Using Press Nip Impulse to Improve Machine Efficiency

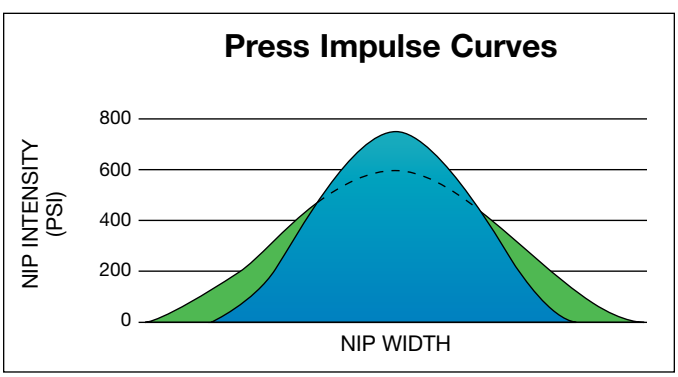
Embedded sensor technology allows papermakers to optimize nip impulse, thus maximizing moisture removal from the sheet and protecting sheet qualities, while sustaining performance of rolls and felts.

By Bob Carney

One of the main factors in improving machine efficiency is the ability to remove water from the sheet by controlling the nip impulse. The optimum nip impulse will maximize moisture removal, protect sheet qualities, and sustain performance of rolls and felts. The nip impulse is the area under the curve of the nip intensity and nip width.

The best way to monitor the nip impulse is by using embedded sensor technology. This has been used for several years to improve process efficiency. Initially, these systems were sparsely used but in just a few short years they have become commonplace with many mills employing multiple systems to monitor different parts of their process. This rapid growth is a testament to the value derived from these systems.

Armed with accurate real-time knowledge of nip performance, operators can adjust operating parameters and make corrections. These systems have quickly identified improper cover crowns, biased loading, and uneven roll cover wear resulting in reduced costs through extended cover and clothing life, reduced downtime, lower raw material consumption, and reduced energy costs. Embedded sensor technology is field proven and providing documented results.



SMART® Technology, from Xerium Technologies, employs a proprietary embedded sensor system to extract data from the roll cover during machine operation. A series of sensors is embedded across the width of the roll cover, providing a continuous flow of profile data. The sensors are monitored by head-mounted electronics that rotate with the roll and transmit data wirelessly to a dedicated computer. A custom operator interface provides dynamic monitoring of the pressure profile, pressure profile standard deviation, and roll speed. The system also maintains a historical log of past loading data.

The use of new polyurethane cover technology allows for the use of softer covers at higher loads. This allows for a combination of higher nip width as well as higher nip intensity. This increase in nip impulse allows for increased machine speed and increased paper production.

CREATING THE IDEAL NIP IMPULSE

To design the proper nip impulse requires taking into account what parameters need to be controlled. It is important to analyze the following operating conditions:

- Nip intensity, nip width and the dwell time
- Start up time, felt life, moisture ratio
- Sheet strength, smoothness, bulk, basis weight
- Sheet breaks, holes, draw, sheet transfer

In order to match the conditions listed above, roll covers are designed to develop nip intensity, nip width and venting. Felts are designed to handle water, transfer the sheet and pressing uniformity.

For a long time it was difficult to achieve the ideal nip impulse because cover technology was not able to match the requirements. Standard polyurethane covers had issues

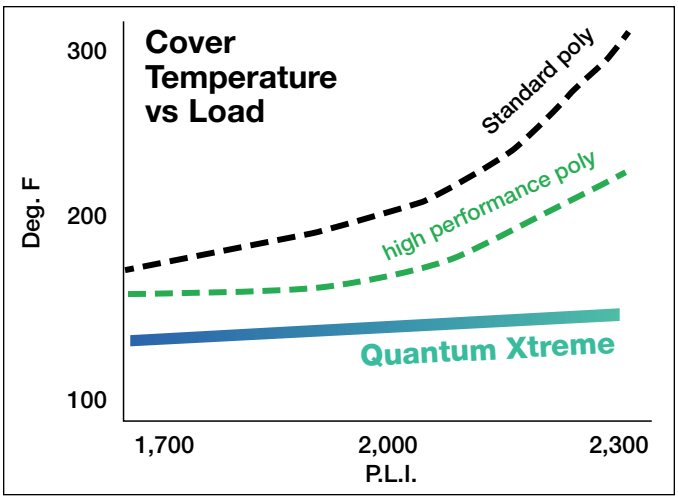


Figure 1.

