

N85-32436

TEMPERATURE-STRESS MODELING

WESTINGHOUSE ELECTRIC CORP.

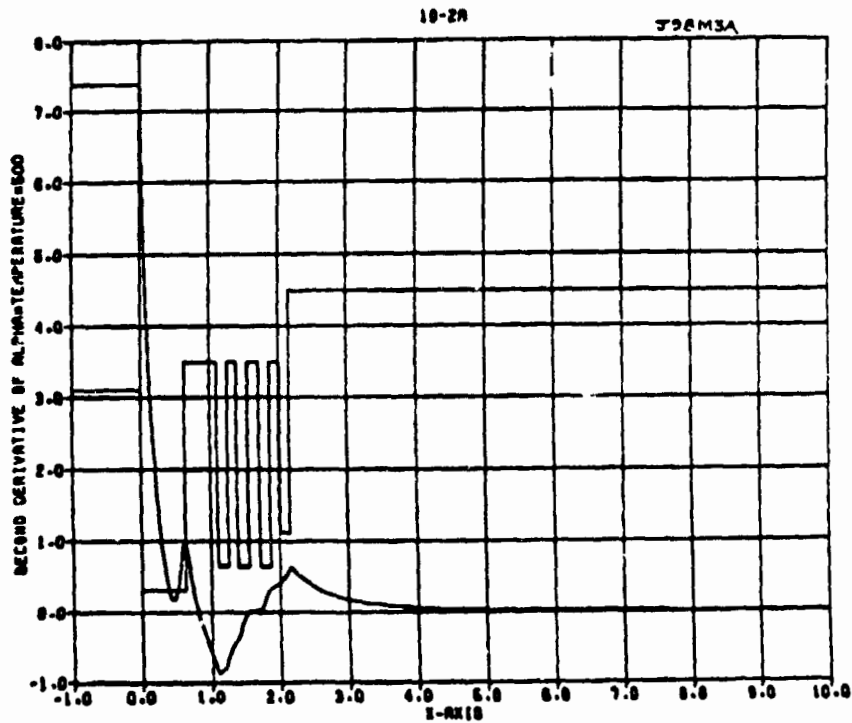
R. Seidensticker

Overall Goals

- Develop Higher Throughput Systems
- Clarify Limitations on Ultimate Throughput

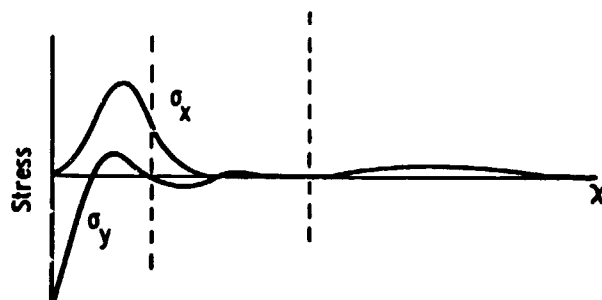
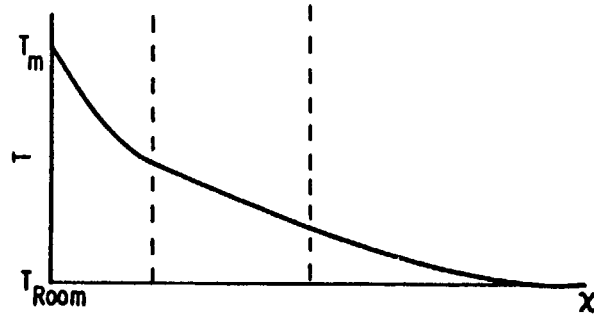
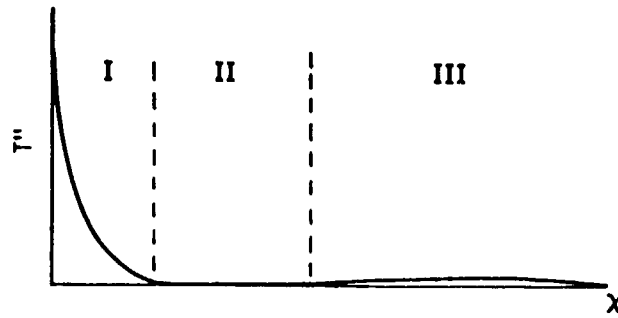
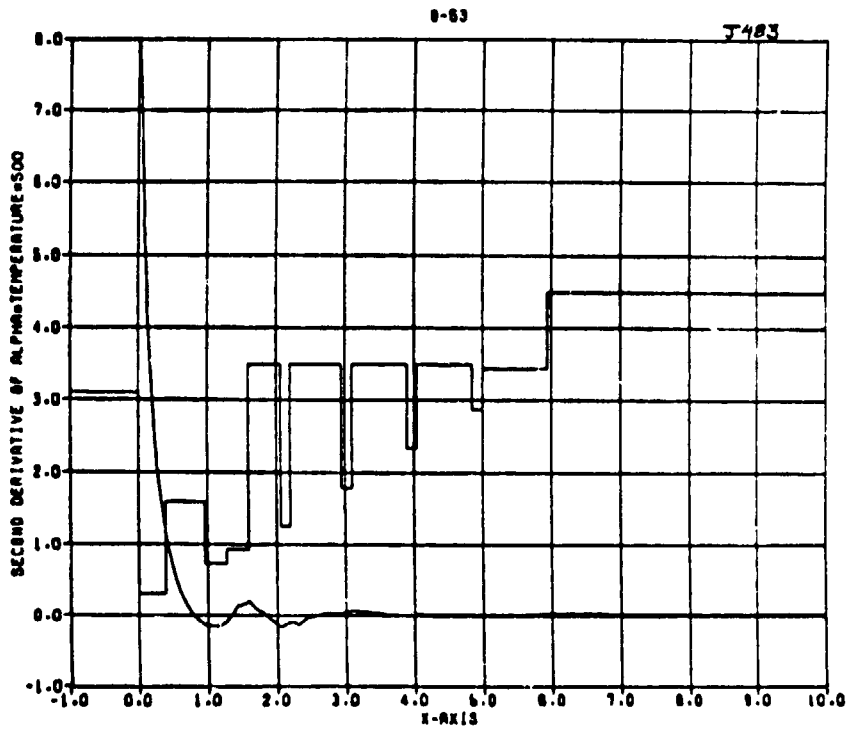
Current Work

- Temperature/Stress Fields near Growth Front
- Effects of Lateral Temperature Gradients



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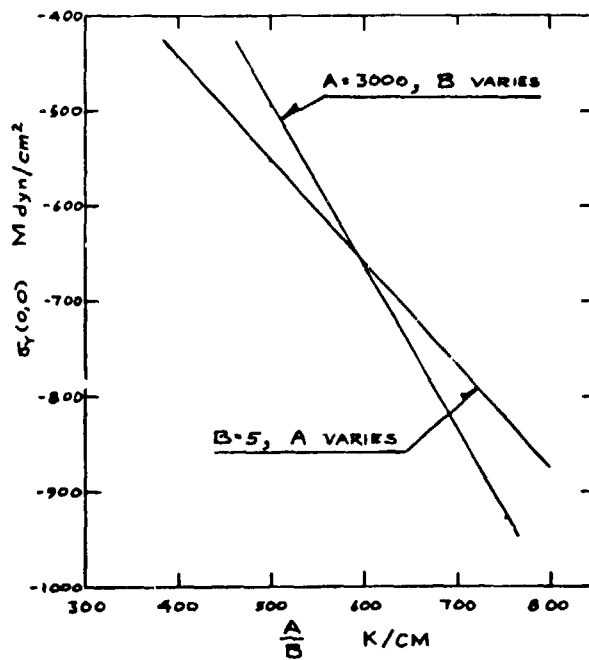


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Dependence of σ_y at Interface on A/B; $w = 1.35$ cm



