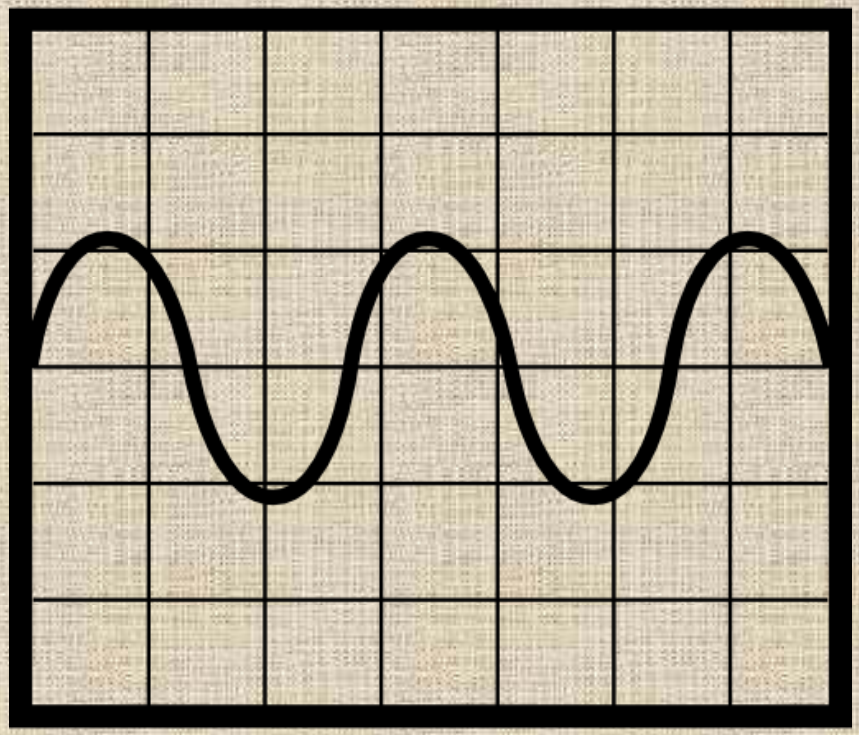
Web 101.88SM – Oscillation

A Study of Oscillation

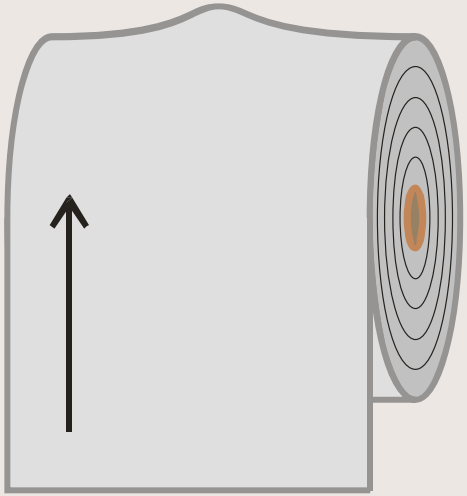


David Roisum, Ph.D.
Finishing Technologies, Inc.

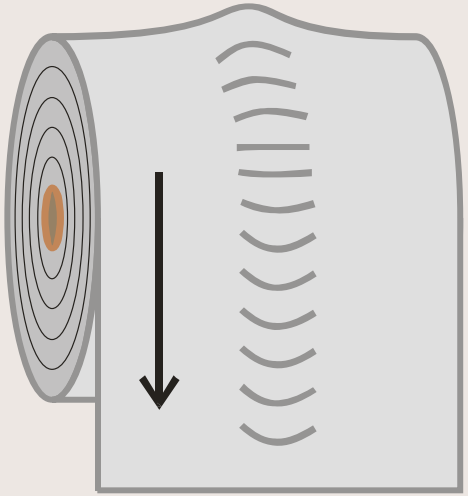
Courtesy Freepik from www.flaticon.com

Winding With Gage Variation

- Winding



- Unwinding



The size of the **diameter variation** that might do this could be as little as **1/1,000**

