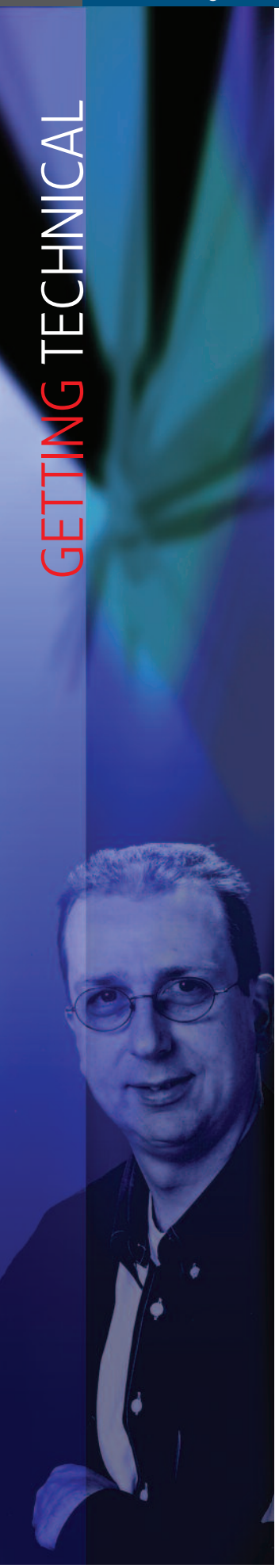
GETTING TECHNICAL



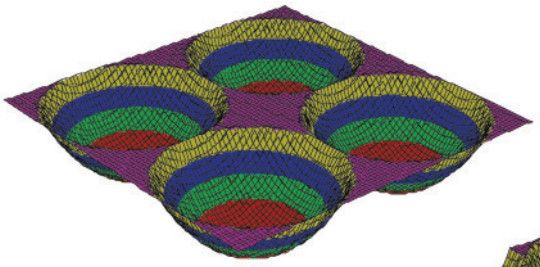
THE BEST SCREEN ROLL FOR YOUR PRINT PROCESS. HOW DO YOU SPECIFY IT?

MR STREEFLAND HAS WORKED IN THE CORRUGATED INDUSTRY SINCE 1992. DURING THIS TIME, HE HAS BEEN TECHNOLOGY DEVELOPMENT MANAGER FOR SCA PACKAGING AS WELL AS TECHNICAL MANAGER AT STORK SCREENS. HE STARTED TECHNOLOGY COACHING BVBA IN FEBRUARY 2005.

The financial markets have spread its crisis 'virus' across all industries. Yes, it's an economic 'winter', but soon spring will be here and business will pick-up. Now we have the time to rethink our production processes and get ready for the busy times ahead.

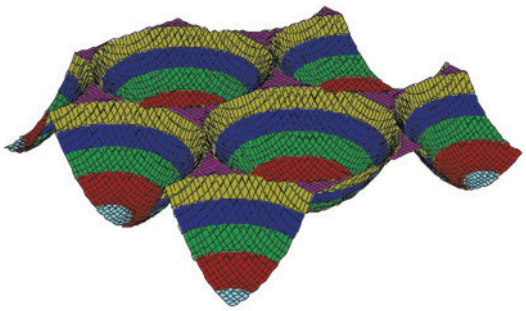
I have used these quiet times to look at some new ideas as well as projects I worked on in the past. One of these was the simulation of the surface engraved on a screen roll. Not finishing the project at the time was not due to the lack of knowledge, but the need for more computing power. I started on the simulation routine in 1995 during a trip to the USA. I was suffering jet-lag and decided to use the time developing a formula simulating the surface profile of a screen roll. I used a laptop which had good specifications for that time. It had a 486 processor with co-processor, Windows 3.11, a hard disk of 120mb and Excel 4 — not very exciting compared to what is available today! Entering the formula was not a problem, but for the laptop it was a bit too much having to compute a spreadsheet of 80 x 80 cells (6,400 cells). At the time, the file size was a challenge for the hard disk and Windows 3.11 extended memory was a bit small for this Excel spreadsheet size. I solved all these problems writing Excel macros in the complicated Excel macro language.