Stress Fields at Growth Front

Model Representation

$$T(x) = \frac{A}{B^2} \exp(-Bx) + C + D$$

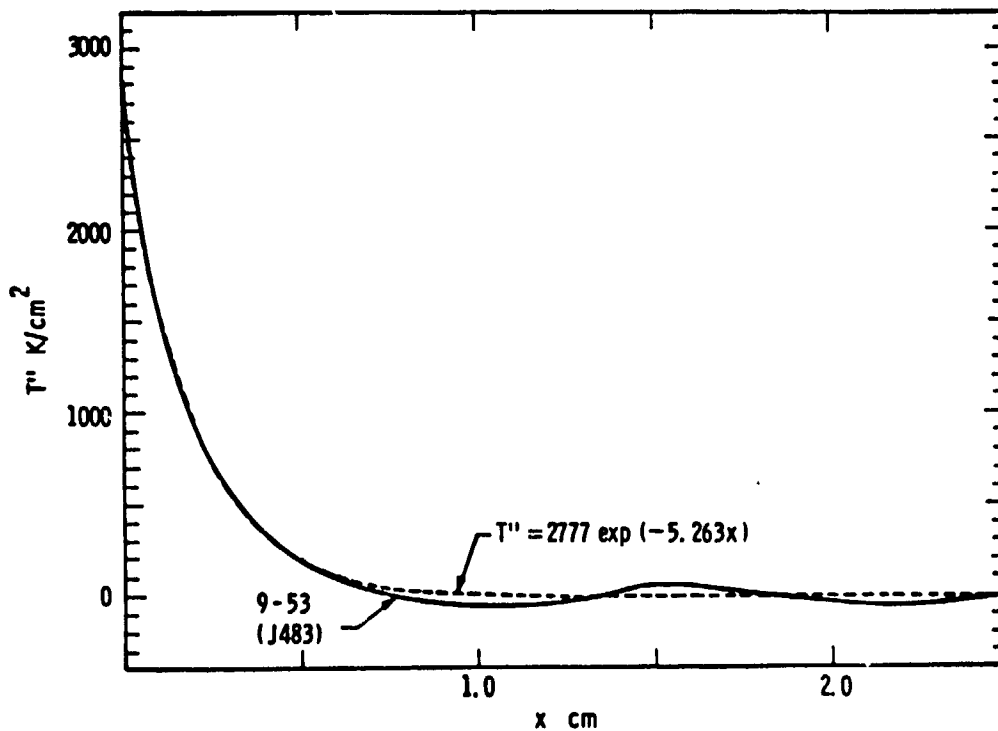
$$T'(x) = -A \exp(-Bx)$$

$$T'(0) = -\frac{A}{B} + C$$

Results:

Stress fields depend on A and B
but not on C and D

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Lateral Temperature Variation

With Dr. R. F. Sekerka

Causes:

1. Variation in thermal environment across width of web
2. Variation in cross section across width of web

Modeling Representation

$$T(x,y) = T(x) g(y)$$

where

$$T(x) = \frac{A}{B^2} \exp(-Bx) + Cx + D$$

and

$$g(y) = \frac{1 + c_n (y/w)^n}{1 + c_n / (n + 1)}$$

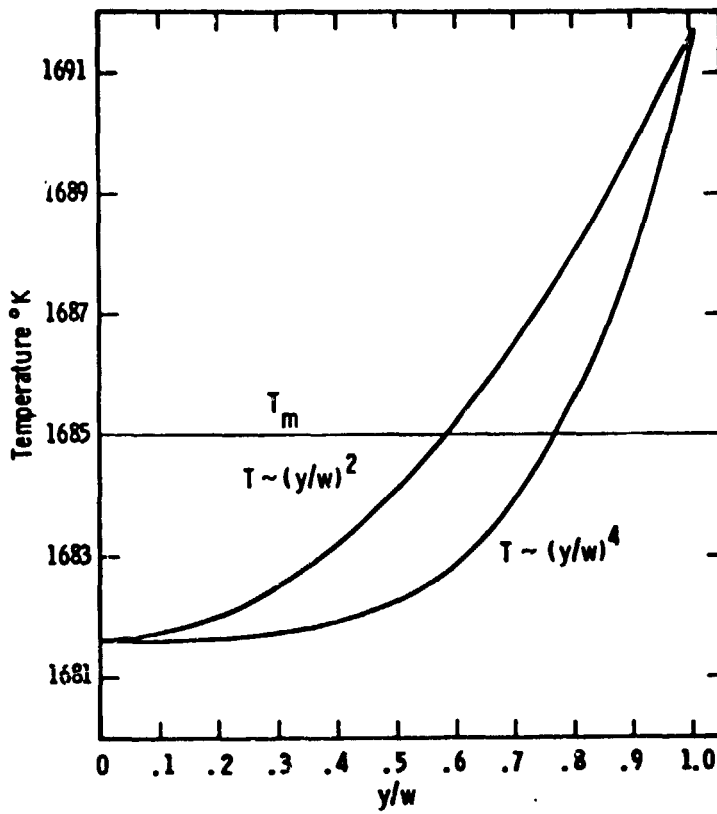
where w = ribbon half width

$c_n > 0$ concave upward (smiling)

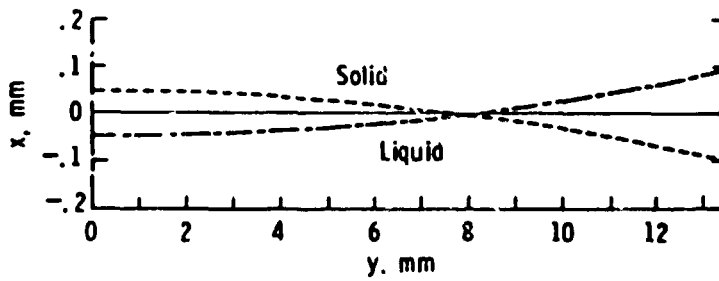
$c_n < 0$ concave downward (frowning)