The web **gage variation** that caused this may be in the range of **1-10%**

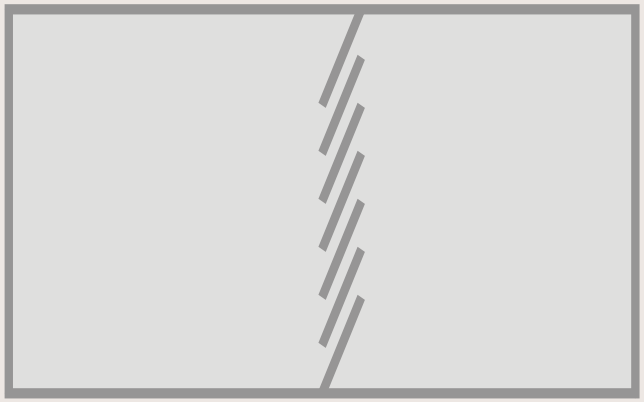
Land, Cecilia Baggy paper webs: Effect of uneven moisture and grammage profiles. Ph.D thesis, Karlstand University, Sweden, Oct 2010

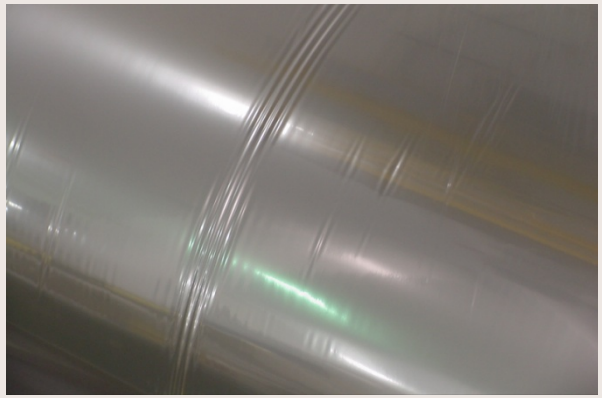
Roisum, David R. *The Secrets of a Level Process and Product*. Various venues, 2001.

Roisum, David R. Web201.45c Baggy Web Troubleshooting - Caliper Variations

Corrugation Description

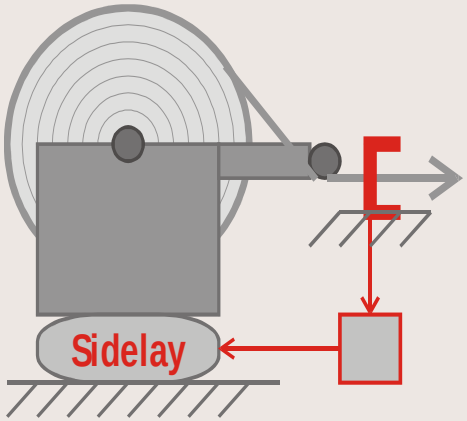
- A.K.A. Ropes, Chain Marks, ‘Tin Can’
- Narrow annular band, wrinkles at an angle
- Caused by Winding
  - A caliper-varying product
  - Tight, especially with nip



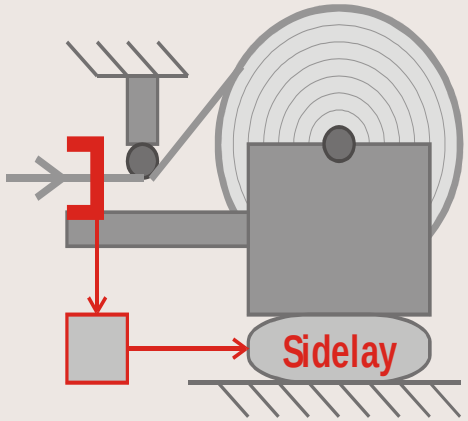


All Guides can Oscillate

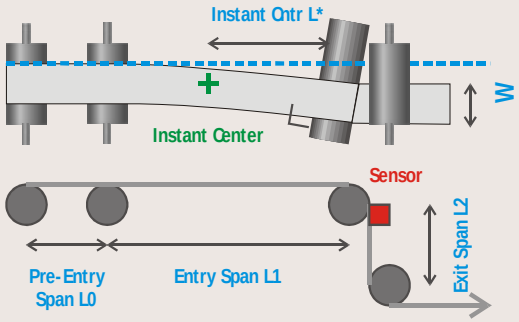
Unwind



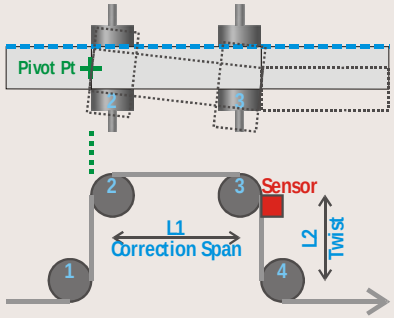
Winder



Steering



Displacement



<u>Also:</u>
End Pivot
Side Shifting

Oscillation Parameters

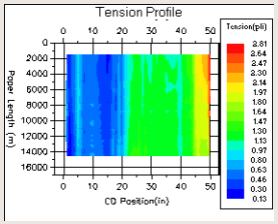
- Stroke
- Speed
- Shape
  - –Zig-Zag
  - –Sine Wave
  - –360 Degree (blown film)

