to the need for trading priorities among different profiles while keeping all actuators within constraints. Multivariable CD control scheme has weighting factors that allow users to make their trade-off among different profiles. In practice, not all profiles and all actuators are always needed in a single multivariable control configuration. Depending on different process conditions, a subset of the full multivariable control may be more appropriate. The multivariable CD control is also flexible enough to accommodate this requirement.

**System architecture**

To make the implementation of multivariable CD control seamlessly integrated with modern control architecture [16], open communication standards such as OPC and TCP/IP are fully utilised. Fig. 3 illustrates the network layout of ABB’s Multivariable CD control. The multivariable CD control resides in an OPC server called Advanced Multivariable Control Server (AMCS). AMCS communicates via the standard Ethernet to various OPC servers for obtaining paper machine data such as frame information, measured profiles, actuator control modes and feedbacks, machine speed, grade data, etc. After the multivariable CD control derives desired control actions, it sends setpoint outputs to the various actuator systems via OPC. This architecture allows the multivariable CD control to be integrated with many existing QCS. AMCS can be installed on nearly any paper quality control system that supports standard OPC communication.

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results and the flexibility to make clear trade-offs. There are also a number of displays that specifically designed for engineers to setup and configure a multivariable CD controller.

**Application examples**

**Example 1:** Weight and moisture control on a dual-headbox liner-board machine

A linerboard machine is frequently equipped with two or more headboxes. Each headbox has a set of slice screws for controlling both weight and moisture profiles. On the same machine there might also be other CD actuators such as a steambox and a water spray. Fig. 4 illustrates an example of such a machine that has four sets of CD actuators. The slice screws from primary and secondary headboxes have been selected to control both the weight and the moisture profiles. The trade-off between weight and moisture allows the moisture profile to be more tightly controlled.

**Example 2:** Weight and twist profile control on a multi-headbox machine

On paper machines, it is well known that the slice opening shape influences weight and fiber orientation simultaneously. Fiber orientation determines the twist characteristics of a sheet. The example in Fig. 5 demonstrates that multivariable CD control can effectively control both weight and twist, which is derived from fiber orientation measurements. This example shows that multivariable CD control effectively utilises multiple headboxes to balance the control of multiple profiles so that the sheet properties are fully optimised.

**Example 3:** Gloss and caliper control on a supercalender

For a supercalender application it is very crucial to obtain uniformly high gloss on both sides of the sheet and maintain a specified caliper profile for good reel building. The following example in Fig. 6 shows that a multivariable CD control achieves the above goals with two induction CD actuators on a supercalender. The multivariable CD control is an indispensable tool to enhance supercalender applications.

**Summary**

The state of the art multivariable CD control described here has been applied to a variety of machines. The advanced control implementation and easy-to-use HSI has empowered papermakers to fully utilise the capability of their paper machines. Multivariable CD control flexibly coordinates multiple sets of CD actuators. The underlying control algorithm systematically makes the best utilisation of the control ranges of all actuators and controls sheet property profiles toward their targets. The application and the results of multivariable CD control have been well accepted by papermakers.

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**Turning quality data into integrated decision data**

Reverting to approved methods and solutions is regarded as stagnancy in the fast moving world of technology. Thus, further developments, innovation, and speed have to determine the appearance of a company. True to this philosophy, Parsytec presents new means of production process optimisation in coating machines. The cue in this context is made out to “automatic defect classification”.

Paper producers long to manufacture high quality products at reasonable costs. Hence, men and machines must work together and complement each other in order to reach this goal. Obviously, the solution most wanted comprises of innovations adapted specifically to customer needs. Those needs arise from discontent, which again may have various reasons. The most common are downtimes of the paper machine that cost great amounts of money and time. These standstills are often caused by web breaks or machine damage – both may find their origin in web defects.

**Looking in on web defects**

First of all, before defining the term “web inspection system”, the meaning of web defects has to be illustrated. Web defects are abnormalities that arise on the produced paper. Their origins may vary,