$n = 2$ quadratic case

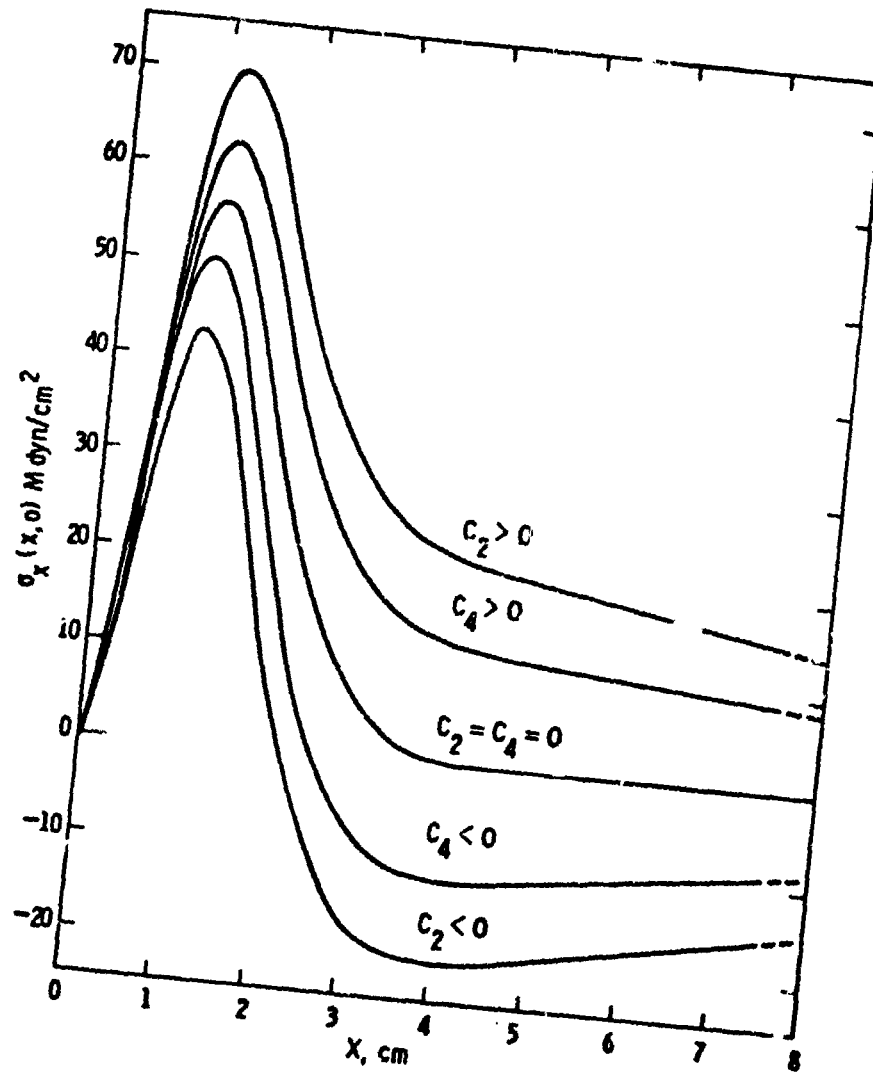
$n = 4$ quartic case



Interface Shape