



A Problem Solver Application Bulletin

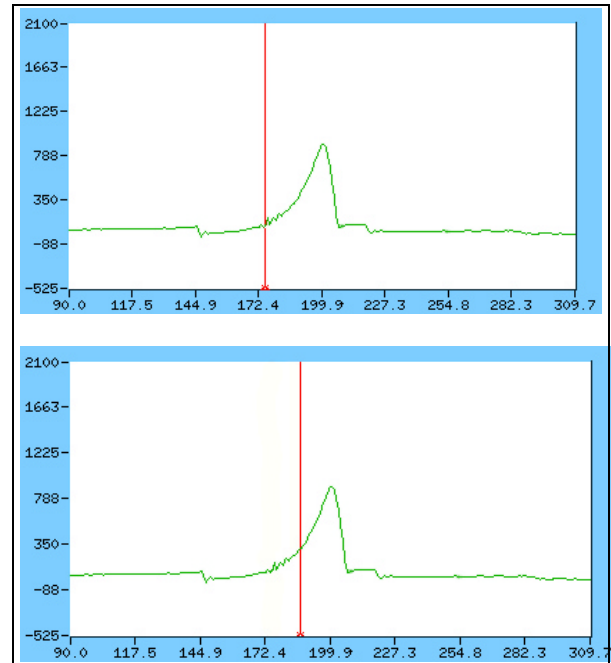
Measuring Material Work Hardening (N-Factor)

Using the **Signature Technologies SA-2000** Statistical Analysis Module (**SAM**), and an exclusive **algorithm solely licensed by ST**, one can calculate the work hardening coefficient on drawn panels or other components.

Signature Technologies has cooperatively developed with **Ford Motor Company** a means of determining percentage variation of material Work-hardening coefficient (N-factor) away from nominal in cases where a free stretch draw is made by measuring the force during the draw and post-processing the data with algorithms developed and patented by **Ford Motor Company**. The features in this application can detect wrinkles, tears, and monitor panel work hardness.

In practice, one ST feature called "Ratio" is taken at the beginning of the draw process, and another "Ratio" feature is obtained later in the draw, well up the force slope. ST processes are used to eliminate the draw ring backpressure so that only the draw forces are considered.

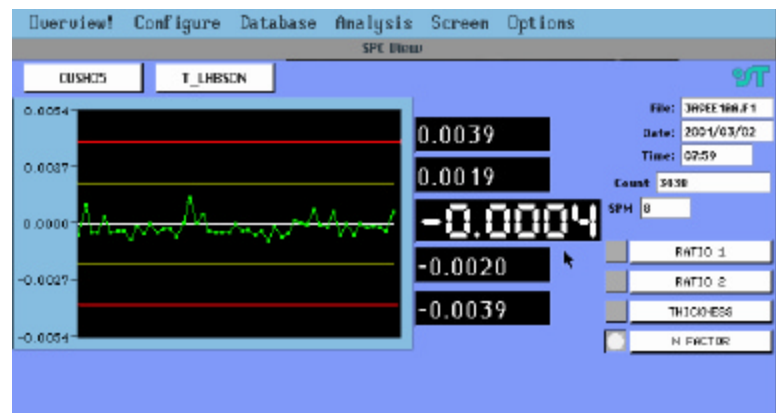
The system works by post processing the returns from the "Ratio" features with the patented Ford algorithm to discern changes in the amplitude, and the slope of the signature. The feature screens are shown in the **upper illustrations**. Note the placement of the Ratio Features on the forming slope.



The **screen capture** below illustrates variations of the work-hardening coefficient in fractions of a percent from nominal.

The **SAM™** module can handle measurement inputs in groups of 8 up to 56 total points.

Signature Technologies can supply a wide variety of solutions to various manufacturing process problems dealing with measurement, verification of properties, tool condition, and machine health. We can also "close the loop" by performing process adjustments in response to specific variations in force, location, or shape of the work piece, as well as more simple controls which can track and reject specific parts which don't meet specific quality criteria.



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