with significant temperature increase as the nip intensity increased, however, in recent years new technology has significantly improved the cover operating parameters. New cover materials, like Quantum Xtreme, have low hysteresis which allows the cover to operate at a lower temperature under higher loads, allowing the rolls to operate without water cooling (see **Figure 1**). Additionally, new elastomers were developed that have increased wear resistance. This increased wear resistance allows the roll to maintain its groove and hole geometry for a longer period of time, and also allows the roll cover to maintain its profile for an extended period of time.

Although earlier versions of SMART® Technology delivered tremendous benefits in some positions, it was limited in its potential applications. The latest technology allows for measurement of both nip width and nip intensity (press impulse). By measuring these two parameters it gives the mill crucial information that is necessary for the press impulse, which is key to the drying of the sheet and how much moisture is removed.

The nip width is measured by the embedded sensor system which takes up to 1000 readings per second while the sensor is in the nip. These readings allow for the software to determine how large the nip width is. Nip width measurement is critical because it is one of two factors in the total nip impulse.

Many factors can impact the nip impulse. These factors include but are not limited to roll cover hardness, loading pressure, temperature, felt caliper and sheet caliper. As a roll and felt progresses through its life the nip impulse will vary greatly based on the factors mentioned above. In addition it is important to know the nip impulse as paper grades change. This is a factor that is increasing in the paper industry today.

New cover materials, like Quantum Xtreme, have low hysteresis which allows the cover to operate at a lower temperature under higher loads, allowing the rolls to operate without water cooling.

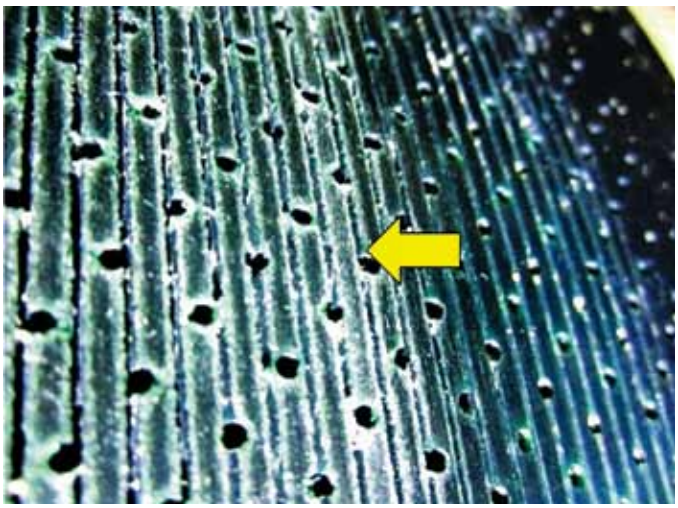
One additional factor that assists operations is through the development of the OPC link for the SMART Technology. The OPC link allows for data that is generated in the nip to be transmitted and displayed throughout the mills DCS system. This feature allows for the data to be put out to anyone's desk that has access to the DCS system. This is in addition to the display on the computer that is normally located in the operators control room.

IMPROVING MACHINE EFFICIENCY

There are two ways in which SMART Technology improves machine efficiency. The first is that it assists in achieving a flat nip. A flat nip is critical because a flat nip helps to create a better sheet quality. The sheet quality is improved because there is consistent moisture content across the entire sheet. In the past, the nip was monitored during static conditions. In some cases this was accurate enough to maintain a flat nip profile, but there are several factors that can cause the nip to not be flat during the dynamic running conditions. These factors show the importance of using the embedded sensors since this is the only way to truly measure what is happening in the nip while it is running.

Without a flat nip there are several issues that can occur. The first issue is that the moisture in the sheet will not be consistent. If the moisture in the sheet is not consistent, machine speed will need to be reduced to ensure that the wettest part of the sheet dries properly. In addition, the sheet caliper is likely to vary as well. This variation will likely cause quality issues.

