# What FEA Analysis Can Tell Us About Spreaders

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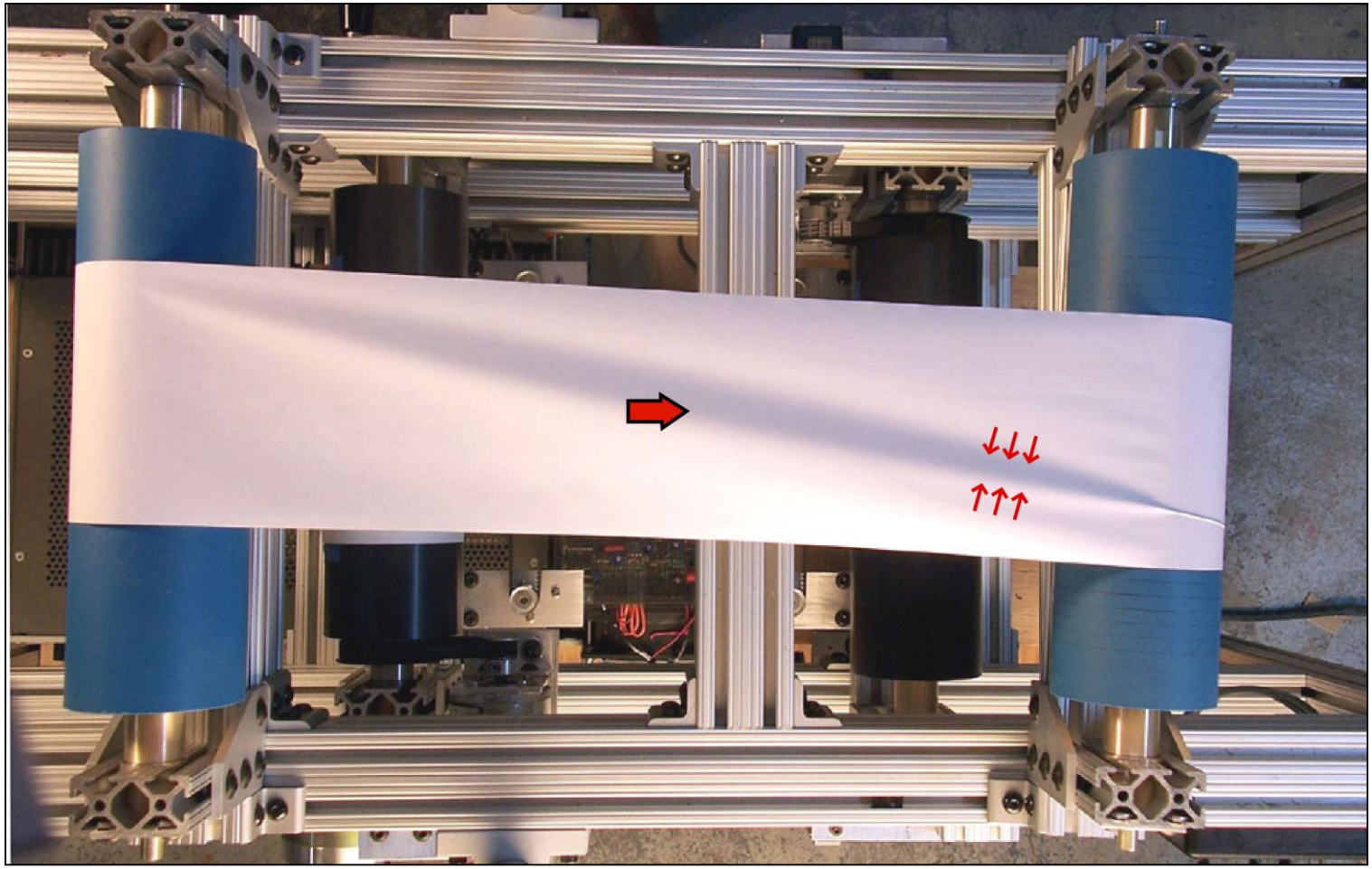
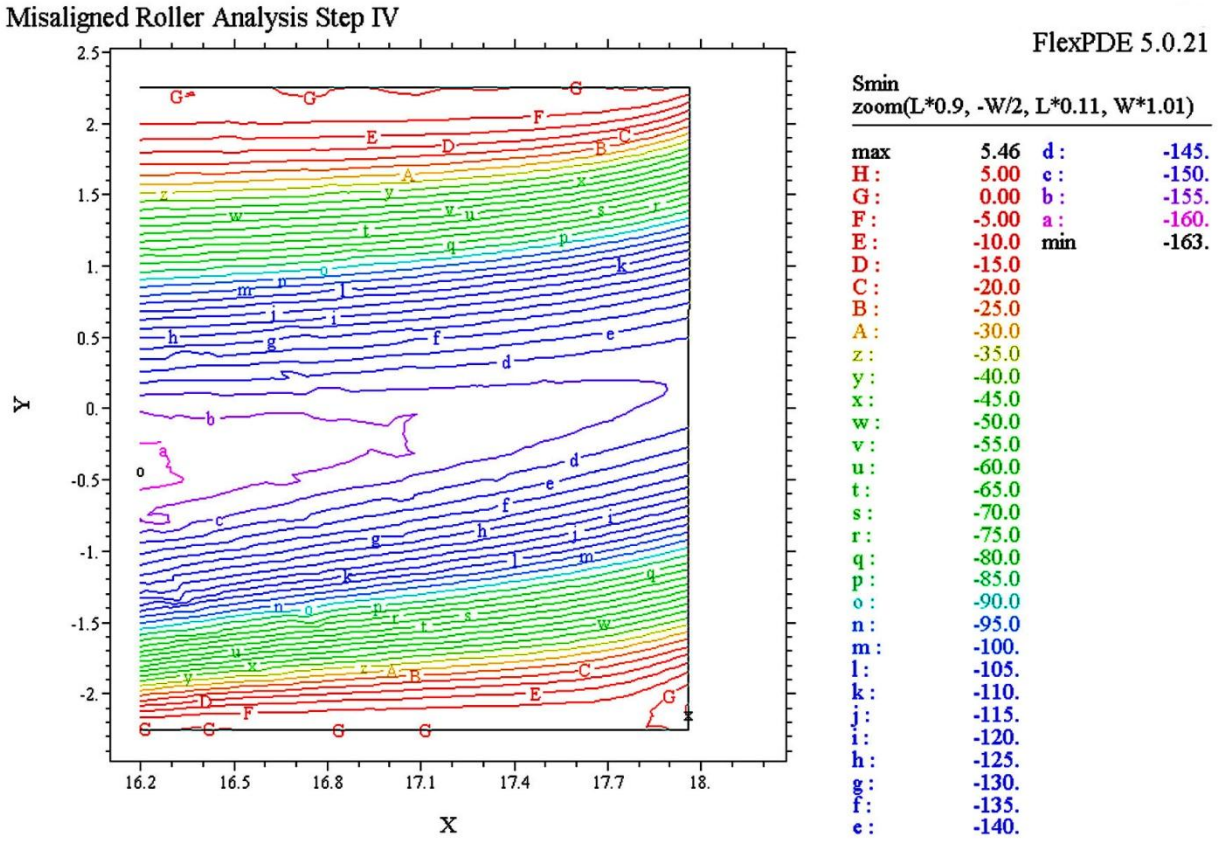
# Compressive stress



