184 \end{bmatrix}$$

Figure 18: Orientation tensor of 2nd order of UM

$$\begin{bmatrix} 0.024215 & -0.005161 & 0.008090 & -0.010533 & 0.071365 & -0.001987 & -0.000197 \\ 0.000521 & -0.002327 & 0.007878 & -0.006421 & 0.068342 & -0.001566 & -0.050582 \\ & & & & 0.735799 \end{bmatrix}$$

Figure 19: 4th order orientation tensor of UM

2.7 OR

Resolution: 0.00690456 mm/voxel

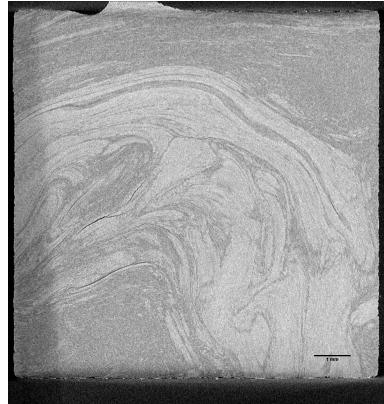


Figure 20: Section of the volumetric image of the OR PA6/CF sample

$$\begin{bmatrix} 0.164933 & 0.140757 & -0.005911 \\ 0.140757 & 0.758623 & -0.119834 \\ -0.005911 & -0.119834 & 0.076445 \end{bmatrix}$$

Figure 21: Orientation tensor of 2nd order of OR

$$\begin{bmatrix} 0.026448 & -0.013980 & 0.036163 & -0.091668 & 0.635783 & 0.002666 & 0.003363 \\ -0.010814 & 0.111955 & 0.013834 & -0.014186 & 0.086677 & 0.002237 & 0.025438 \\ & & & & 0.064422 \end{bmatrix}$$

Figure 22: 4th order orientation tensor of OR

2.8 MR

Resolution: 0.00690456 mm/voxel

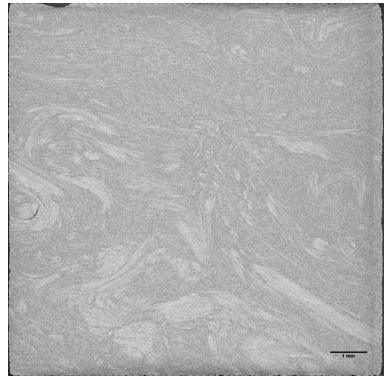


Figure 23: Section of the volumetric image of the MR PA6/CF sample

$$\begin{bmatrix} 0.248761 & 0.196508 & -0.028304 \\ 0.196508 & 0.673319 & -0.099772 \\ -0.028304 & -0.099772 & 0.077920 \end{bmatrix}$$

Figure 24: Orientation tensor of 2nd order of MR

$$\begin{bmatrix} 0.029968 & -0.008355 & 0.024712 & -0.074990 & 0.537822 & -0.000211 & 0.004942 \\ -0.017574 & 0.132937 & 0.023240 & -0.016427 & 0.110785 & -0.010520 & 0.058629 \\ & & & & 0.114736 \end{bmatrix}$$

Figure 25: 4th order orientation tensor of MR

2.9 UR

Resolution: 0.00690456 mm/voxel

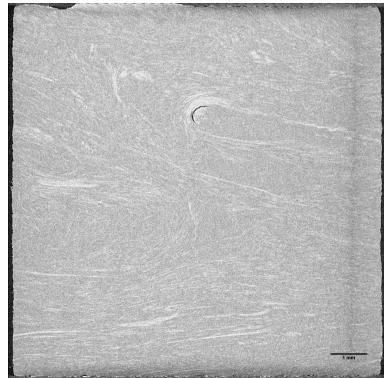


Figure 26: Section of the volumetric image of the UR PA6/CF sample

$$\begin{bmatrix} 0.398303 & 0.118596 & 0.006867 \\ 0.118596 & 0.521223 & -0.015272 \\ 0.006867 & -0.015272 & 0.080475 \end{bmatrix}$$