I was already over my jet-lag, but still working on the screen roll surface simulation, finally finishing a module for a square pattern screen and a hexagonal screen. These were the resulting images:



Square Pattern Screen

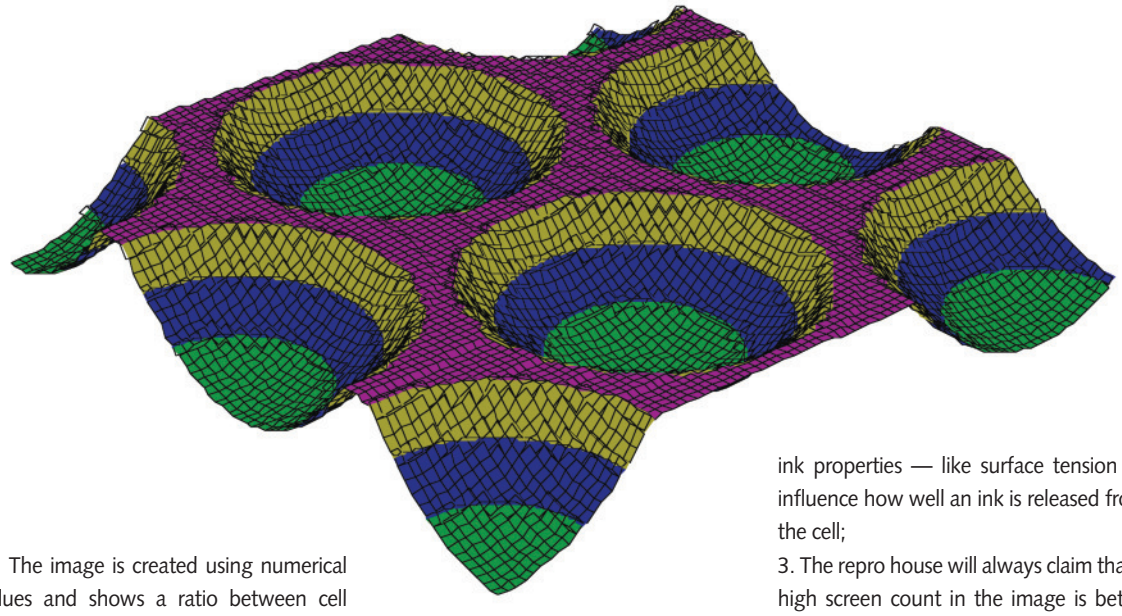
Hexagonal Pattern Screen



The images were used in presentations to show the difference between a square pattern, commonly referred to as a 45° angle screen roll and a hexagonal pattern, commonly referred to as a 60° angle screen roll. The main difference being that the hexagonal pattern allows about 20 per cent more cells on the surface of the screen roll than a square pattern.

A few weeks ago I found the spreadsheets on an old floppy disc and I decided to rework them. While doing so, I noticed that this could become a useful tool for helping customers choose the right screen roll specifications.

In the reworked spreadsheet, the number of cells was increased to 100,000 and the mathematical formula was adjusted in order to simulate the screen roll surface more accurately. The following image shows the result.



The image is created using numerical values and shows a ratio between cell depth and width. Using the numerical surface values allows calculating the actual values as a function of the screen count. The colours in the image help to show the surface profile. The depth values of the surface profile are calculated on every crossing of two lines in the image. In this image you can see the surface and the "wall thickness" between the cells.

There is more to specify on a screen roll, such as the total indicated run out or dynamic balance of the roll. In this article I will only focus on the engraving and thus the cell configuration.

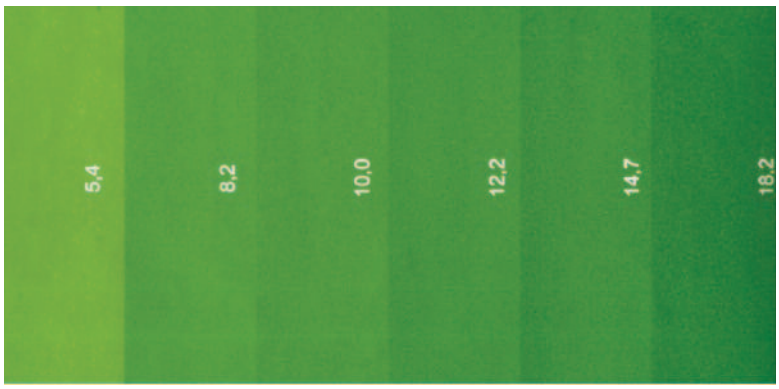
Who are your partners and what information do they need to provide?

The screen roll is probably the core of your printing process. It determines how much ink is ready for transfer to the printing plate. It 'prepares' the ink film that can be transferred. The actual ink film transferred from the screen roll depends on:

- The ink properties, mainly surface tension;
- The surface properties of the printing plate, surface energy;
- The cell shape of the screen roll.