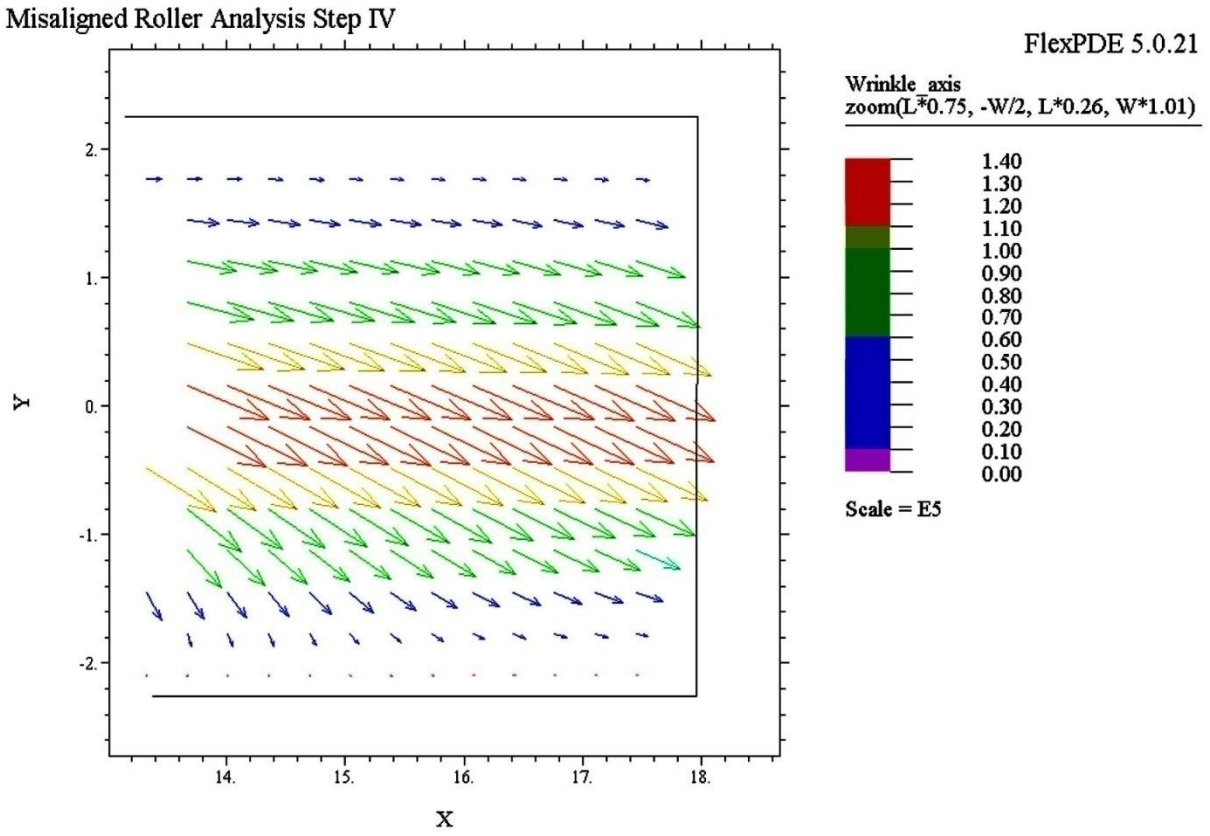
# Parameters for the paper web

- Length of span = 18 inches
- Width = 4.5 inches
- Thickness = 0.003 inch
- Tension = 6 Lbf
- Modulus = 500,000 psi (estimated)
- Poisson's ratio = 0.25 (estimated)
- Misalignment = 2.7 degrees

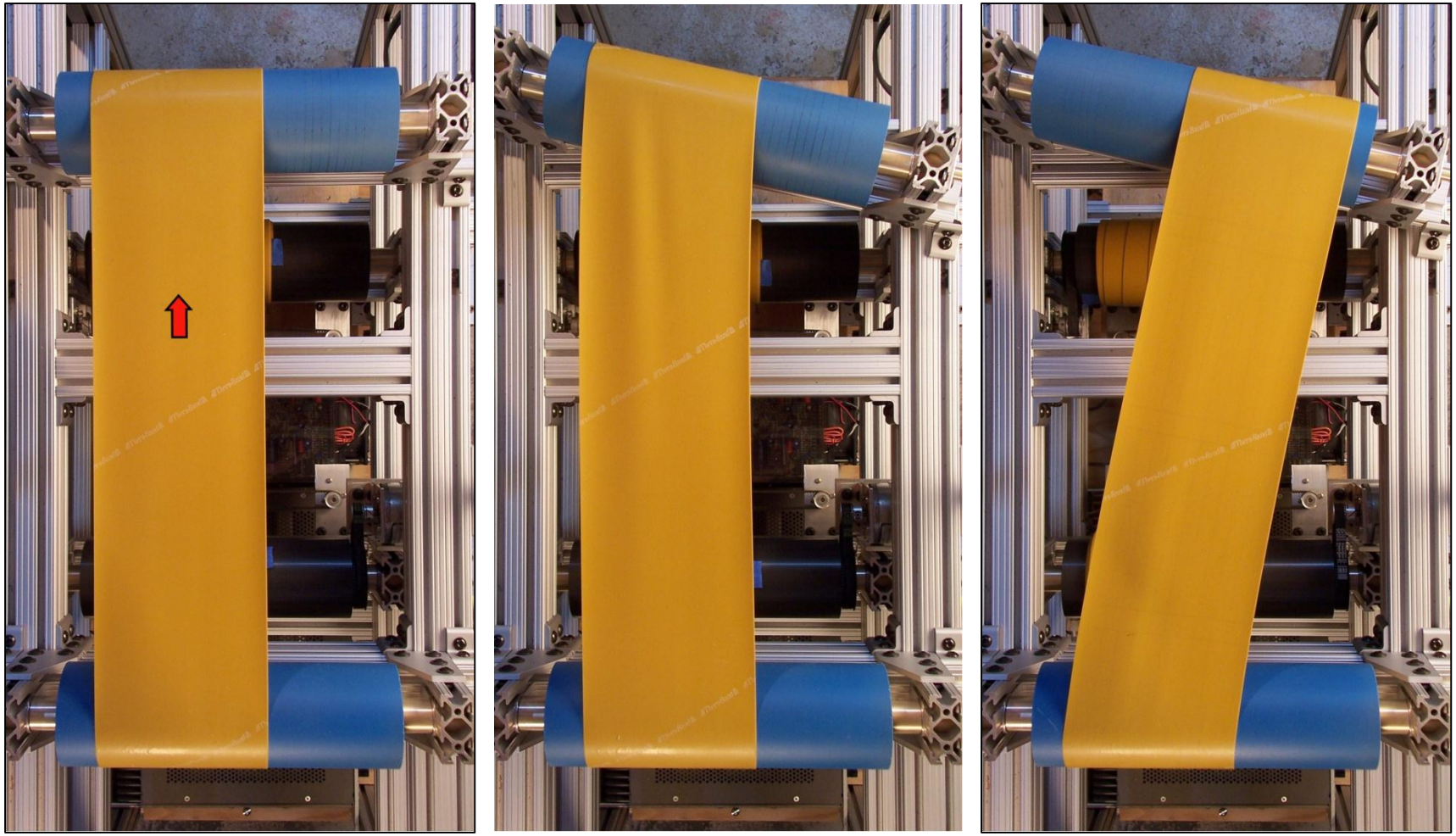
# Compressive stress at a misaligned roller