Thickness Variations are Streaky

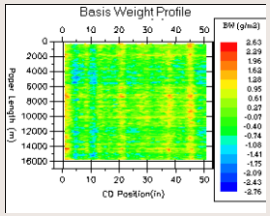
- Almost all web manufacturing and converting thickness profiles tend to be streaky.
- CD profiles tend to be stable for hours, to day, to even perhaps for life

Frost, Paul J. *The Application of Statistical Process Control to Web Products.* Conf paper 1989 and book 1991.

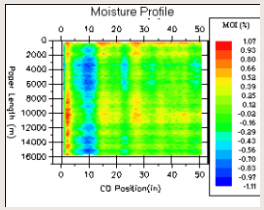
Tension



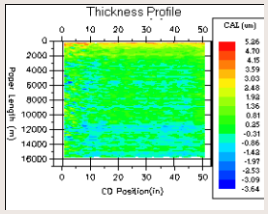
Basis Weight



Moisture



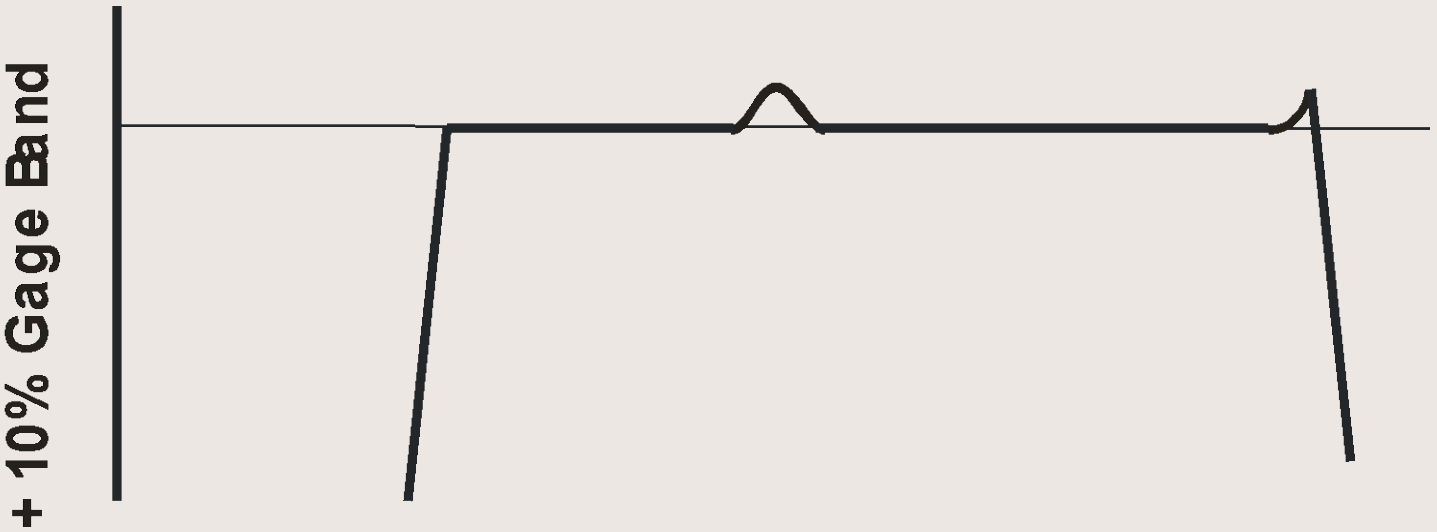
Thickness



Figures Courtesy of FPinnovations (PAPRICAN)