We are able to simulate the cell shape only. Talking to your suppliers gives you many suggestions but you probably are left none the wiser! So who are the partners that need to provide you information so you can select the right screen roll surface profile?

1. Your substrate supplier should give you a value for the minimum ink film the substrate needs to be printed with to give a good surface coverage. Possibly they don't know, so you might need to do a test with a banded screen roll to find out what it is. The print will look like this:



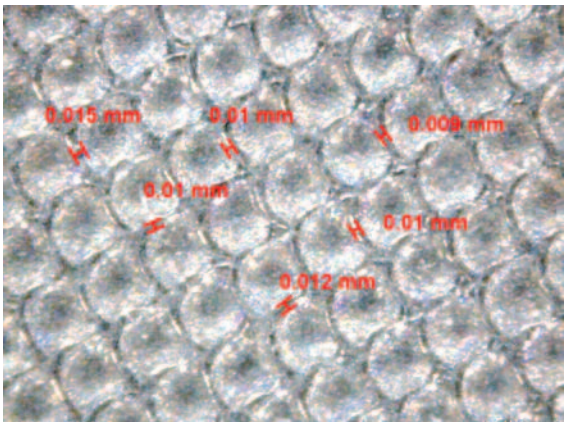
Remember that brand owners are particularly focusing on a perfect printed full tone area. You might find that changing screen rolls on your machine is not always easy. It is wise to set the ink film thickness to at least a level that a full tone area is printed on 95 per cent of the substrate volume, problem free;

2. Your ink supplier needs to provide you with a specification for the cell width to depth ratio. It is important that the cell on the surface of the screen roll has a shape able to release the ink. Narrow deep cells will have problems releasing the ink compared with wide, shallow cells. The ink properties — like surface tension — influence how well an ink is released from the cell;

3. The repro house will always claim that a high screen count in the image is better and claim that your screen roll needs a 4 times higher screen count. Remember it is the observation distance to the image you are viewing that determines what screen count is best. Images viewed closely need a high screen count so fine details can be reproduced (eg. magazines) but it will result in a low contrast in the image. Images viewed from a farther distance (eg. products on the shelf in a shop) need contrast to attract the customers attention and mostly can achieve this with a lower resolution in the image. The human eye can't see fine details at a long distance;

4. Your screen roll manufacturer needs to tell you what the smallest cell wall width is that can be engraved. Not everything is possible. If he engraves a 500 lines/cm screen on the roll, then the space to engrave one cell is 20 µm. If the minimum cell wall he can reliably reproduce is 10µm then only 10 µm is left for the cell. This is

not much. The following image shows a 120 L/cm screen and the cell wall width is measured in the image:



The cell width is around 0.010 mm which is equal to 10µm.

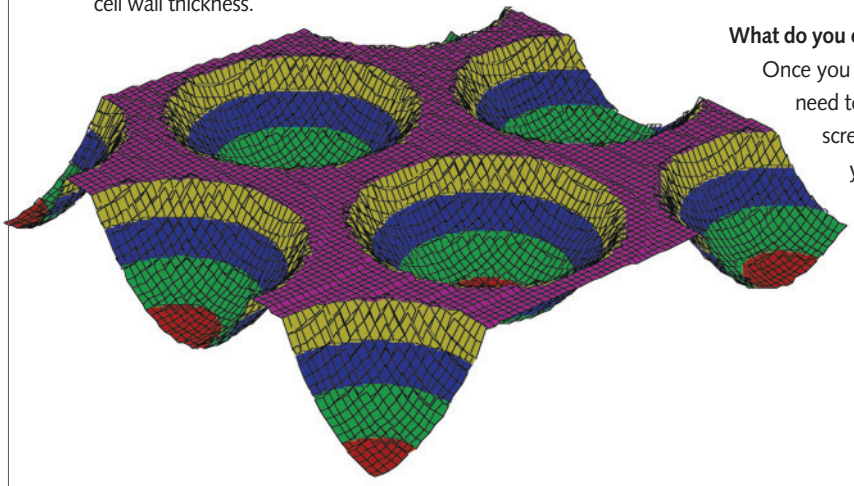
Simulating the screen roll specification using a cell surface simulation

Let us now show how a simulation works. Assume the following feed back from your suppliers:

- The Repro house claims you need (for your jobs) a 120 L/cm (305 L/inch) screen;
- The substrate supplier and ink supplier agree the need to use a screen roll ink film thickness of 11 µm (5.9 BCM/inch²);
- The ink supplier advises a cell width to depth ratio of 1:2.5. This to be sure the ink is released from the cells and the cells can be cleaned;
- The screen roll manufacturer claims that the minimum cell wall thicknesses he can engrave is 10 µm (0.0039 inch);

The values are entered into the simulation and the programme is started. During the simulation process, the algorithm optimises the relation between cell depth, width, the wall thickness between the cells and the screen count. The change in the ratios can be seen in the changing image.