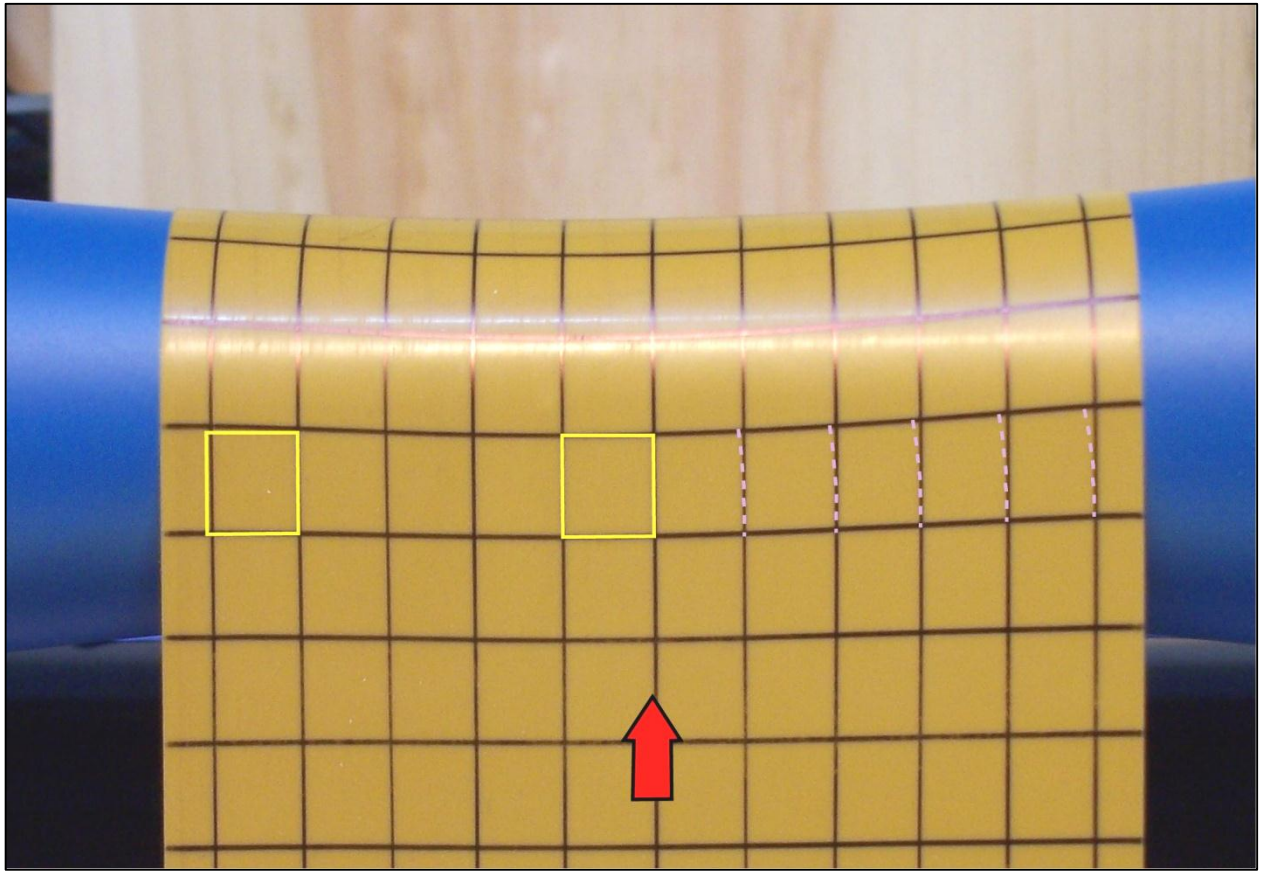
# Trough direction vectors



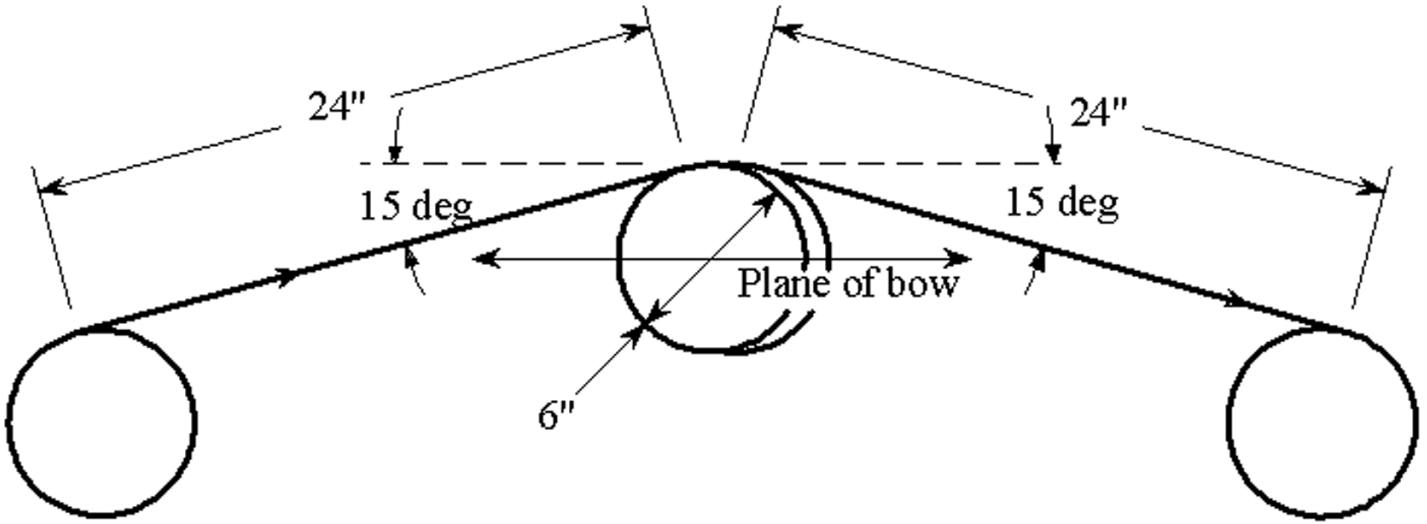
# Normal entry rule



# Normal strain rule



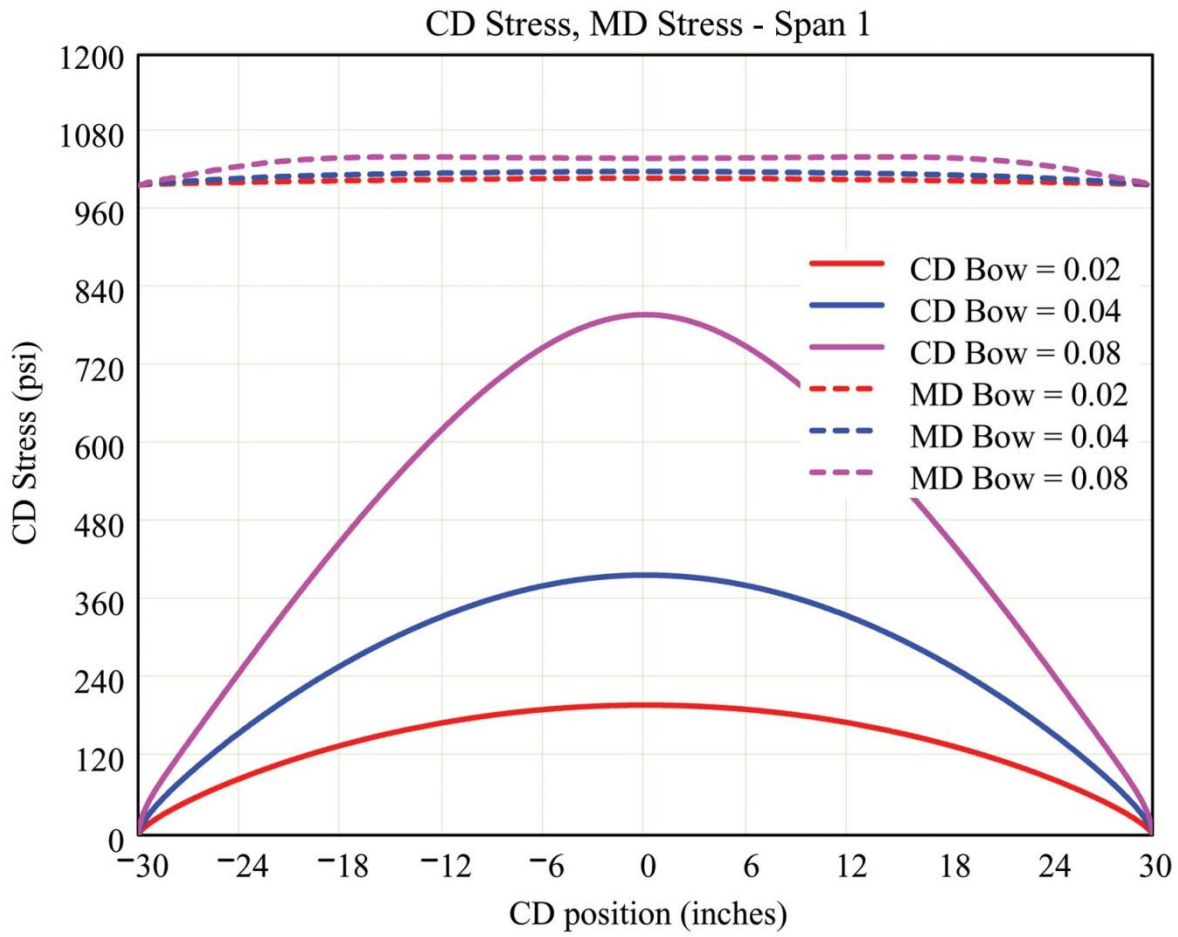