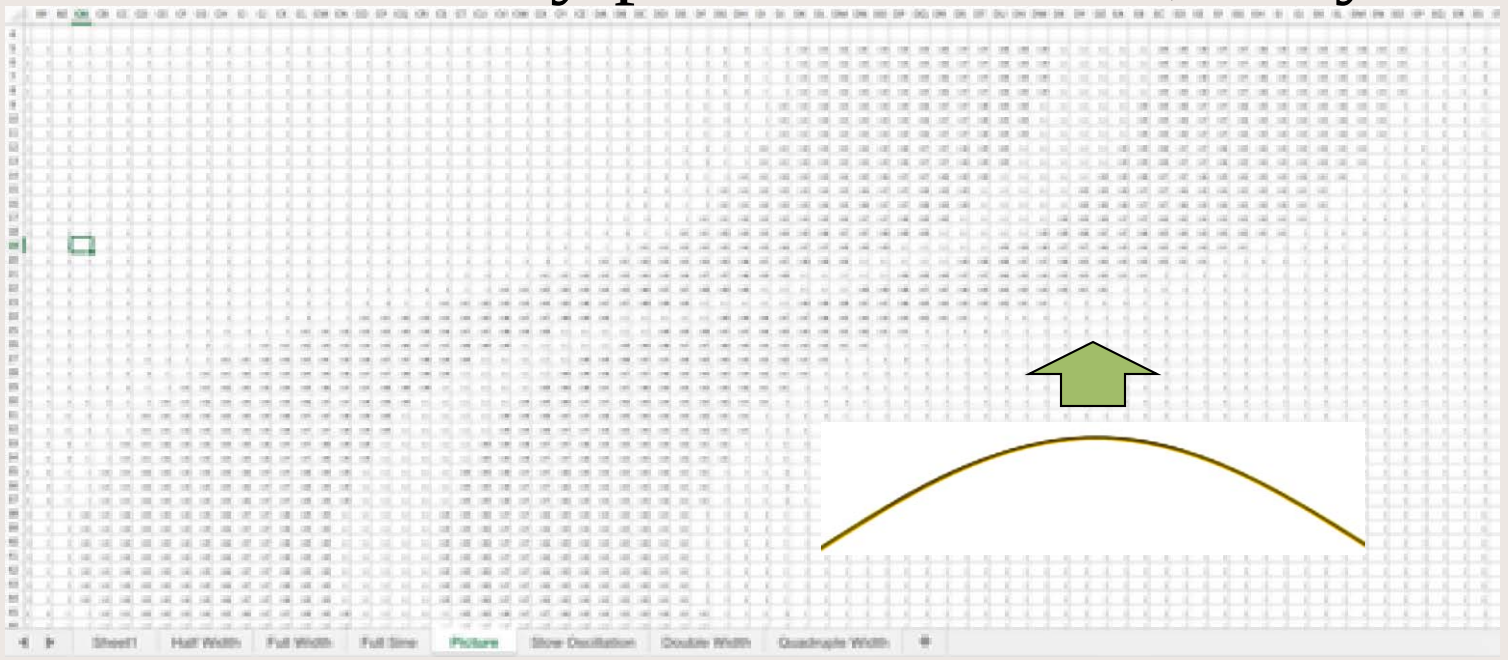
Center & Edge Ridge

- Usually high lanes worse than low lanes, examples
- **Gage Band** from manufacturing or converting
- **Slitter Lip** caused by cutting distortion
- **Size** range: 1% no problem, 10% no product