Note that the image is showing a calculated screen roll surface and not a close-up photo of a screen roll surface. The algorithm uses the same numerical values used to make the image to calculate the potential ink film thickness available on the surface of the screen roll, the cell width depth ratio and the cell wall thickness.



The image shows the last graph of the simulation when the algorithm has found the optimum cell ratios for a screen count, giving the requested potential ink film thickness.

The simulation had to reduce the screen count from 120 L/cm to 110 L/cm in order to meet the other specifications. You will be able to view a video of the simulation when you go to www.tcbvba.be and click on "Screen Roll Selection Support!"

Understanding the result of the screen roll surface simulation

The result shows that it might not be possible to meet all target specifications, with a screen count of 120 L/cm (305 L/inch). The screen count has been reduced to 110 L/CM (279 L/Inch) to meet the other target specifications.

You might want to rethink the target specifications. What can you do if the screen count has to be 120 L/cm?

- Reduce the ink film thickness? This might result in not having a good full tone print or the need for upgrading substrate specification. You might not have the option to change the screen roll in your machine for every job so you need to have rolls in the machine that fit for the majority of substrates you print on;
- Reducing the cell wall thickness? It might not be possible to be engraved by the screen roll supplier. We showed in the image that a cell wall thickness 10 µm is a realistic value;
- Reduce the cell width to depth ratio? This might result in ink release problems and can quickly cause clogging of the cells in the screen roll, meaning no ink is transferred from the screen roll to the printing plate. This is certainly not what you want!

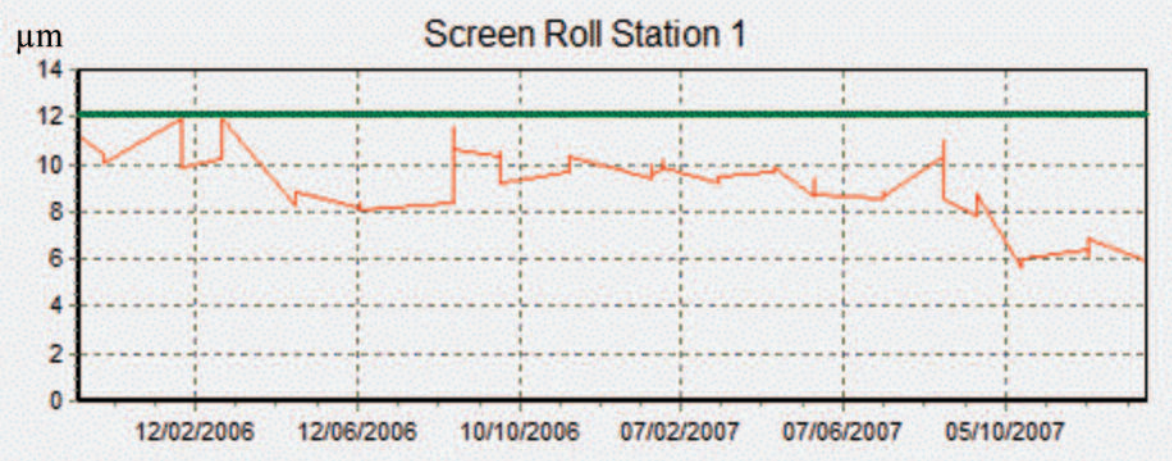
It might be better to reduce the screen roll screen count in order to have a reliable process and print a consistent colour, instead of being able to print very high screen count halftone images. Set yourself a target related to how you want to earn money with your machine. Quality is, after all, what your customer wants. The brand owners want a constant colour.

Remember that any thing specified has to be practical. However exciting a 500 lines/cm screen count on a screen roll sounds, to me it is likely it transfers very little ink. The question is, does a substrate exist that can be printed with the ink film thickness transferred from a 500 lines/cm engraved screen on a screen roll.

