

INSTRUCTIONS FOR CREATING DIC PATTERN FOR PRINTING

This file contains instructions on how to prepare an A4 file containing an optimized DIC pattern for printing at the University of Southampton Print Centre. We will be using Photoshop to scale the original file to different speckle sizes. Photoshop commands will be presented in bold.

First decide on needed resolution of printer, there are 4 options (refer to the report produced by Yves):

- High: 1058 x 902 DPI (Pix size of $\sim 28\mu m$)
- Fine Art: 446 x 601 DPI
- Quality: 446 x 451 DPI (Pix size of $\sim 57\mu m$)
- Express production: 446 x 301 DPI

The choice is between Quality and High due to the aspect ratio of nearly 1:1. For very small speckles High is desired (probably $< 100\mu m$ across), otherwise use Quality as the printing is faster.

Open the original speckle pattern in Photoshop (pattern_20x10_res300_original.tif) and set the resolutions of the file according to the chosen printer resolution (smaller of the two resolutions) (**Image->Image Size->Resolution**).

At this point you can zoom in to your pattern and look at the number of pixels across a speckle to estimate size of the speckle – e.g. when you use 451 DPI in Photoshop and see 5 pixels across the speckle, the size of the speckle will be approximately $285\mu m$. At this point you should decide how much you need to inflate/compress the image to meet the desired speckle size based on the magnification of your DIC setup.

In order to compress the original image (decrease the number of pixels across the speckle), enter crop mode (**Press C**), from the list in top menu originally displaying **1 x 1 (Square)** select **Size & Resolution**. Select the largest possible rectangle from your pattern e.g. in case of pattern_20x10_res_300.tif use 9 cm x 9 cm @ 451 DPI. Click the tick on the upper bar to accept the crop. Select the cropped image (**Ctrl+A**) and copy it (**Ctrl+C**).

Now create a new file (**File->New**). Select resolution as before (e.g. 451 DPI), color mode as **Grayscale (8 bit)** and the size of the canvas based on the desired compression factor. First estimate compression factor: if your original pattern had speckles of approximately $285\mu m$ and you desire $200\mu m$, the factor will be $200/285 \approx 0.70$. Now, take the size of the cropped pattern (e.g. 9 cm x 9 cm) and multiply it by the compression factor ($0.70 \times 9 = 6.32$ cm). Put this number to **Width** and **Height** fields, make sure you switch units to cm. This should work as well with inflation of the pattern, the factor will be >1 .

Paste the pattern to the new file (**Ctrl+v**). Zoom out and enter **Transform mode (Ctrl+T)**. Drag the outlier of the copies pattern to the outlier of new canvas and accept. Zoom in to estimate the size of the speckle again. In this example the speckle shrunk from approximate 5 pix across to 4.

IMPORTANT REMARK: The scaling of the pattern (as well as tweaking the resolution of the file) uses lots of interpolation which creates a bias in black/white balance by removing some of white for grey. The next step is to restore some of this balance. Once you are satisfied with the size of your speckle adjust the histogram (**Image->Adjustments->Levels or Ctrl+L**). Slide the middle marker to reduce the counts from greyish pixels created during the scaling process. Accept and change the type of document to bitmap (**Image->Mode->bitmap**, you can use diffuse dither or 50% threshold). If satisfied

with size of the speckles and the balance between white and black proceed to the next step. If either of those two is not correct, adjust either the compression factor, or the levels (you can remove last steps from History to go back to the original).

Now use this pattern to fill A4 shit. Select **Image->Define Pattern** and give it a name. Create a new file (**File->New**), select **Preset: International Paper** and set the desired resolution and color mode to bitmap. Fill the new A4 file with the pattern (**Edit->Fill or Shift+F5**). Select the pattern and save as pdf. In options select **Compression -> Do Not Downsample** and **Compression: None**. The file is ready to go. Make sure to specify resolution setting used (High or Quality) when down in the printing center.

Few final consideration: The printer has a limited accuracy and thus is more likely to put some extra black ink compared to the image displace in Photoshop. Mind that when tweaking the balance between black and white. This is probably important when your speckles are about 4-6 pixels across. For thicker lines, the printer seemed to do a good job.

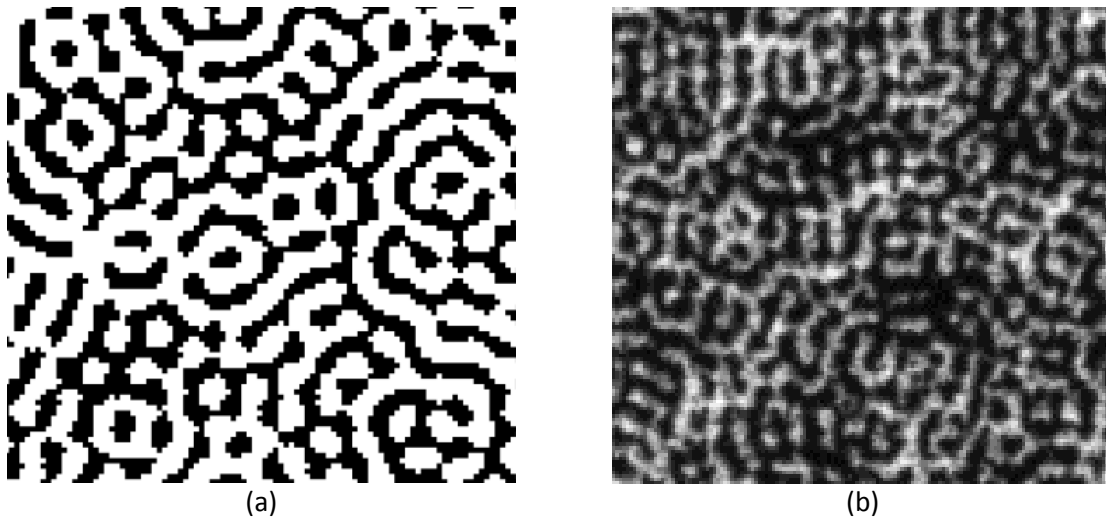


Fig. 1 Comparison of (a) generated pattern with (b) printed pattern. The printed pattern have speckles of about 65 microns across. At that scale and quality setting, black lines came out thicker than on the original file.