The Importance of Software in Managing and Maintaining Image Quality

Simon Edwards
Product Manager
DFE
Atlas User Interface

Machine Control
Atlas Server

Print Controllers
Drive Electronics

IDS
Ink Systems
**Comprehensive Software Platform**
- Software for end users, machine development, commissioning and support
- Single platform to cover many products
- Supports scanning, single pass, direct-to-shape and custom applications

**Print Systems Integration**
- Datapath / electronics
- RIP & Workflow (PDF-VT, JDF, variable data)
- Ink delivery / cleaning systems
- Vision, monitoring, verification
- Automation, motion, transport
- PLCs, heaters, dryers, UV curing

**Quick Route to Market**
- Rapidly develop user interfaces using production-ready components
- Enhance, restrict and customise components for your application
- Compatible with existing software / system platforms

**SDK Module Licencing**
- Fully customisable interface – including fonts, icons, colours and branding
- Easy-to-implement language localisation
- Complete GUI control with the ability to create tools
- Integrate with third-party software
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Nothing is perfect and digital printing is no exception

Intelligent image management
• Colour correction
• Linearization
• Nozzle density correction
• Nozzle out compensation
• Printhead stitch correction
• Ink flow correction
• Geometry correction

Closed loop vs low latency
• How quickly does correction need to be made?
Real-time workflows
Mime entry points
Colour management
Screening and nozzle correction
Print queue to hardware
Achieving Flat Colours

• **Inkjet systems need to:**
  – Stitch printheads without visible joins
  – Print large areas of solids/flat colours

• **Drop volumes not always consistent across printhead**
  – More apparent the more heads you have in an array
  – “Non-linearity” in drop volume
  – Even small difference can affect final print – particularly areas of solid colour
  – We want uniformity - flat colours

• **Lots of reasons this can happen:-**
  – Printhead manufacturing issue - drop ejection may not be consistent
  – Temperature variation in ink system - affects ink viscosity
  – Piezo activity - heavy use of some sections of printhead creates warm areas
  – Electronics - uncalibrated/low quality electronics may affect drop volume
Printhead Density Correction

- **Electronic/printhead solutions**
  - Depending on printhead technology
    - Trim each nozzle/cluster of nozzles/nozzle bank
      - Trimming can introduce drop alignment problems
        » (Tuning for volume will modify velocity)

- **Image correction – offers greatest capability**
  - RIP’ed data (contone or screened) can be manipulated to:
    - Reduce the number of drops in given area, or
    - Reduce the size or value of the greyscale drop in a given area
Digital Printhead Linearization
(via image correction)
Hard Stitching - Masking

- **Masking (Hard Stitching)**
  - Nozzle on/nozzle off
  - Wide variety of options

- **Stitches can massively improve output quality & different applications benefit from different strategies**
Soft Stitching - Greyscale

- Greyscale stitching makes full use of the greyscale capabilities of the head
  - Slowly reduces the density of the image printed by one printhead while increasing the density printed by the next printhead
- Only adds value over masking in areas where the density of the image is greater than the smallest drop size
Missing Nozzles

• **Nozzle sizes are getting smaller**
  – More easily blocked or deflected

• **Large print bar arrays**
  – Many more nozzles
  – Higher probability of issues and lower MTBF
  – Need coping strategies

• **Strategy 1 : Double Up - Redundancy**
  – Add second row of printheads per colour so when one nozzle fails another can be used
    • Expensive

• **Strategy 2 : Hide the problem**
  – Identify where a nozzle is faulty and spread the jetting responsibility to neighbouring nozzles and/or colours
Nozzle Out Compensation

- **Isolated nozzles work best**
  - Clusters of 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

- **Works best in mid & light mid tones**
  - Also improves dark tones

- **Helps disguise/makes the missing nozzle less visible**
  - Less white space

- **Numerous patents exist**
Nozzle Out Compensation

4 Level CMYK
Magenta nozzle out on line 511

Uncorrected

Single Channel Corrected
Ink Flow Compensation
Challenges of Finishing

- **Key challenge is alignment & registration with pre-printed substrate**
  - Pieces/sheets or in-line web

- **Many different possible distortions (image and/or media) – can be solved by:**
  - Mechanical
  - Vision systems + software

Translating (X & Y):
- Product detect (X translation)
- Feeders or software offset (Y translation)

Rotating:
- Feeders
- Vision system + fiducials + software
Challenges of Finishing

- Vision system + fiducials + software
- Encoder + product detect

Trapezoid / Skew

- Vision system + fiducials + software

Stretch and Compression (X & Y)

- Vision system + fiducials + software
- Encoder + product detect

GIS Correction Map For Finishing Layer (inverse of error)
Mesh based correction accurately places finishing data in the desired location. Handles all translation, rotation, stretch, compression and skew as well as localized distortion correction

- General software conversion approach
- If you can measure the error – it can be corrected
Tubes, Cones & Tubs

- **Tubes** – well established/well understood technology
- **Cones or conical/tapered shapes**
- **Software correction required?**
  - Typically no, for small area coverage
  - Yes, for significant or full wrapping
    - Corrects nozzle alignment
    - Provides density correction
    - Ensures no dot gain issues
    - Ensures no screening artefacts
- **Tubs**
  - Required corrections change during the print
    - Often from pixel to pixel
    - Multi-dimensional nozzle, density and screener correction technology can be adjusted to each surface type and associated application process
Thank you – Any Questions?

Simon Edwards, Product Manager
simon.Edwards@globalinkjetsystems.com

Global Inkjet Systems Limited
Edinburgh House
St John’s Innovation Park
Cowley Road
Cambridge CB4 0DS

Tel: +44 (0)1223 733 733
Web: www.globalinkjetsystems.com

Technical support offices in UK, Japan and China