Troubleshooting felt barring using high speed permeability and moisture meters

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This paper describes the advantages of a high sampling rate used by new diagnostic systems to monitor the press and forming section.
We will focus on the press section devices, well known as a helpful tool to troubleshooting and optimisation of the papermaking process.

Through the introduction of new tools with high speed sampling, it is now possible to detect precisely any periodical variation of moisture and permeability directly on felt.

PresScan™ (felt moisture meter, 1500 sps) and PermFlow™ (water permeability meter, 256 sps) are portable instruments with the newest sensor technology and the highest sampling rate on the market.

Analysis on press felt with a portable device can be considered as a single-shot test because in a few seconds, the whole surface of the felt is scanned. CMD (Cross Machine Direction) moisture and permeability profiles can be considered as the average of several MD profiles.

The results of the CMD will be more reliable if the time spent scanning across the felt width is higher, using a higher sampling rate.

A CMD scanning is a combination of CD and MD variation. It is well known that it is difficult to separate the effect of CD variation from those in MD direction, especially if the variations in MD are close to the sampling rate of the sensor. CD profile moisture and permeability contents changes relatively slowly, while MD changes rapidly. The only solution to separate this variation is to have a high sample rate that will definitely allow the detection of any periodical variation on MD and a filter to clean all MD noise and periodical variation.

Figure 1
PermFlow, Cristini's high speed felt permeability meter

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The high sample rates of 1500 s/sec in the PresScan moisture meter and 256 s/sec in the PermFlow permeability meter can make the difference in terms of reliability and precision.

A practical example is a moisture measurement in a 10m wide and 30m long press felt, running at 1,000 m/min. A moisture meter with a sample rate of 20 samples/sec will measure the water content in steps of 0.83 meters of felt in MD. Therefore, an MD variation close to 20 Hz will not be detected.

A moisture meter with a sample rate of 1500 samples/sec will measure the water content in steps of 1.1 cm, therefore a wide range of MD variations can be easily detected. A filter will allow the averaging of all the samples and will give a clear understanding of the CD profile.

Sampling at 20 samples/sec is not the same as sampling 1,500 samples/sec and filtering (by averaging them) to 20 samples/sec, especially if MD variations are close to the sample rate. High sample rates allow us to scan the whole felt surface with far more reliable results, avoiding the misunderstanding between MD and CD profiles. Nowadays the ever-increasing demand of production, paper quality and sheet uniformity has led to an increased demand for machine optimisation, so it is necessary to systematically use devices able also to detect machine direction variation, at high speed.

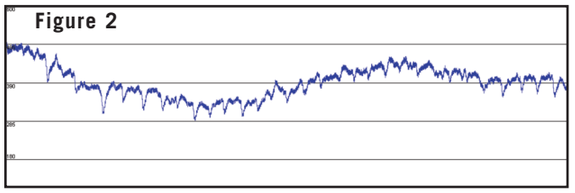
In Figs. 2-3 it is shown how PermFlow's sample rate and the sensor response makes the difference in understanding the moisture/permeability profile. The permeability is taken by PermFlow at 256 samples/sec. The peaks that can be interpreted as changes due to the oscillation of the high pressure shower are in fact periodical variations in the machine direction (felt barring).

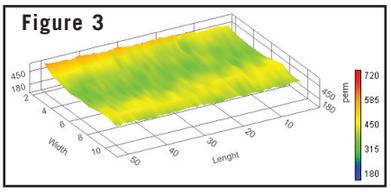
The instrument software can convert the readings immediately on board into a 3D map (Fig. 3), to clearly separate MD from CD variations.

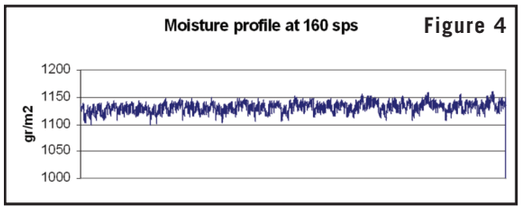
Obviously, the sampling rate is not the only parameter that makes the PermFlow and PresScan scanners accurate and precise. The sensor response is an important factor, as well. For sensor response we mean the capacity to detect any mass/permeability variation in a very short time. The size, technology and design of the microwave field is important in the measurement of narrow moisture band.