Another issue associated with an uneven nip is that this will increase the wear on portions of the roll cover. This increased wear will require the roll to be removed earlier than normal, reducing machine run time and requiring additional maintenance time. In addition to wearing the cover, uneven loading will also have impact on venting on the roll cover. This can cause additional wear or closing of the grooving and blind drilled portion of the rolls. It is also possible that an uneven nip could cause the roll cover to be damaged and require the operator to reduce the nip pressure.

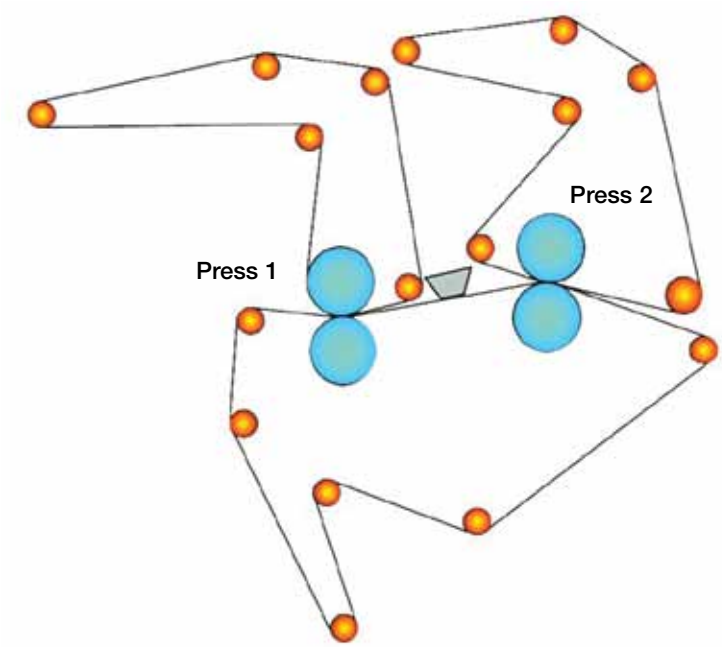


Non-uniform press load caused premature wear.

These two factors will greatly affect the performance of the machine.

Another problem with an uneven nip is that it will affect the performance of the felt. Where the nip is loaded heavier it will cause the felt to compress more than the rest of the felt. This increased compressing of the felt will reduce the effectiveness of the felt to carry water away from the nip, ultimately reducing the felt life in the machine which will increase the costs of operating the machine.

The second benefit of using SMART Technology is that it gives the papermaker the confidence to increase the loading of the press roll. Because the papermaker is confident that the nip is flat, he can increase the loading and he can be assured that the cover is operating properly. The ability to increase the loading is part of the nip impulse which helps to remove more moisture from the sheet. This allows for the machine to speed up because the sheet is drier.



"This increased compressing of the felt will reduce the effectiveness of the felt to carry water away from the nip, ultimately reducing the felt life in the machine which will increase the costs of operating the machine."

In addition to using embedded sensors, the use of new technology polyurethane like Quantum Xtreme, allows the papermaker to increase the nip intensity. This increased nip intensity helps to increase the nip impulse, and the increased nip impulse will allow the papermaker to remove more moisture from the sheet. This will allow for the mill to increase the machine speed, or reduce the amount of energy necessary to dry the sheet.

CASE STUDY

The theories listed above were instituted in a 2-ply recycled linerboard machine. This machine is two straight thru press application as shown below.

Originally the second press on the machine was operating at 1200 PLI. After the addition of the new polyurethane covers and embedded sensor technology, the load was increased to 1600 PLI. Because of the increased loading, the speed on the machine was increased from 2200 FPM up to 2500 FPM. In addition, the rolls were able to increase the grind interval from 6 months up to 1 year. Also, felt life is increased from 8 weeks up to 12 weeks. This increase in speed correlated to an increase of 31 tons per day. The mill has replaced all of their rolls with this new technology and continued to operate at this higher level.

This is just one example of how the use of SMART Technology and Quantum Xtreme roll cover technology improves machine performance and efficiency. New polyurethane technology covers allow presses to run at higher loads, improving the amount of water removed from the sheet, while SMART Technology gives the mill the confidence to operate at higher loads because they know that they have a flat nip. This also allows the mill to extend the life of the press felt because a flat nip has the felt to compress equal amounts in the cross machine direction. ■

Bob Carney is Director of SMART Technology for Xerium. He can be reached at: bob.carney@xerium.com.