Web Guiding Terminology

Article

Different terms related to web guiding are discussed in this article.

Web Guiding

Web guiding is the process of regulating the cross machine position of the web while the web is transported over the rollers in roll-to-roll processing machinery. Other terms for web guiding include:

- Steering
- Tracking
- Edge/Line/Contrast Guiding
- Lateral Control
- Lateral Registration
- CD (Cross-machine Direction) Registration
- Lateral Alignment
- EPC (Edge Position Control)
- LPC (Line Position Control)

Web Guide

The device that is used to automatically control the lateral position of the web in a roll-to-roll or converting machine is called a web guide. The different terms used for a web guide include guider or web guiding system or simply a guide.

Web guide is a term that is used to describe the mechanism or the structure as well as the complete control system. A better term to refer to the complete system is a web guiding system. The web guiding system includes the following four essential components:

- Web guide mechanism
- Sensor
- Controller
- Actuator

Web Guide Mechanism

This is the mechanical structure that makes contact with the web and positions the web. The web guide mechanism typically translates and/or rotates to position the web. Some other terms for web guide mechanism include, web guide structure or web guide frame. As mentioned above, sometimes the web guide mechanism is referred to as a web guide for short. But this becomes often confusing.

Sensor

The web guiding system should include a sensor that measures the position of the web. This position measurement is used as the feedback for the web guiding system to guide/position the web to the desired location. Other terms used for the sensor include:

- Web edge sensor or edge sensor
- Web guide sensor
- Web position sensor

Controller

Controller is the intelligent part of the web guiding system that enables the automatic control. The controller acquires the web position feedback from the sensor, computes the desired corrective action and commands the actuator (connected to the web guide mechanism) to position the web guide mechanism in order to position the web at the desired location.

Actuator

Actuator, the muscle of the web guiding system, provides the force or thrust to move the web guide mechanism based on the controller command.

All web guides or web guiding systems have the four key components. Depending on the application each of the four components have different types of their own. This article will mainly focus on the different types of web guide mechanisms and their respective terminology. In subsequent articles we will discuss the different types of sensors, controllers and actuators and their respective terminology.

Intermediate Guide

Intermediate guide is a term used to refer to a web guide mechanism that is used in the interior part of a roll-to-roll or converting machinery. These guides are shifting the web that passes over them. Typically they are located right before a critical process such as printing, coating, lamination, slitting, etc. There are several types of intermediate web guides including:

- Offset pivot guide (OPG) a.k.a

    - Displacement guide
    - Positive displacement guide
    - Pivot frame
    - Table guide
- Remotely pivoted guide (RPG) a.k.a
    - Steering guide
    - Steering roll(er)
    - Swivel roll(er)
    - End pivoted guide
    - Center pivoted guide
    - Turnbar

In some cases passive web guides such as crown rollers, spreader rollers and even reel flange are used for guiding the web, This might work for some applications but not a good idea where web guiding is critical.

It is not uncommon to hear people loosely call a guide as a steering guide. Most often they are referring to a web guide, not necessarily the specific type of intermediate guide which is the remotely pivoted guide. Since the different types of intermediate guides have their advantages and disadvantages based on the application, it is necessary to understand the application before a certain type of intermediate web guide is used. The application depends on the locational constraints, guiding performance requirements, type of web used, etc. Please consult one of our experts if you have any questions.

Most intermediate web guides have one or more roller(s) over which the web is transported. The roller(s) is mounted on a movable top structure that is rotated or translated while a fixed bottom structure is mounted rigidly to the machine frame. The web guide mechanism positions the web as it rotates and/or translates.

Terminal Guide

Terminal guides are located at the entry and exist of roll-to-roll machines and they move the entire roll of web. When the roll of web is fed into a machine or when the roll is wound back into roll, the whole roll will be moved so that the web is fed at the right location and wounded at the right location. Terminal guides have several terms such as:

- Shifting stand
- Shifting base
- Shifting sidelay
- Roll positioning stand
- Unwind guide

- Rewind guide

It has to be noted that these terminal guide are moving the entire roll of web on the unwind or rewind stand. Typically these guides have a movable stand on linear bearings that is positioning the entire unwind or rewind roll at the desired location.

It is common for users to call a web guide as an unwind guide or a rewind guide, just based on where they are located. In fact they may be referring to intermediate web guides that are located at the unwind or rewind section and not necessarily a terminal guide that is moving the entire roll on a stand. Hence it is necessary to understand the terms and use them appropriately, since the two types of web guides function different.

Lateral Web Dynamics

The physics or dynamics that governs the cross-machine direction behavior of the web as it is transported over the rollers is called the lateral web dynamics. This web behavior is affected by several parameters such as, the type of web guide mechanism, the installation of the web guide mechanism, web speed, web tension, web thickness, web width, web stiffness or Young's modulus of the web.

Entry Span

The web span just preceding the entry roller (or the guide roller if the web guide mechanism has only one roller) of a web guide mechanism is called the entry span. For intermediate web guides the entry span play an important role since the span could affect the lateral web dynamics.