# Bowed roller application



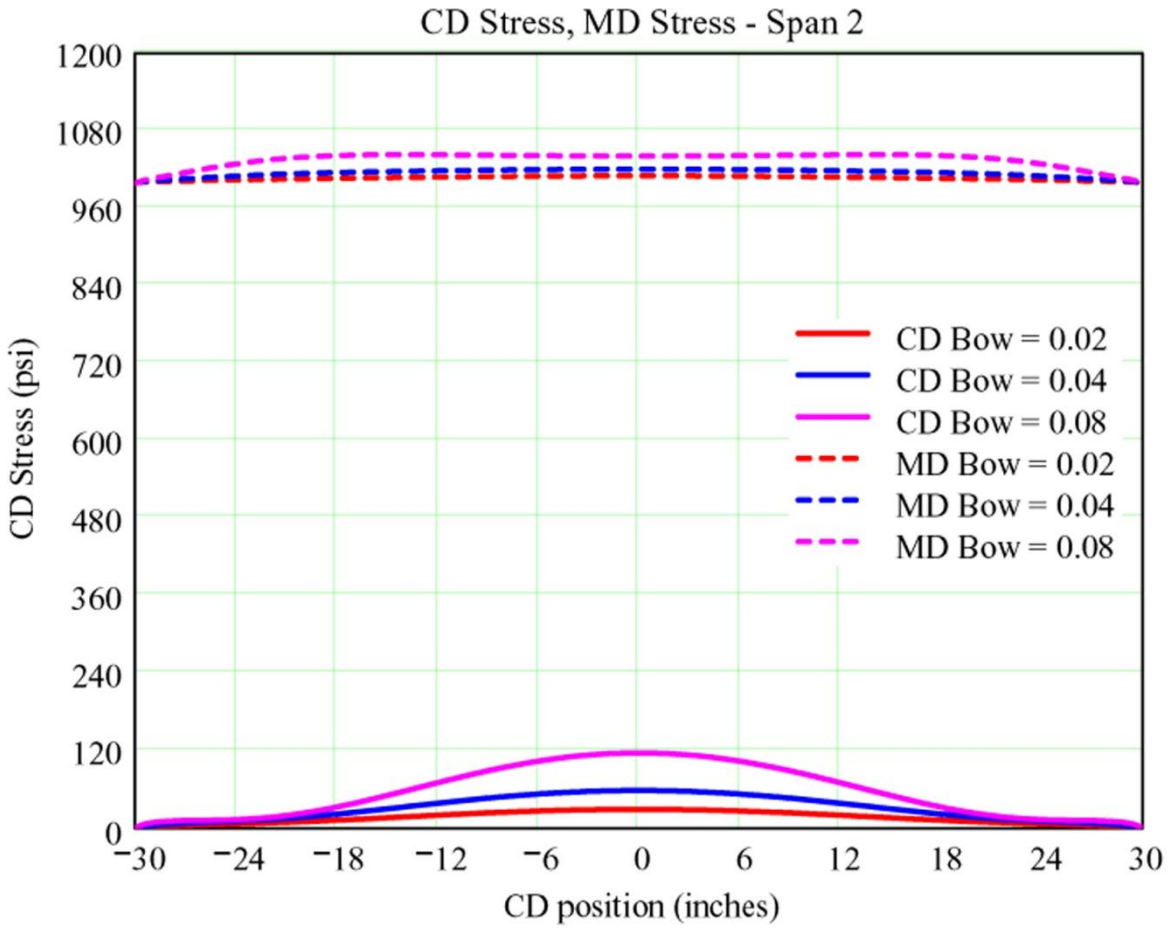
# Parameters

- Width = 60 inches
- Thickness = 0.0005 inch
- Modulus = 600,000 psi
- Poisson's ratio = 0.35
- Roller length = 72 inches
- Coefficient of friction = 0.5

