Provide Integration Solutions for Digital Printing Applications

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Abstract

Given the rapid evolution in the world of digital industrial printing, where ink, printhead and printer manufacturers improve their competitiveness in terms of versatility and cost, it becomes relevant to enhance their know-how in several fields. The quality and the performance of an ink jet printer are not only related to the head assembly, but also to the interactions between the ink behavior in the head and the waveform signal applied to optimize the droplet and between the spreading and drying of this ink on the media. In this context, integrators play a major role between printhead manufacturers, ink providers and end-users, by studying in first place, the feasibility of the customers' needs, then by helping them to design and industrialize their system.

In this article, we will focus on the development of an ink jet integration solution, based on printhead modules, electronic boards and hydraulic parts to generate controlled droplets. Experimental visualizations of the dynamic behavior of the droplet cures under UV drying system are investigated. Thanks to these investigations and developments, an industrial equipment and application are presented.

Introduction

With increasing demands of industrial printing, the ink jet market is growing rapidly. The technology used for this industry is the Drop on Demand, whose main advantages are better resolutions and lower costs. However, many components such as printheads, inks and medias have to be chosen meticulously in order to constitute a printing system answering to customers' needs. This is the objective in this work and we want to show how an integrator of ink jet system and a mechanical manufacturer worked together to provide an industrial equipment.

In this paper, steps of realization of this project are presented as follows. The first one concerns a feasibility study on the future product, where visualization techniques are used to follow ink jet droplet behavior from its exit at the nozzle plate to its curing on the substrate. The second step consists in designing the printing system in cooperation with customers up to a final industrial application.

Ink - Head - Media Interactions

An experimental set-up,[1] based on visualization tools, droplet devices, and waveform generator is used for optimizing interactions between ink/head and ink/media. There is a need in identifying and rejecting heads or inks which may present printing problems. The required parameters for the printheads could be in drop sizes, for the inks in terms of optical density, color gamut, and uniformity and so on and the media in terms of drop impact, spreading, UV curing and absorption behavior. Critical issues in the print quality are the coalescence of ink on the print media and imperfections related to the manufacturing of printheads. The expected performance is to define the links between ink and print media. The experimental observations and analysis procedures have been designed to obtain qualitative and quantitative information on the ink behaviour.[2,3]

Therefore it is relevant to note the influence of the ejected temperature and the waveform on the drop formation, the size and the shape of the printed dot. In the case of UV curing, you have to take into account another parameter, the choice of the drying techniques, as the ink containing UV photo-initiators reacts to the UV spectrum and the power emitted by the UV lamp.[4]

Experiments realized in feasibility studies allow a better definition of the components of the ink jet integration system in an industrial application and so, allow performing the optimization of the quadruplet printhead/ink/media/lamp on the final printing quality.

Machine Development

Customer's Needs

Even if the digital printing technologies are numerous, only few of them allow answering to specific conditions defined by the printing industrialists' needs and integrator's councils. In fact, many of these technologies are made for high volume productions and smaller quantities are not profitable with these same techniques. However, ink jet technology is one the most reliable to solve the problem and an example is given in the following, by showing the different steps of this achievement.

In this project, our customer is a leader in manufacturing large format folding machines and trimmers. He wants to increase his range of products by developing his own industrial printing machine: a UV plotter. Therefore, he contacted Ardeje, an expert in the field of drop on demand ink jet technology, to contribute to this development.

The Ardeje Print Engine

Based on S-Class Spectra printheads, ARDEJE provides a system called "print engine" which can be integrated easily in a producing chain or single machine. This system is divided in three parts, as shown in the figure 1:

- first the electronics boards which drive four 128 nozzles piezoelectric heads in terms of fire pulse, and data,
- second a pneumatic and hydraulic circuit regulating the income of inks to the heads and the stabilization of the printing
- finally a specific power supply for the generation of high voltage pulses.

Furthermore, Ardeje has developed is own software which is the link between the plotter and the end user. This software controls all parameters for the printhead and the pneumatic circuit.

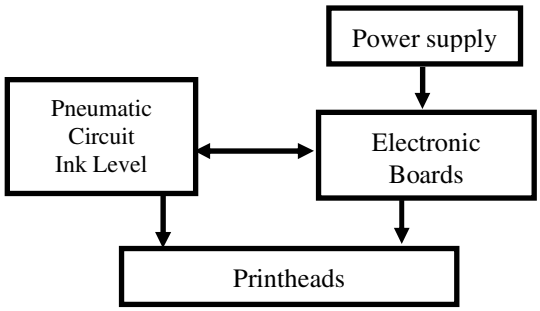

Figure 1. Representation of the print engine

Integration System

Ardeje has adapted this print engine on customer's mechanic, and designed an electronic daughter board which allow controlling all the mechanic parts of the machine: motors, UV lamps, sensors and tachymeter. During the first step of the project, Ardeje was in charge of the optimization of the ink jet system thanks to experiments in laboratory. Then Ardeje worked on the increasing the printing quality and the productivity of the machine.

Industrial Application

Therefore a prototype based on multi heads for multi colors is designed to realize numerous validations tests on each components of the system in order to optimize the better as possible the industrialization part.

In that way, a machine, represented on figure 2, is finalized to be able to print on flexible or rigid substrates up to 50 mm, using UV curing inks. Eight printheads may be embedded to obtain the best results, in CYMK colors. The best productivity is up to 25sqm/h and maximum resolution is up to 400 x 400 dpi. This UV plotter is designed in three print widths, 180, 250 and 320 cm.

Figure 2. Neolt UV plotter powered by Ardeje

Conclusion

In this work, it is presented a description of the achievement of a digital printing system thanks to a common wish, between a manufacturer and R&D team to develop a new product. This UV plotter corresponds to the expectations defined by Neolt customers and allows finding a way in a competitive market.

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Biographies

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