Exit Span

The span just succeeding the exit roller (or the guide roller) of a web guide mechanism is called the exit span. Exit span also plays an important role for intermediate web guides since they could affect the lateral web dynamics.

Guide Span

When a web guide mechanism has more than one roller, the span within the web guide mechanism is called as the guide span. For some intermediate web guides, the length of the guide span is a design parameter that is influenced by the application.

Edge Guiding

When the edge position of the web is used for guiding it is called edge guiding. For a variety of applications edge guiding may be sufficient especially if the roll-to-roll machine is designed to convert a constant width web all the time. Typically a web edge sensor is located in the downstream span of a web guide (except with

a rewind guide). Typically the web edge is sensed in the free span and not on a roller. Several types of edge sensors based on different sensing principles are available in the market. These include pneumatic web edge sensors, ultrasonic web edge sensors, infrared web edge sensors, optical web edge sensors, camera based web edge sensors and fiber optic web edge sensors. The different sensor technologies have their advantages and disadvantages.

Center Guiding

When webs with different widths are processed within a single converting machine, it is often common to have the processes centered with respect to the machine. In those scenarios the web would also need to be guided to the middle of the machine irrespective of its width. This can be achieved by guiding the centerline position of the web, instead of one edge of the web; this is called center guiding. Center guiding can be achieved by measuring the position of both edges of the web using one or more sensors. The average position of the two edges would correspond to the center line position of the web. This measurement is used as feedback by the web guiding system to position the web appropriately.

Line Guiding

Mostly in printing and subsequent converting applications, it may be necessary to guide the web based on the position of a printed line instead of the edge (or the centerline position of the web). This is because the printed pattern on the web may not always be at the same distance from the edge of the web on every roll. If in the subsequent process the web alignment with respect to the printed pattern is critical then it may not be appropriate to guide the web based on the edge position or the centerline web position. In line guiding applications, apart from the print pattern for the web, a line is typically printed close to the edge of the web which is subsequently used for guiding the web in a downstream locations.

Contrast Guiding

Similar to line guiding, contrast guiding involves guiding the web based on a contrasting feature on the web instead of the edge or the centerline position. The main difference between the line and contrast guiding is that a line is not explicitly printed just for guiding purpose; rather an existing repeated pattern or a contrasting feature on the web is used for guiding purpose. The feature may be edge of a print or edge of a coating or edge of a pattern such as a barcode.

Wrap Angle

When the web is threaded over a roller, the angle (in degrees) the web makes contact with the circumference of the roller is called the wrap angle. Wrap angle is an important aspect of web handling and web guiding, Wrap angle affects traction and thereby web guiding since without traction the web cannot be guided

properly.

Backup roller

When a contrast feature or a line on the web is used for guiding, it is typical to use camera based sensor or optical sensor to detect the contrast/line. When a contrast or line sensor is used, it is necessary to support the web to provide a stable image for the optical/camera sensor. A roller is used to support the web by wrapping the web around this roller. This support roller is called a backup roller. Typically the angle of wrap with the backup roller is small so that the roller does not significantly influence the lateral web dynamic due to that backup roller.

Plane Change or Web Pass Line Variation

When a web guide structure rotates or translates, the plane of the web in the span immediately downstream of the guide roller may change. The exit span may twist or bend the web which causes the plan to change. This plane change is also called the pass line variation. Depending on the magnitude of the rotation or translation, the plane may change significantly. Some sensors might be affected by the plane change or pass line variation.

Normal Entry Rule

Web approaching a roller will align itself perpendicular to the axis of rotation of the roller, this is called the normal entry rule. Most web guide mechanisms take advantage of this fundamental principle to position the web. Most intermediate web guides have a mechanism to enable the guide structure to rotate so that the axis of rotation of the guide roller(s) are changed thereby guiding the web.

Pivot Point

The web guide mechanism that rotates typically have a physical pivot point around which the mechanism rotates. Pivot point is typically present in intermediate web guides such as offset-pivot web guide (or displacement web guide) or end pivoted web guides.

Virtual Pivot or Instant Center

For certain web guide mechanism a physical pivot point may be absent. Virtual pivot point is the point around which the web guide mechanism rotates or the virtual center of rotation of the mechanism. Virtual pivot points are common with steering guides, center pivoted web guides and certain displacement or offset-pivot web guides. For steering web guides the virtual pivot point is also called as the instant center.

Turnbar Web Guides

Turn bar is a device that twists the web and changes the web path and the plane of the web, often about 90° with each twist. As the name suggests turn bars are fixed cylindrical bar and do not rotate. For certain application, turn bars are actuated to guide the web and such devices are called as turnbar web guides.

Plane of Motion

Plane of motion of the web guide is the plane in which the guide mechanism rotates or translates. For most web guiding system installation the plane of motion is not critical. However, for steering guides plane of motion is an important installation parameter. It is recommended that the exit span is at an angle of 90° for the best web guiding performance.

In the subsequent articles we will dive into more details about web guiding addressing several of the topics in much more rigor.