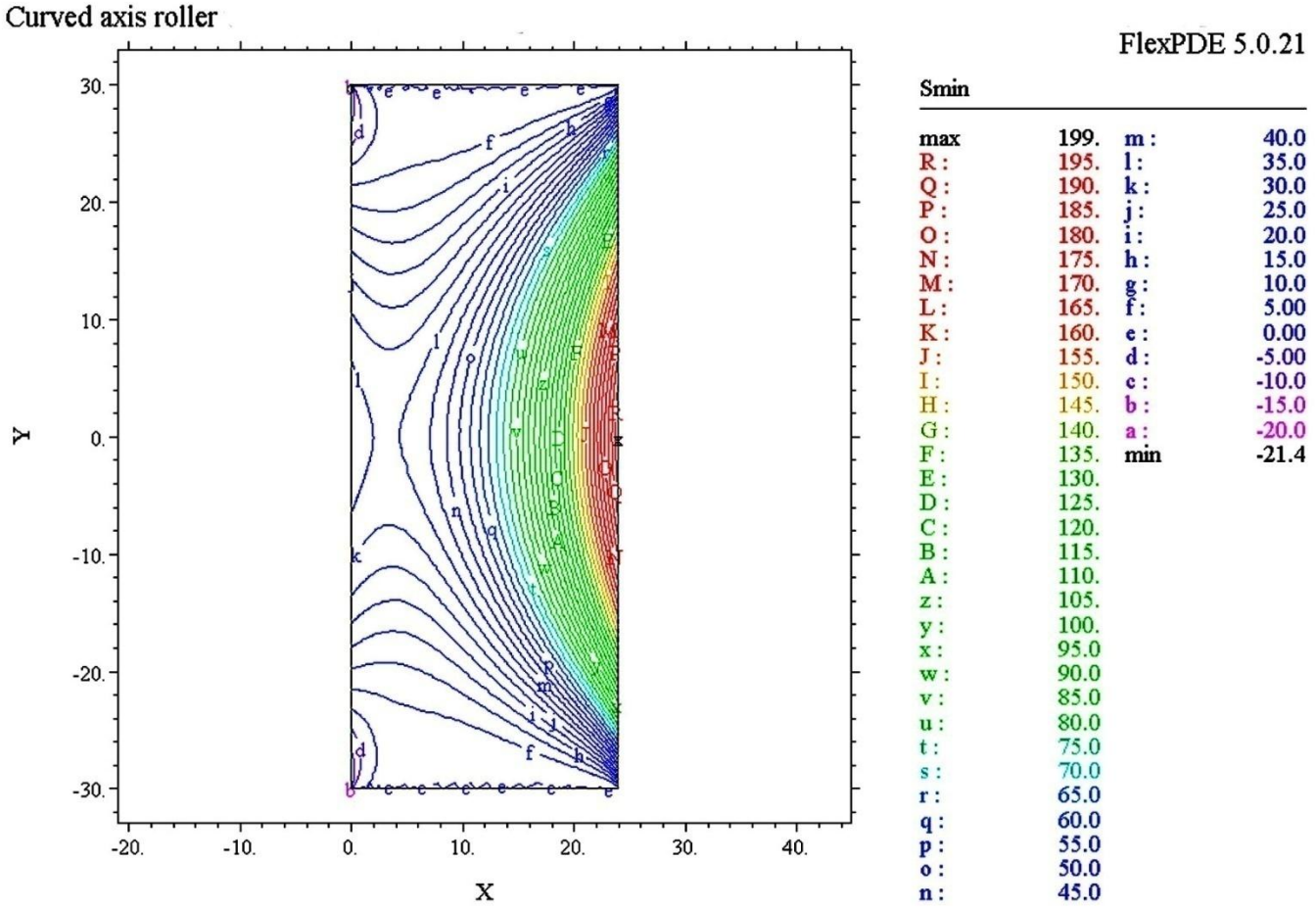
# Stresses at entry to bowed roller



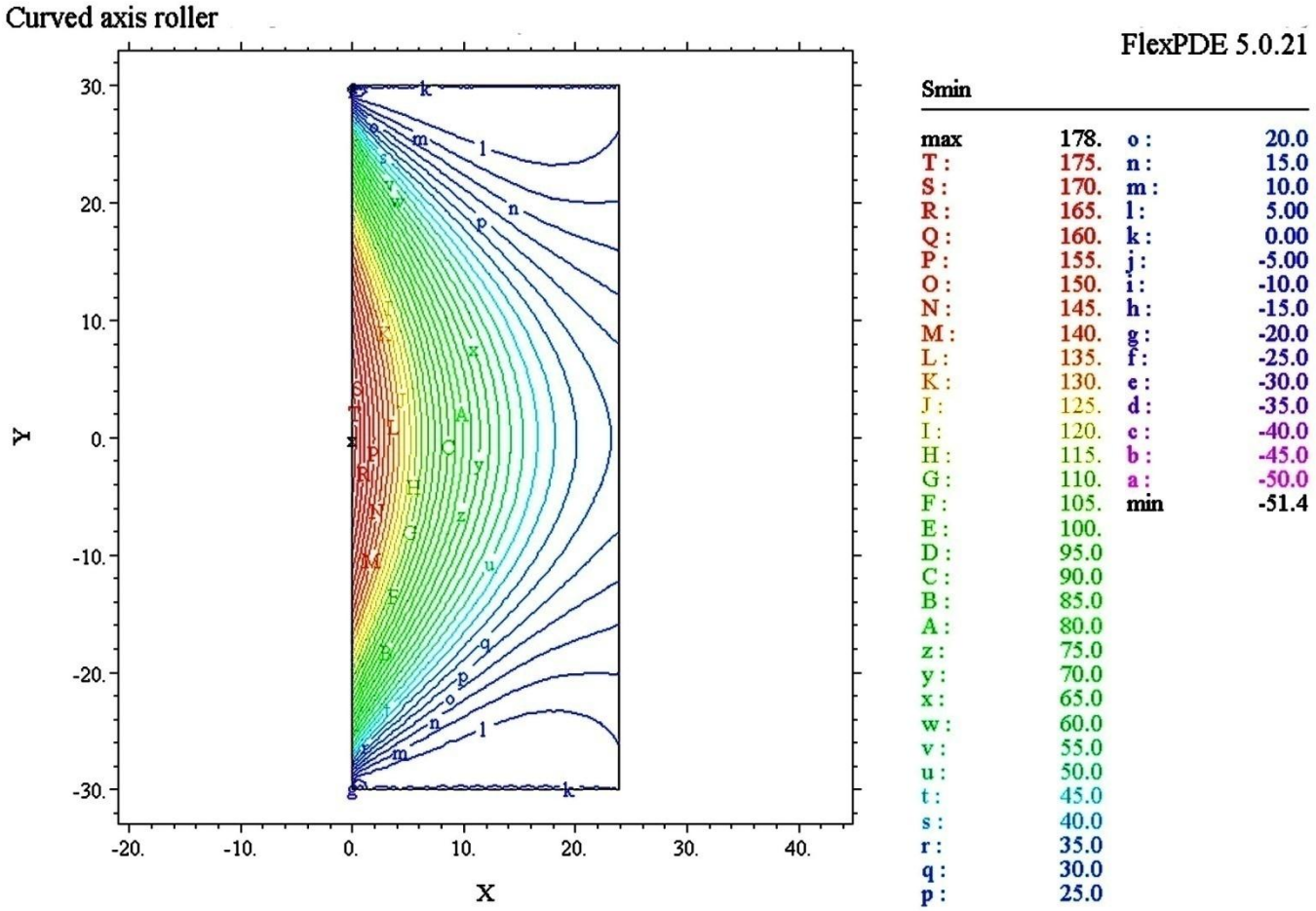
# Stresses at entry to next idler



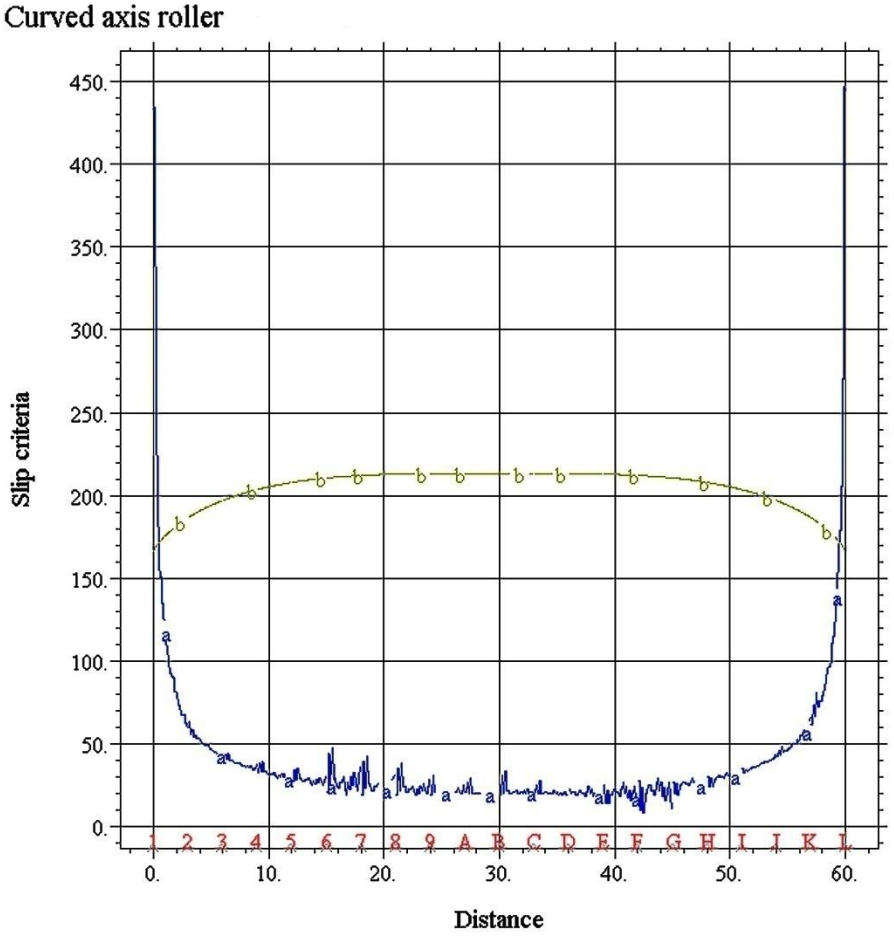
# CD stress pattern in entry span



# CD stress pattern in exit span



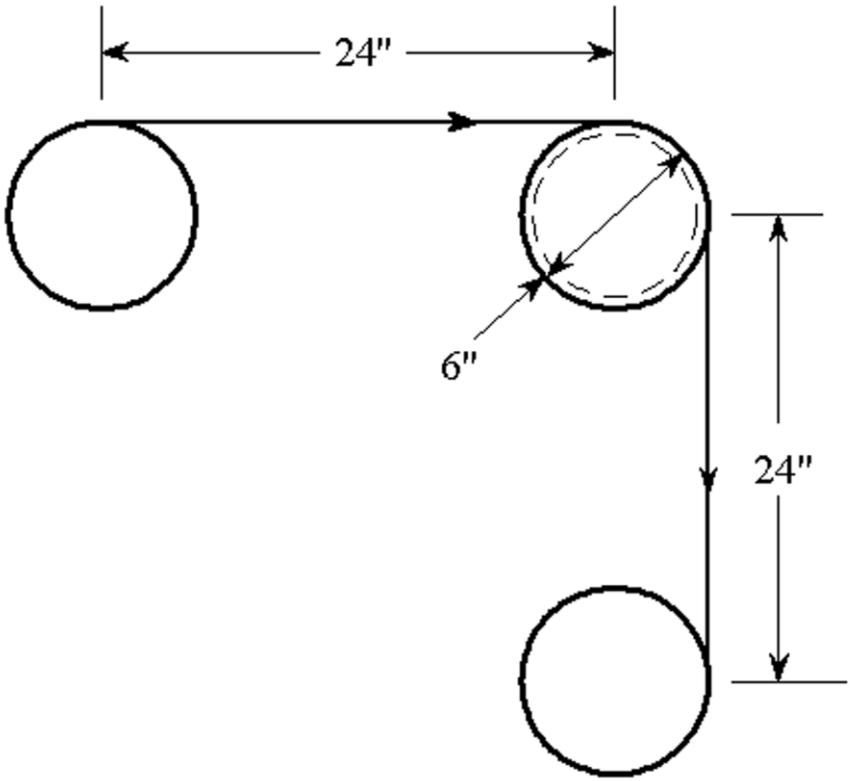
# Traction on bowed roller



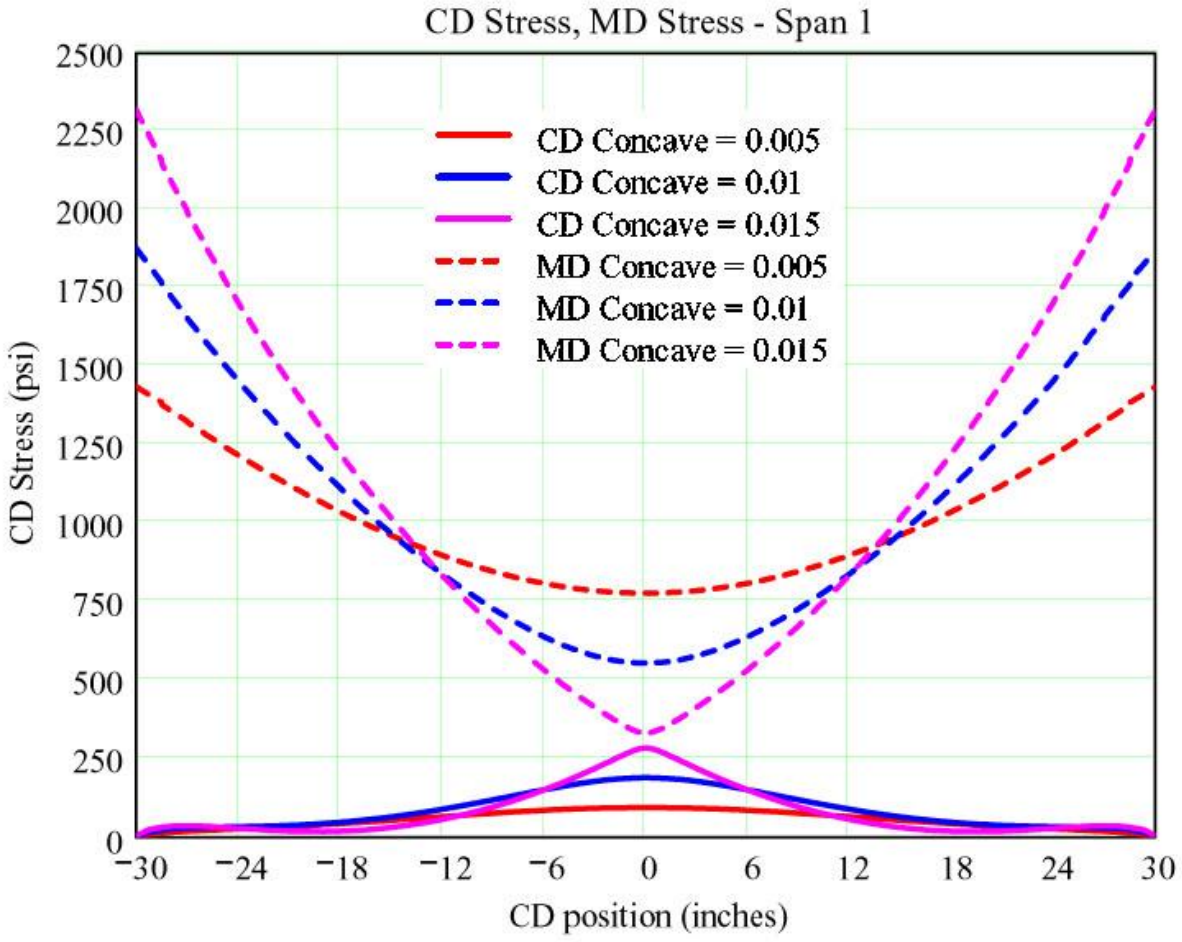
# Conclusions about bowed rollers

- It doesn't take much bow to have a big effect.
- The spreading action has little effect on the MD stress profile.
- The exit span should be kept very short if spreading action is needed at the next roller.
- Bowed rollers are aggressive spreaders that can be adjusted to create excessive spreading stresses, resulting in lateral slipping.