for Curved Isotherms

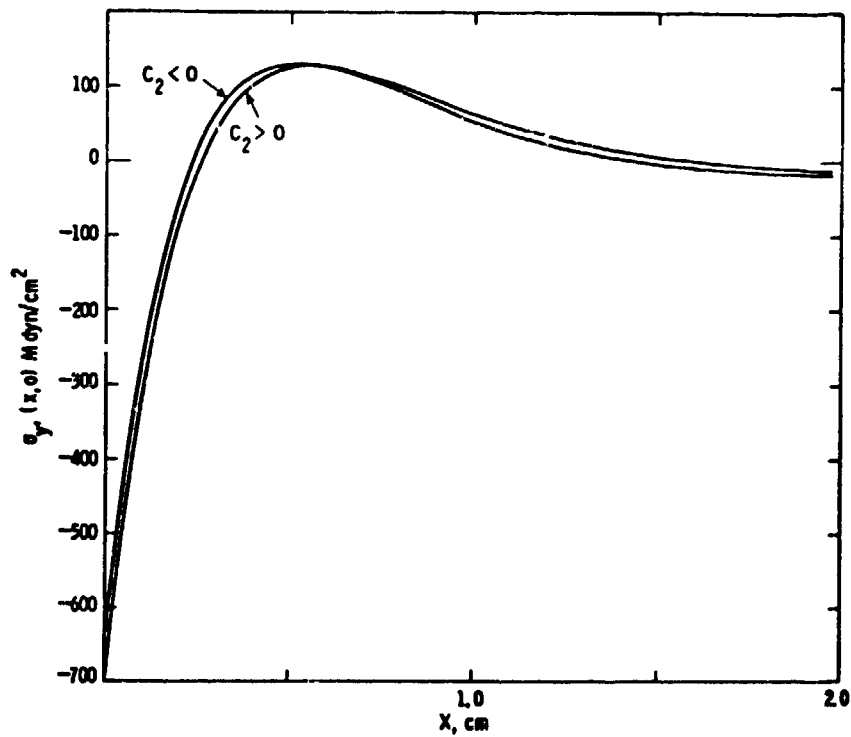
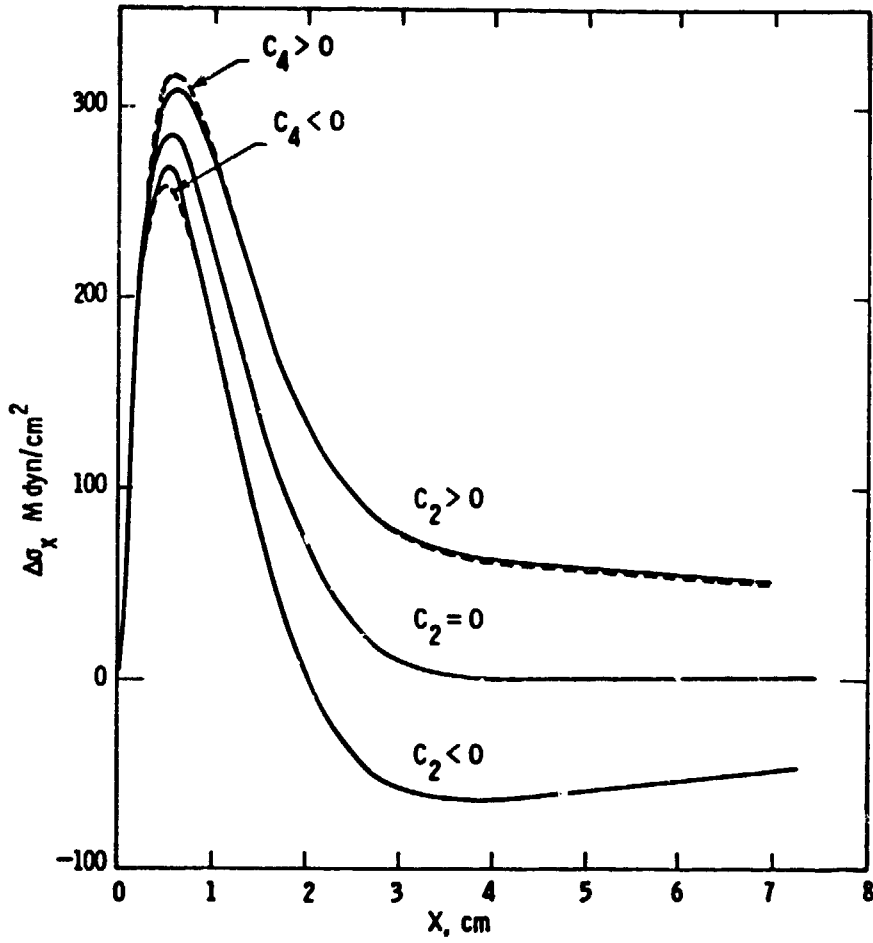