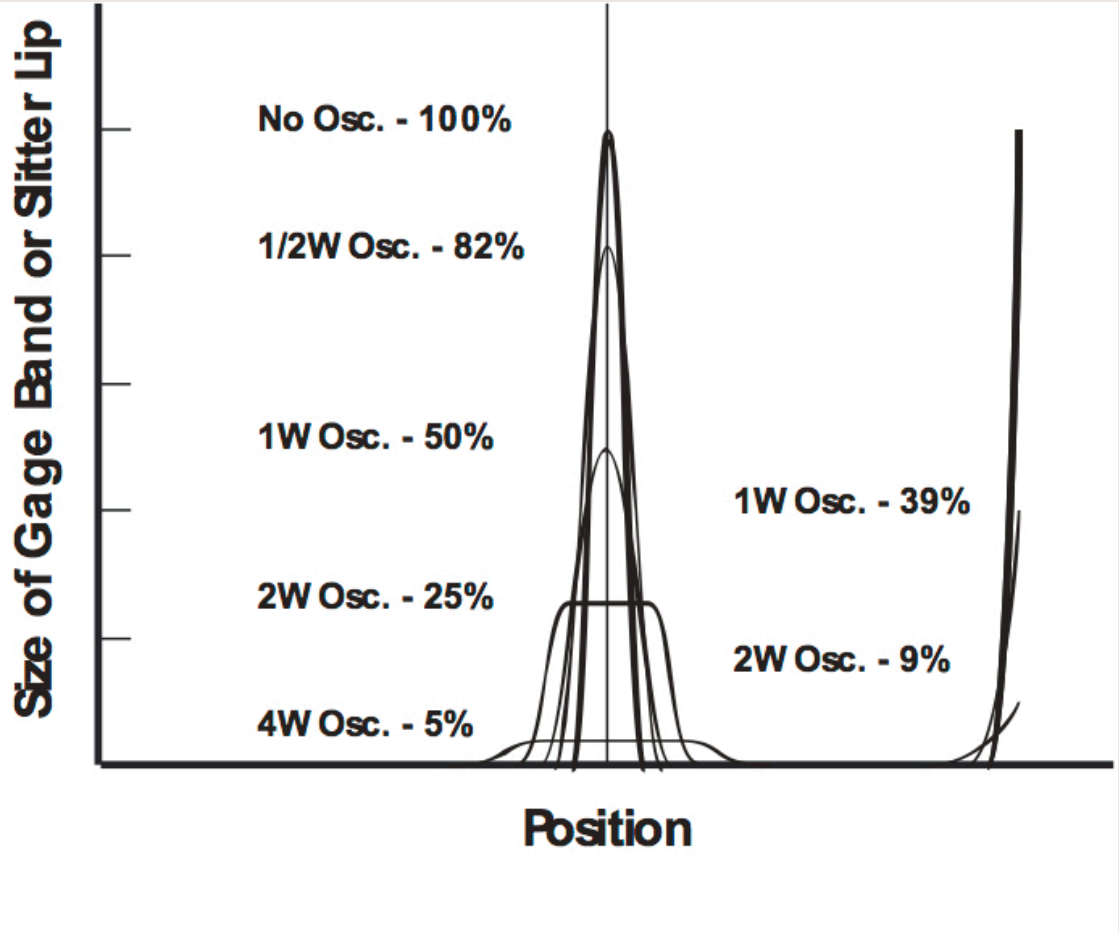
Spreadsheet Layout/Calculation

- This run is a sine shaped gage band of 10% height and 18 ‘units’ wide.
- Shown is a tiny portion of width, ½ cycle

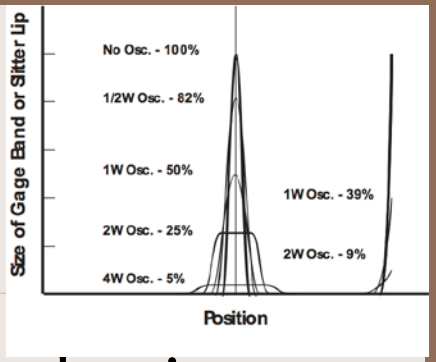


Results - Visual

- Sine shaped center ridge
- Exponential slitter lip
- Osc. Mag.
  - ½ width
  - 1X width
  - 2X width
  - 4X width



Results - Words



- Historical 1X width gives only 50% reduction
- May need 2-4X that wide
- Much more effective for raised slitter edges
  - Narrower to begin with
  - A 2X width brings lip down more than 90%

- A flat top begins just before 1X wide
- Shape of defect and oscillation unimportant
- Only *relative* heights and widths matter

What About Oscillation Speed?

- All that is needed is ½ cycle to smear everything, (other ½ cycle is just a repeat in other direction)
- The depth of influence is key. Various studies indicate that most of the influence is the outer 2 cm (1”) for typical shipping rolls.
  - Winding models (high Et/Er anisotropy)
  - Roll hardness measurements
- Given above, oscillation become sharply ineffective if less than ½ cycle takes place before the stroke reaches 1X width.

The Future

- Should be verified by
  - Spreadsheet models
  - Oscillating 3D winding models
- Still, probably safe to conclude
  - Oscillate 2-4X if economically possible (for ordinary gage bands)
  - Oscillate width of defect before 2 cm of buildup
  - Shape of defect and shape of oscillation very unimportant

Questions?

Answers:

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