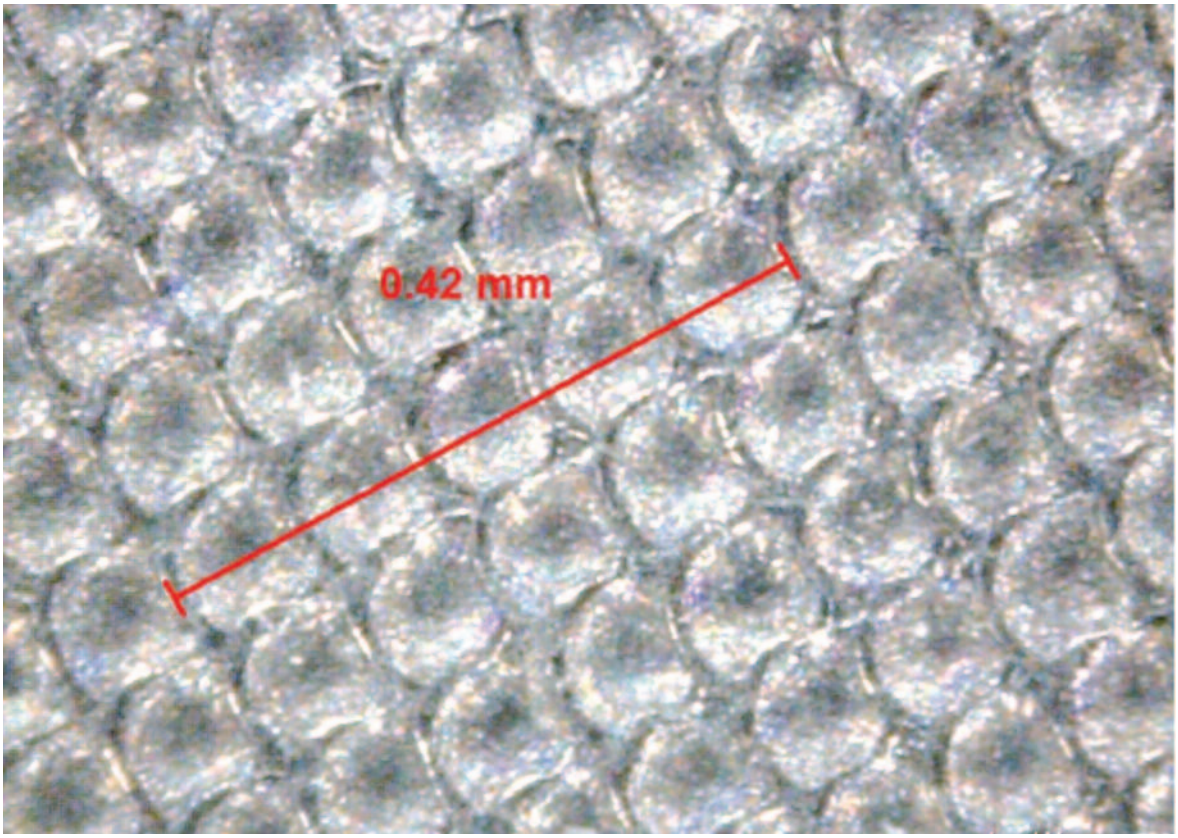
What do you check when the screen roll is ready

Once you have agreed specifications, all parties involved need to commit to what they have agreed. Next, the screen roll supplier will engrave the rolls and then you have to check if the result is what you specified. In terms of the surface engraving you need to check:

- The potential ink film thickness on the surface of the screen roll. You can do this by using IFT Analyzer. It allows you to monitor the ink film thickness over time, as the following graph shows.



- The cell wall width as shown in the earlier image using the USB Print Microscope with 500 times magnification;
- The screen count using the USB Print Microscope with 500 times magnification as shown in the next image. In this image the distance over 5 cells is 0.42 mm resulting in a screen count of 118 lines/cm;



- Measuring the cell depth is more complicated — you need a microscope that allows you to focus on the surface of the cell walls and the bottom of the cells. The difference between the two focal distance values is the value for the cell depth. Screen roll suppliers have this type of microscope. You can check the cell depth at the screen roll supplier before the roll is shipped to you.

Recommendation

Simulate your roll specification before you order them. It might avoid disappointment in the performance of your rolls. Because it takes time to change rolls on your machine you should choose a specification that satisfies 95 per cent of the substrates you have to print on. Cleaning a clogged screen roll with heavy detergents due to the wrong specifications is not really the best for the environment and it costs money and time. So choose a cell shape that releases the ink.

Regular cleaning of your screen rolls is essential in order to keep your screen roll ink film thickness constant. You need this in order to print a consistent colour over time.

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