Print Quality Requirements of Industrial Inkjet Applications

産業用インクジェットアプリケーションの印刷品質要件

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GIS Introduction  GISの紹介

Complete image management from pixel to drop

GIS customers - system builders, OEMs, integrators, fluid developers worldwide in many different applications and markets
Presentation Agenda

Applications and Print Quality
- Key print quality issues and market demands

Challenges of Achieving Print Quality
- Key trends and requirements for inkjet systems
- Focus on software solutions

GIS Eco-System
- GIS technology & solutions
Applications & Print Quality Requirements

アプリケーションの印刷品質要件
How Difficult Can It Be? どれほど難しいのか？
Quality Issues…(Just a Few Examples)

- Jetting errors  吐出エラー
- Image artefacts
- Poor edge definition
- Grainy images  粗いイメージとなる
- Density shift  密度のシフト(バンディングなど)
- Nozzle drop outs  ノズルからインクがでない
- Poor registration  印刷位置合わせ
- Texture/unevenness in areas of solid colour
- Colour not stable  色安定性
- Colour bleed  滲み
- Ink supply issues  インク供給
- Lack of thermal control  温度制御
- Reticulation  網目
Factors Effecting Print Quality

Inkjet printing systems have interacting & co-dependent parts

As inkjet enters more demanding applications – print quality requirements increase
• Growth in demand for:-
  • Colour consistency
  • Solid flat colours
  • Stitching strategies
  • Missing nozzle compensation
  • Very high data rates
    • High resolution / high speed
    • Demand for 1200dpi
  • Closed loop workflows
  • Rotation / skew correction
  • Ink flow compensation
  • Image compensation for printing onto containers (bottles, cones, tubs)
Other (Materials Deposition) 材料膜形成

- **Key requirements**
  - Uniform layers / coatings
  - Printhead density correction
  - Stitching strategies
  - Missing nozzle compensation
  - Verification – closed loop workflows
  - Image compensation for complex shapes – ink jet & robotics for injection molded parts
# Different Applications - Same Challenges

<table>
<thead>
<tr>
<th>Graphics</th>
<th>Need to achieve:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide format Textiles Packaging Labels Ceramics Glass Laminates Varnish</td>
<td>Flat colours Uniform coatings Invisible stitch zones Colour consistency Colour accuracy Edge definition Accurate drop placement Registration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials Deposition</th>
<th>Need to correct:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional coatings Encapsulation layers Conductive tracks Colour filters</td>
<td>Uneven printhead density Acceleration / deceleration issues Missing nozzles Rotation / skew Banding</td>
</tr>
</tbody>
</table>
Challenges of Achieving Print Quality

印刷品質達成への挑戦
Factors Effecting Print Quality 影響するファクター

Simple summary – reality is much more complex
現実ははるかに複雑です
Factors Effecting Print Quality

- Surface Energy
- White point
- Rigidity
- Resolution
- Compression
- Source Image
- Printing Quality
- Encoder
- Resolution
- Compression
- Gamut
- Dissolved Gas
- Ink Temp
- Ink System
- Flow Rate
- Meniscus Pressure
- Ink Temp
- Dissolved Gas
- Ink System
- Flow Rate
- Meniscus Pressure
- Source Image
- Print Quality
- Encoder
- Resolution
- Jitter
- Position
- Gamut
- Ink Temp
- Ink System
- Meniscus Pressure
- Process
- Pre & Post Treatment
- Multipass
- Resolution
- Stitching
- Media Control
- Static Build-up
- Alignment & Rotation
- Jet Straightness
- Height
- Waveform
- Mechanical
- Substrate
- Linearisation
- Colour Management
- Screening
- Ink Limiting
- Grey Level Mappings
- Feedback Correction Vision systems
- Software
- Print Quality
- Encoder
- Process
- Mechanical
- Printhead
- White point
Achieving Print Quality 印刷品質の達成

All factors affecting print quality can be summarised in three key issues

This presentation we will focus on Software
Software can compensate for many system imperfections
ソフトウェアにより多くのシステム欠陥を補うことができます

