Software compensation of print defect



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Factors effecting print quality









Software compensation stages

Reshaping the Electronics Industry*





Screeners types



- Error Diffusion (ED) and Ordered Dither (OD) Screeners
- Comparison is difficult without controlled viewing conditions
- ED shows slightly less grain in skin tones and better fine detail
- Differences become smaller at higher resolution
- OD significantly faster to compute than ED



Error Diffusion

Ordered Dither



Frequency Amplitude Modulated Modulated (Floyd Steinberg)



Screener effects

- Ultra-fast binary and greyscale screeners are crucial to achieving the best image reproduction for the type of image being printed
- Allow the best image quality conversion of contone images to produce smooth grey-level transitions while maintaining sharp line detail
- Once the screener type has been selected, the screener is optimized to achieve a smooth contone to greylevel mapping, full greyscale dynamic range and ink limiting







With anti-aliasing









Screener grey level optimisation



- RIP technologies
 often allow the user to specify the
 locations where grey levels overlap
 and how they overlap
- This can improve image quality especially on systems where the ink can have a gloss finish as it avoids areas of density where only a single drop size is used
- This technique is only applicable to systems printing with multiple grey levels





Grey level drop optimisation



- A key starting point for maximizing image quality is to chose your drop sizes carefully
- The smallest drop will often dictate the perceived graininess of the image
- Try to 'spread out' the grey levels over the contone range by selecting the appropriate printhead, ink and waveform



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Colour channel linearisation



- This is achieved by printing individual channel linearization test charts, measuring the printed charts with a densitometer resulting in the linearization correction such as CGATS
- Each print mode will need its own
 linearization and colour profile









Colour channel linearisation



- Incorrect colour channel density linearization means the input colour value for a single colour does not match the output colour value comparatively to other colours
- Results in non-linear response and incorrect colour
- Process black (=C+Y+M+K) shows colour shift





Nozzle density compensation











Nozzle Density Compensation

Nozzle Density Compensation adjusts every pixel in the original image with the aim of producing the same output print density for the same input density of the original image for every nozzle.

The application of the GIS Printhead Profiler image correction software can be tightly integrated with the screener software to achieve the fastest correction possible and maintain the highest possible performance of the datapath from original image file to printed output.



Nozzle density compensation

Correcting for print density can be done through software



Print Density Analysis

- · GIS has a suite of tools for creating a density pattern
- Once a test pattern has been printed and scanned users can import scanned images, analyze them and generate a correction file
- For in-line compensation, a line scanner and fully automated workflow is also supported



Correcting Density

- Using a compensation file, GIS software can compensate all print data on the fly to minimize the density variations
- · Users can specify compensation methods, linearization curves and more
- Compensation is normally done during screening to maximize print quality although it is also possible to density correct screened data
- Density compensation is available Fully Integrated or Standalone for use with 3rd party software

Test pattern



Scan Results Window



Original Data

Corrected Data



















Print output enhancement





Able to correct density mismatches **per printhead**, **per bank of nozzles and per nozzle**







Colour management



- Poor colour management results in the printed colour output not matching the desired colours of the original image
- This is the result of poor mapping of continuous colour tones into process colours and poor colour "mixing"
- Resolve by implementing a colour mapping process to produce a colour mapping profile (ICC)





Missing nozzle compensation

Missing Nozzle Compensation

Missing Nozzle Compensation reduces the visibility of missing nozzles. It is tightly integrated with the screeners to maintain optimal performance. In an ideal world all printhead nozzles would be perfect; however, due the size and number within a printhead this is often not the case. Misalignment of or even blocked or damaged nozzles can be masked by software, thereby removing the tell-tale faint lines or missing lines in the final printed image.

Missing Nozzle Compensation allows for neighbouring nozzles to be adjusted to compensate for those issues, thus significantly reducing the visibility of these artifacts and giving the impression that all nozzles are active.











Missing nozzle compensation

Isolated nozzles work best

- Clusters of missing nozzles much more difficult to hide
- Technology works best where there is some substrate bleed/drop overlap

Many different strategies exist using neighbouring nozzles

- Correction in contone or screened data
 - GIS believes best results achieved with contone correction
- Hide error in same colour plane to neighbouring nozzles
- Hide error in other inks in multi-ink backgrounds
 - If Cyan nozzle fails could add a little black to hide white space
 - If Black fails use composite (CMY) black

Works best in mid & light mid tones

• Also improves dark tones

Helps disguise/makes the missing nozzle less visible

• Less white space









Software compensation stages

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Summary

- System stability and repeatability is key
- Selection of screener and configuration has a significant impact on overall print quality
- Channel (Colour Channel) linearisation is critical to ensuring an overall even response from all colours and being able to achieve good colour reproduction
- Printhead are rarely equal and nozzle-to-nozzle variation is common, hence nozzle-to-nozzle and printhead-to-printhead compensation is likely to be needed to achieve good print quality
- Colour profiling should be completed after screener, linearisation and density correction have been calculated and applied
- Missing nozzle correction can in most instance significantly reduce the visual appearance of missing nozzles

THANK YOU!