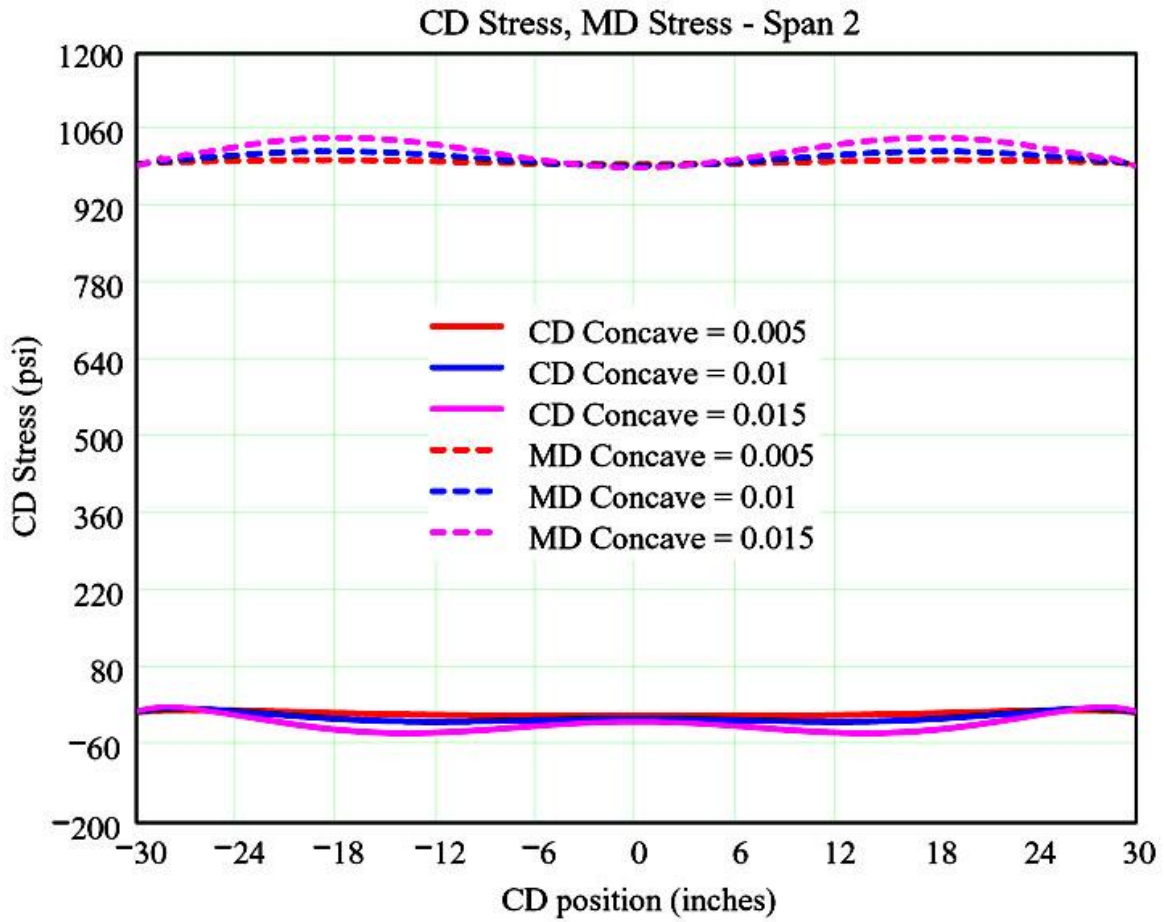
# Concave roller application



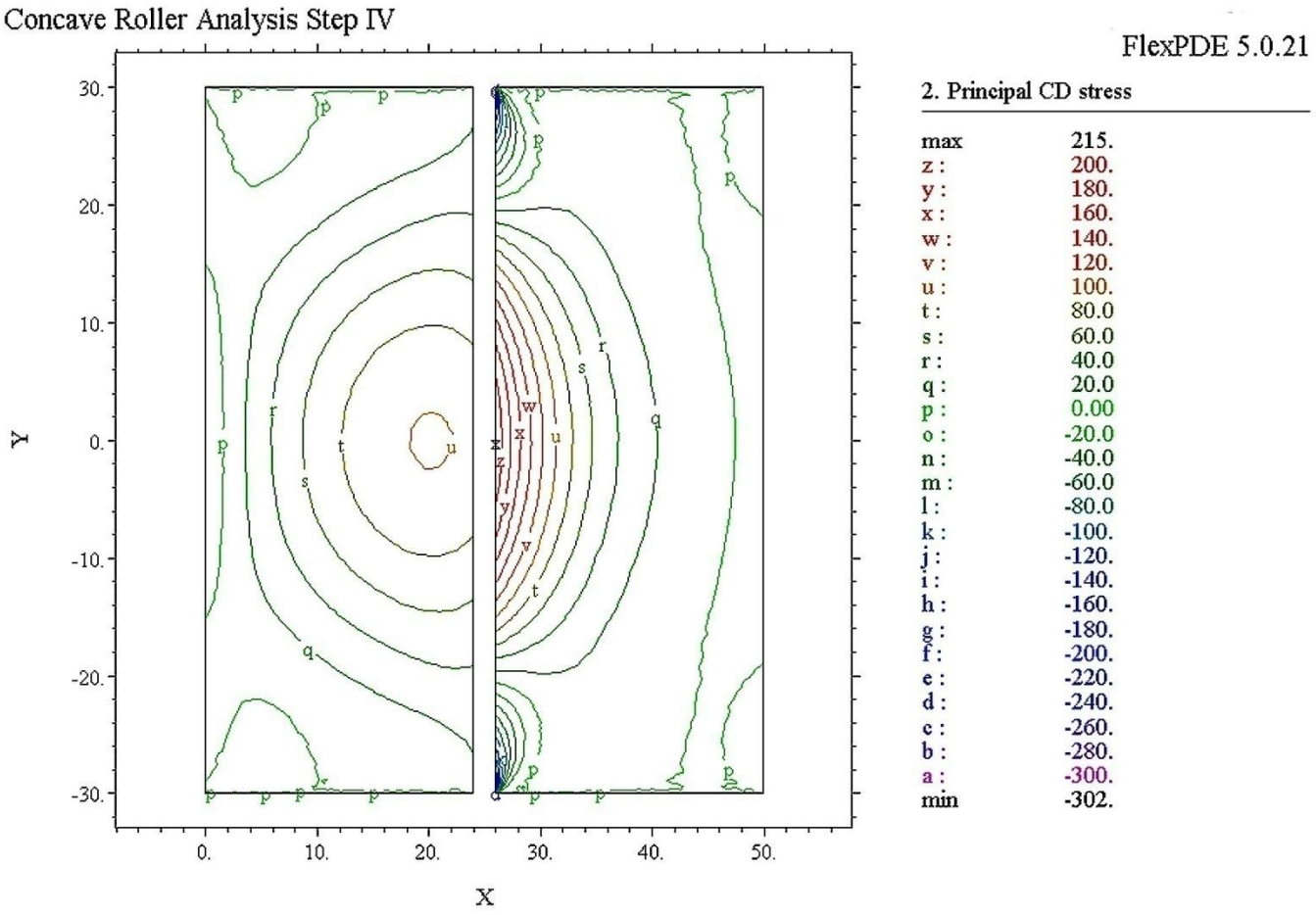
# Stresses at entry to concave roller



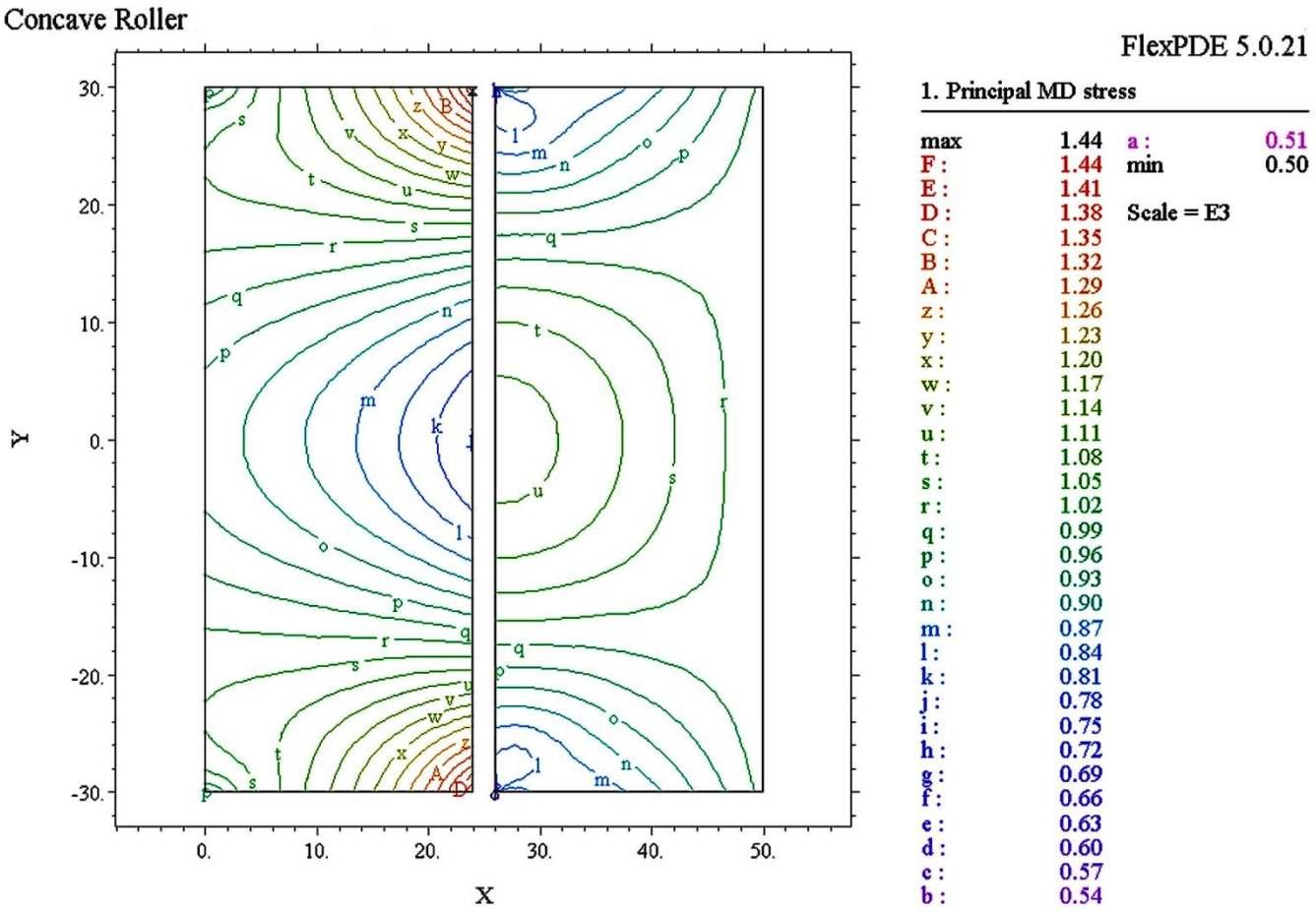
# Stresses at entry to next idler



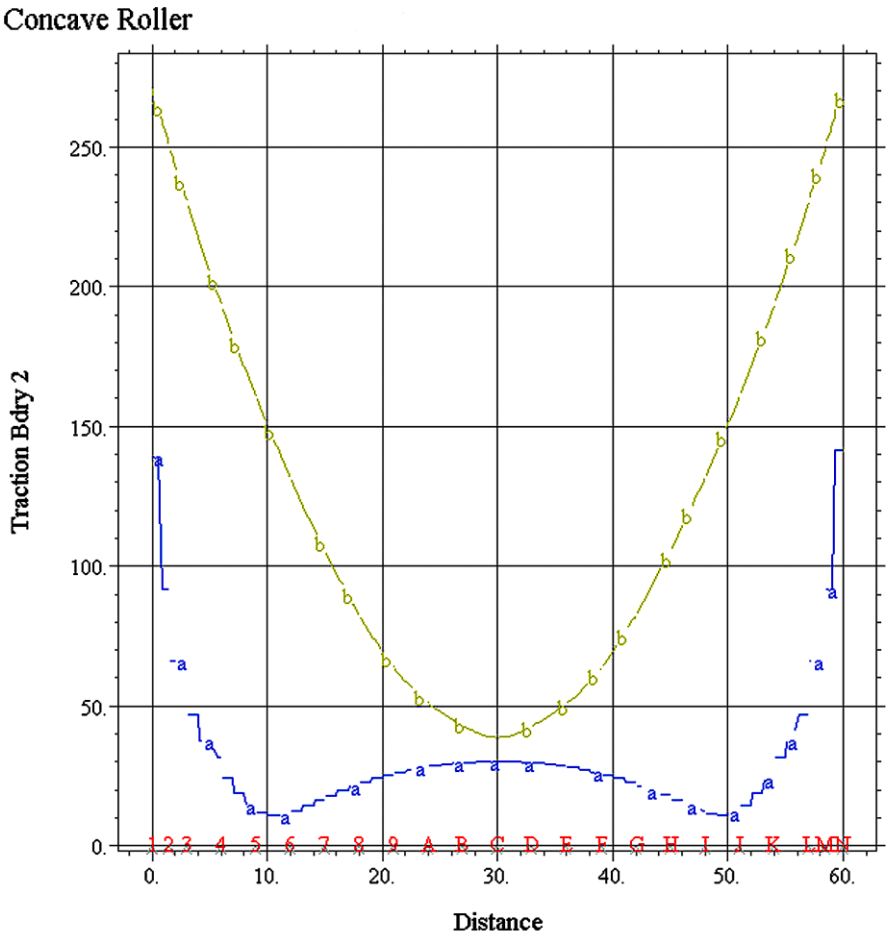
# CD stress pattern in spans



# MD stress pattern in spans



# Traction on concave roller



# Conclusions about concave rollers

- Very stiff materials such as PET require profiles that are of the same magnitude as roller tolerances.
  - For single-purpose lines, running constant width, it may be possible to optimize the profile design to get inside a narrow window of feasibility.
- This type of spreader works best on stretchy materials like polyethylene.

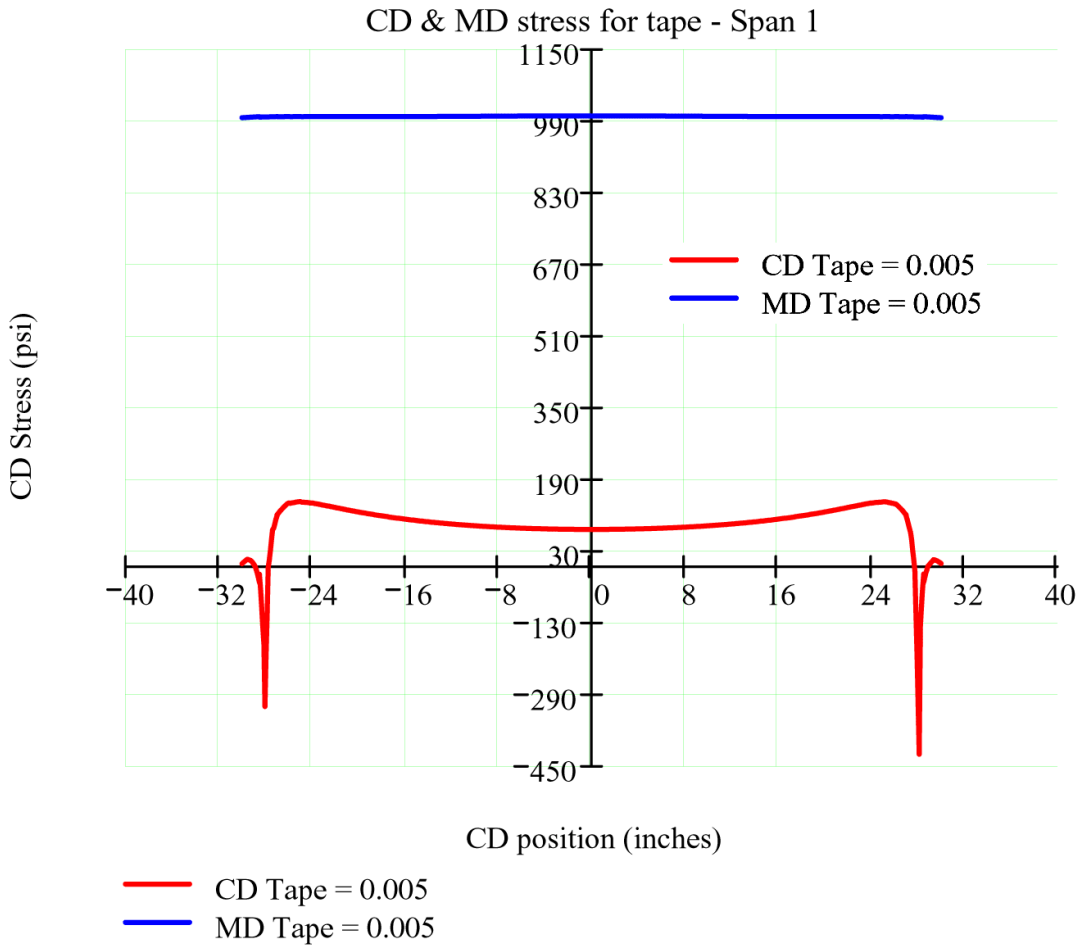
# More on concave rollers

- The benefits of spreading are seen mostly at the spreader roller itself. If concern is spreading downstream, such as entry to a nip, the exit span should be kept very short.

# Tape bumpers

- The next slide will illustrate the effect of using tape bumpers – a band of thin tape applied around the circumference of an idler to produce a stepped profile.
- The next slide shows the effect of a 0.005 inch step on the radius that extends for two inches under each edge of the web.
- Other parameters are the same as in the previous examples.

# Tape bumpers



# General conclusions

- Bowed rollers are very effective spreaders that are theoretically superior to concave rollers. It is unfortunate that they have so many mechanical drawbacks.
  - high turning torque
  - large tolerances on their diameter
  - high maintenance due to bearing wear and flexural fatigue of the covering.
  - Adjustments that open the door to mischief.

# General conclusions

- Concave rollers can be very effective, low-maintenance spreaders if they are designed carefully for the application.
- It is easy to overdo spreading of both types.

# QUESTIONS?

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