PRINT QUALITY ISSUES

SOFTWARE CORRECTION TECHNOLOGIES

Here are some examples....
Software Correction – Example

Rotation/ Skew / Stretch Correction

- Varnish
  - Roll to roll
    - Alignment to labels
  - Cut Sheet
    - Alignment to preprint
- Industrial components
  - Alignment to objects on a conveyor

Trapezoid / Skew

Rotation

Stretch and Compression (X & Y)
Software Correction – Example  ソフト補正例

Rotation Correction for Spot Varnish – Real Time  リアルタイム補正

Job Store Entry
PDF → PDF MIME Handler → PDF RIP → Camera Driver → Rotation → Screener → Image Print → Print Queue

Rotation Detection
Printhead Array
Software Correction - Example

Printhead Density Correction – for Flat Colours / Uniform Coatings

- **Aim** is to achieve even density across a full printhead array for each grey level.

- **Offline solution**: Print greyscale test pattern for each colour channel and measure the density across the printhead array at a range of grey levels.

- **Inline solution**: closed loop with line scanner.

- Adjust the grey level mapping at intervals across the printhead array.
• Many factors contribute to achieving flat solid colours / uniform coatings
• Inkjet printing systems have interacting & co-dependent parts
• Suite of technology solutions needed
• **Multiple strategies required for optimal results**
Closed Loop Workflows

- Closed loop software technology can combine many software corrections tools to achieve consistent print quality
- Missing nozzle compensation, printhead density and colour shift correction – required for high end systems
- Requires very high data rate and processing capability

- TIFF
  - TIFF MIME Handler
  - Colour Management
  - Image Print
  - Missing Nozzle & Nozzle Density Screener
  - Dither Tables
  - Line Scanner Input

- PDF
  - PDF MIME Handler
  - PDF RIP
  - ICC / Device Link / Spectral
  - RIP Settings
  - Colour Correction Data
  - Missing Nozzle
  - Nozzle Density
  - Missing Nozzle & Density Data
  - Image Analysis

Datapath Electronics
Software Unlocks New Markets

Jetting Functional & Decorative Coatings on Industrial Parts

- Combined inkjet and robotics system control
- Unlocks new market opportunities in coating & decorating injection molded parts – automotive industry; industrial components
- Multiple software print quality tools enabled
- GIS Print Path Designer software

Please see GIS video at: https://vimeo.com/376156000/b2a720f1e5
Print Quality Summary 印刷品質

- Pressures on achieving & maintaining image quality will increase
- Advanced software capabilities and RIP technologies are key

Software compensation can significantly improve image performance for system inaccuracies and errors.

Inkjet systems have interacting & co-dependent parts. Multiple print quality strategies required for optimal results.

Some corrections can be carried out offline, others require real-time correction with closed loop systems.

Innovative software can unlock new applications & opportunities.
The GIS EcoSystem

GIS Atlas™ Software

- Atlas Print Quality Tools
  - Printhead Density Correction
  - Missing Nozzle Compensation
  - Stitching Strategies
  - Geometry Engine
    - Rotation /Skew Correction
- Closed loop systems
- Customisable User Interface
- Atlas Screeners
- Atlas Variable PDF RIP
- Atlas Print Path Designer
The GIS EcoSystem エコシステム

GIS Datapath Electronics

- Support printheads from Fujifilm Dimatix, Konica Minolta, Kyocera, Ricoh SII, Toshiba Tec & Xaar
  - Epson – in development
- Choice of USB or Ethernet platforms
- Modular scaleable architecture
- Continuous diagnostics & monitoring
- Robust / Production proven
The GIS EcoSystem  エコシステム

GIS Ink Delivery Systems

- Standalone product
  - Can be used with any datapath electronics
- Fully customizable
  - Family of header tank designs and sizes for different printheads
- All flow modes supported - including high pressure flow
GIS & Partnerships

GIS - Importance of Partnerships

- Long term relationships with customers
  - Strong customer retention: 10+ years with customers
  - Strong reputation for customer support

- Strategic Partnerships
  - jetXpert waveform development critical to many applications
  - GLOBAL GRAPHICS - PDF Engines; so customers have choice
  - Adobe

- New strategic partnerships will be announced in 2020

Meeting GIS

- Please visit our tabletop here at the OIJC for more information
- drupa 2020 in Hall 3
- Welcome to visit us in Cambridge, UK
We look forward to working with you!

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