Figure 27: Orientation tensor of 2nd order of UR

$$\begin{bmatrix} 0.046470 & -0.003033 & 0.011484 & -0.007049 & 0.400218 & 0.000796 & 0.000866 \\ 0.001311 & 0.067865 & 0.022521 & -0.005190 & 0.109521 & 0.004760 & 0.049865 \\ & & & & 0.266261 \end{bmatrix}$$

Figure 28: 4th order orientation tensor of UR

3 Interpolation results

3.1 9x9

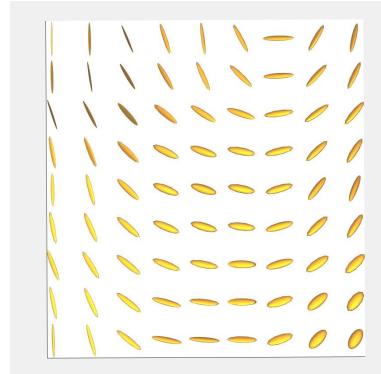


Figure 29: Interpolation results for the $400 \times 400 \text{ mm}^2$ plate with 9 measured OTs and $9 \times 9 - 9$ interpolated ones

3.2 13x13, higher resolution interpolation

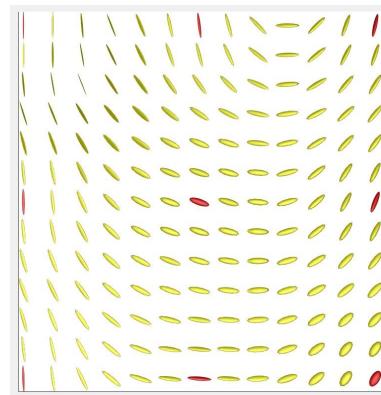


Figure 30: Interpolation results for the $400 \times 400 \text{ mm}^2$ plate with 9 measured OTs (red) and $13 \times 13 - 9$ interpolated ones (yellow)

3.3 Skipping the measured OT "MR" and interpolating it instead

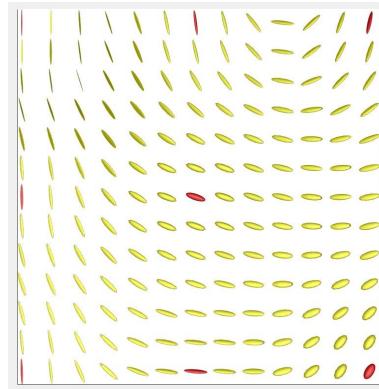


Figure 31: Interpolation results for the 400x400 mm² plate with 8 measured OTs (red) and 13*13-8 interpolated ones

3.4 Skipping the measured OT "MM" and interpolating it instead

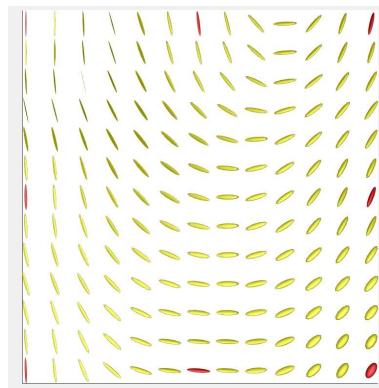


Figure 32: Interpolation results for the 400x400 mm² plate with 8 measured OTs (red) and 13*13-8 interpolated ones

MM is interpolated quite well as it has 8 measured OTs around it! MR only has 5 direct measured "neighbors"!

3.5 Interpolation result for fourth-order orientation tensor (still work in progress)

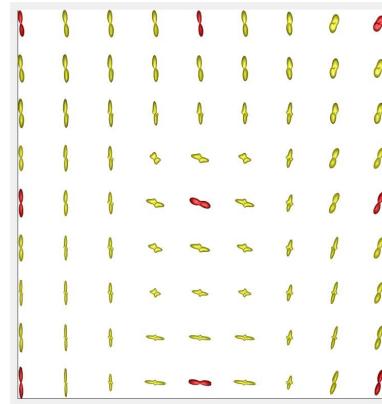


Figure 33: Interpolation results for the 400x400 mm² plate with 9 measured OTs of fourth order (red) and 9*9-9 interpolated ones