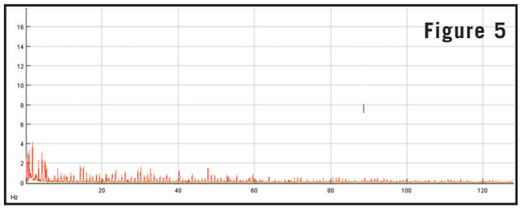
PresScan utilises a revolutionary microwave sensor technology. The sensor is based on a planar/fractal emitter, rather than the old resonance chambers. This allows a more precise, strong, even and customised shape of the microwave field. With this technology, it is possible to design perfectly the microwave field on the three axes, a feature impossible to obtain with the old resonance chambers.

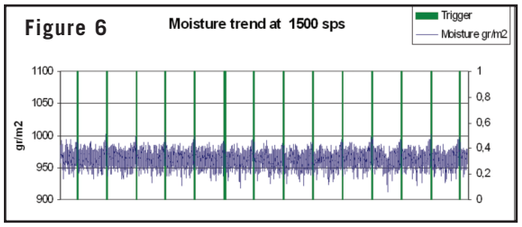
In the following picture we compare measurements taken with a standard resonance chamber microwave device at 160 sample/sec and PresScan

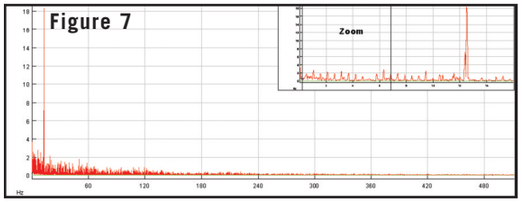


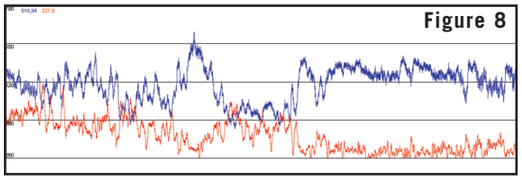


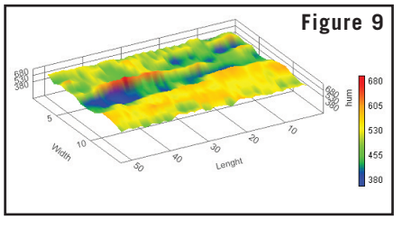


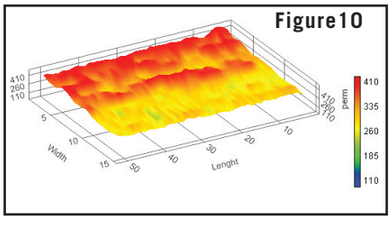












planar microwave sensor device at 1500 sample/sec.

Fig. 4 shows a moisture MD profile taken with an instrument equipped with standard microwave resonant chamber, at 160 samples/sec and relative FFT spectrum (Fig. 5). It shows no remarkable periodic variations.

Fig. 6 shows a moisture profile taken with PresScan's planar microwave sensor at 1,500 samples/sec on the same position, at the same time. The relative FFT spectrum (Fig. 7) shows a periodical variation at 12.5 Hz and harmonics of 0.53 Hz (felt trade line also detected by the optical sensor).

The interesting feature is that PresScan PC software and PermFlow on board software allows an immediate plot of the 3D graph, to immediately evaluate if there is felt barring or stripes, even before performing an FFT analysis! Additionally, this feature is made on a normal permeability profile, which has taken only one minute to be completed.

The powerful PC software allows an overlapping of the moisture and permeability profiles taken by both instruments, allowing an immediate troubleshooting of the felt bands and barring, using the instrument scans taken during the normal routine service, at no extra time (Figs. 8-10).

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CONCLUSIONS

New diagnostic tools with newer sensor technology and faster sampling rate are now available, to help the papermakers and machine clothing suppliers to fast and accurately troubleshoot the paper machines and machine clothing related issues.