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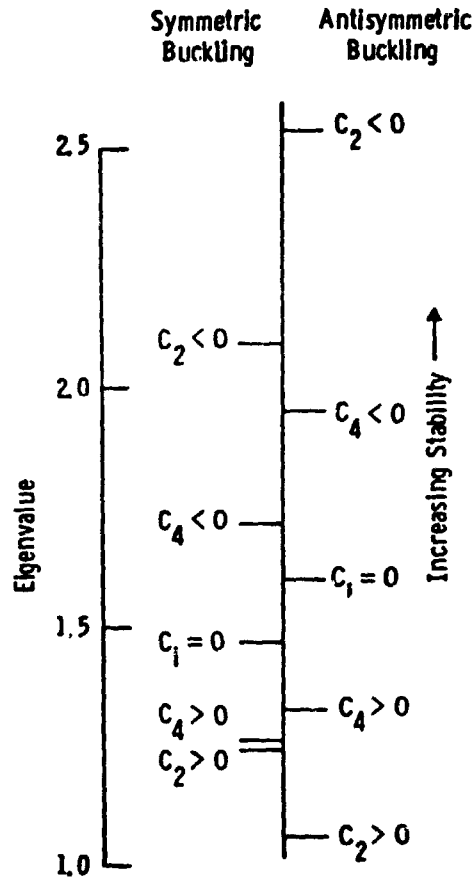


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Lateral Temperature Variation: Summary

"Frowning" Isotherms:

- Inhibit buckling
- Should not affect residual stresses

The J460L configuration has been modified to produce more "frowning" isotherms in the web