

Steel Material Models

Steel_1: Bilinear Steel Model with Isotropic Strain Hardening

INPUT

Steel_1, matID

f_y, E, b

a_1, a_2, a_3, a_4

Definitions:

f_y : yield strength (Fig. 11)

E : Young's modulus (Fig. 11)

$b = E_p/E$: strain hardening ratio (Fig. 11)

a_1 : isotropic hardening parameter, increase of compression yield envelope as proportion of yield strength after a plastic strain of $a_2 \epsilon_y$

a_2 : isotropic hardening parameter (see explanation under a_1)

a_3 : isotropic hardening parameter, increase of tension yield envelope as proportion of yield strength after a plastic strain of $a_4 \epsilon_y$

a_4 : isotropic hardening parameter (see explanation under a_3)

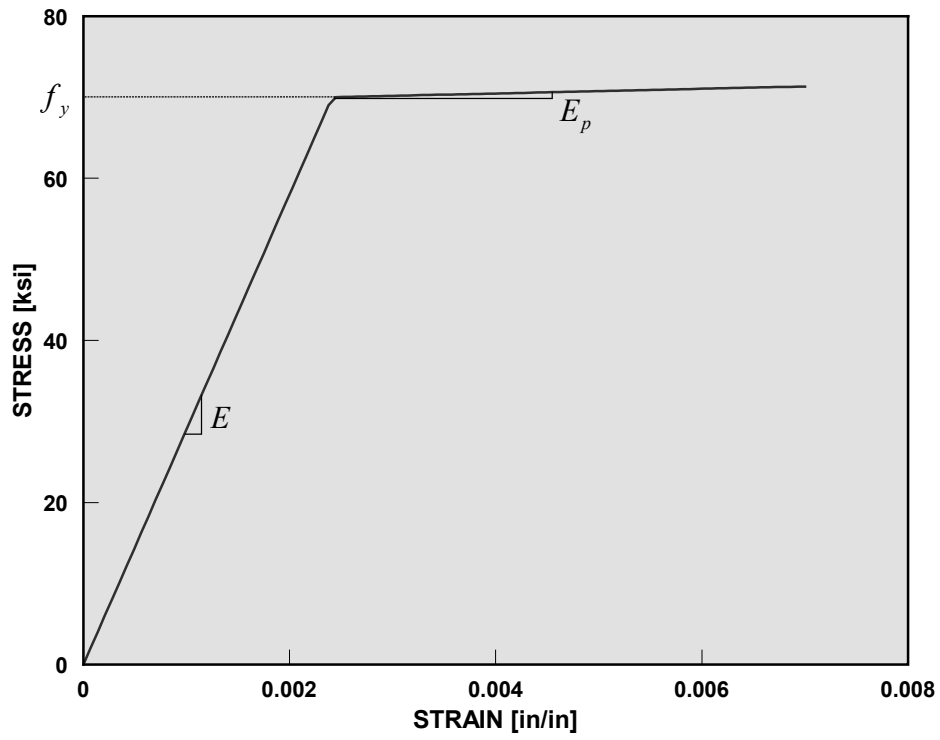


Figure 11. Material Parameters of Monotonic Envelope of Steel_1 Model

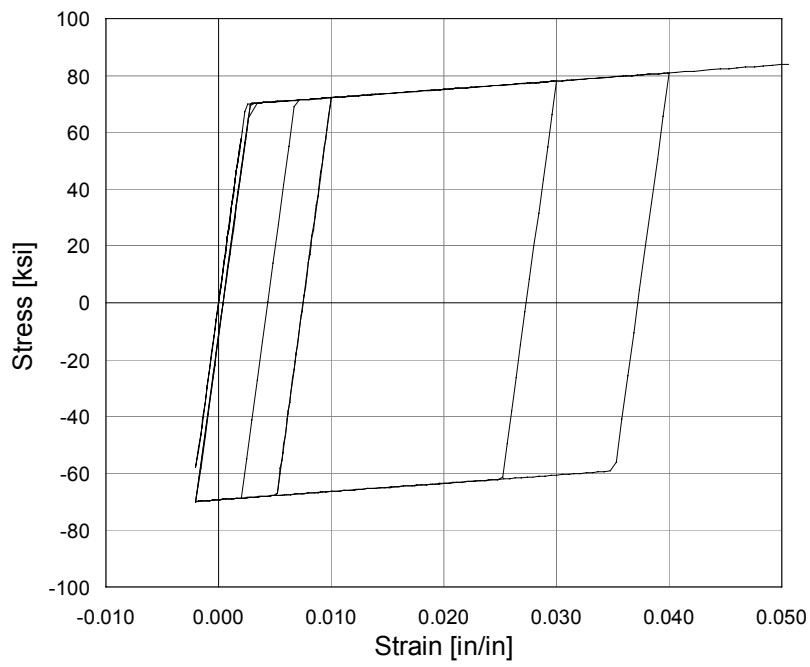


Figure 12. Hysteretic Behavior of Steel_1 Model w/o Isotropic Hardening

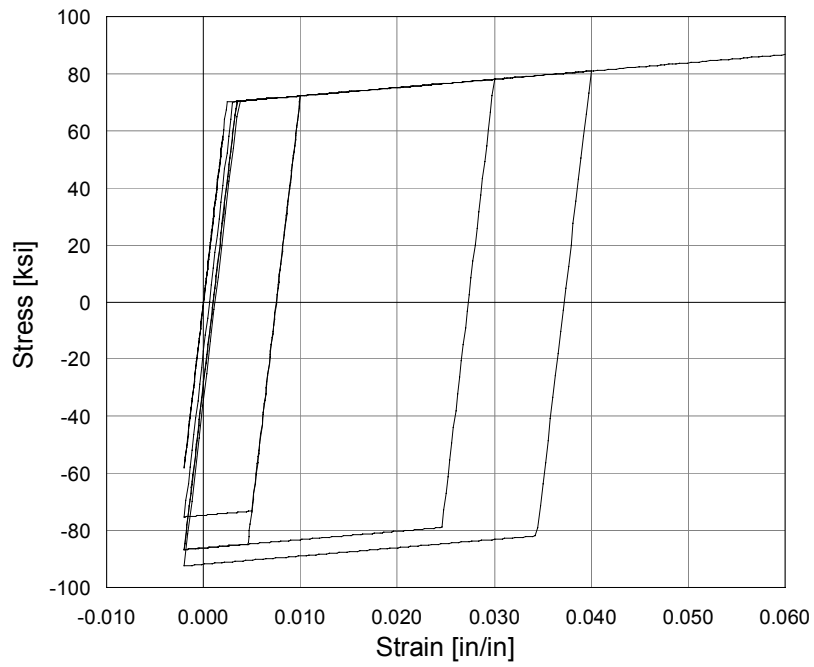


Figure 13. Hysteretic Behavior of Steel_1 Model with Isotropic Hardening in Compression

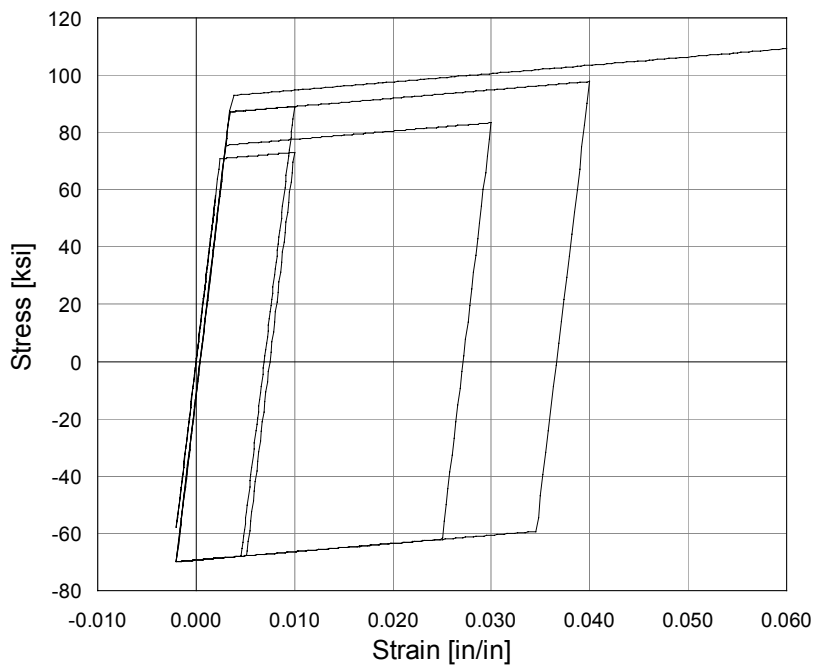


Figure 14. Hysteretic Behavior of Steel_1 Model with Isotropic Hardening in Tension

Steel_2: Giuffr -Menegotto-Pinto Model with Isotropic Strain Hardening

INPUT

STEEL_2, matID
f_y, E, b, R_0, c_1, c_2
a_1, a_2, a_3, a_4

Definitions:

f_y : yield strength (Fig. 15)

E : Young's modulus (Fig. 15)

$b = E_p/E$: strain hardening ratio (Fig. 15)

R : exponent that controls the transition between elastic and hardening branch (suggested values between 10 and 20)

c_1 : parameter for the change of R with cyclic loading history (suggested value 0.925)

c_2 : parameter for the change of R with cyclic loading history (suggested value 0.15)

a_1 : isotropic hardening parameter, increase of compression yield envelope as proportion of yield strength after a plastic strain of $a_2 \epsilon_y$

a_2 : isotropic hardening parameter (see explanation under a_1)

a_3 : isotropic hardening parameter, increase of tension yield envelope as proportion of yield strength after a plastic strain of $a_4 \epsilon_y$

a_4 : isotropic hardening parameter (see explanation under a_3)

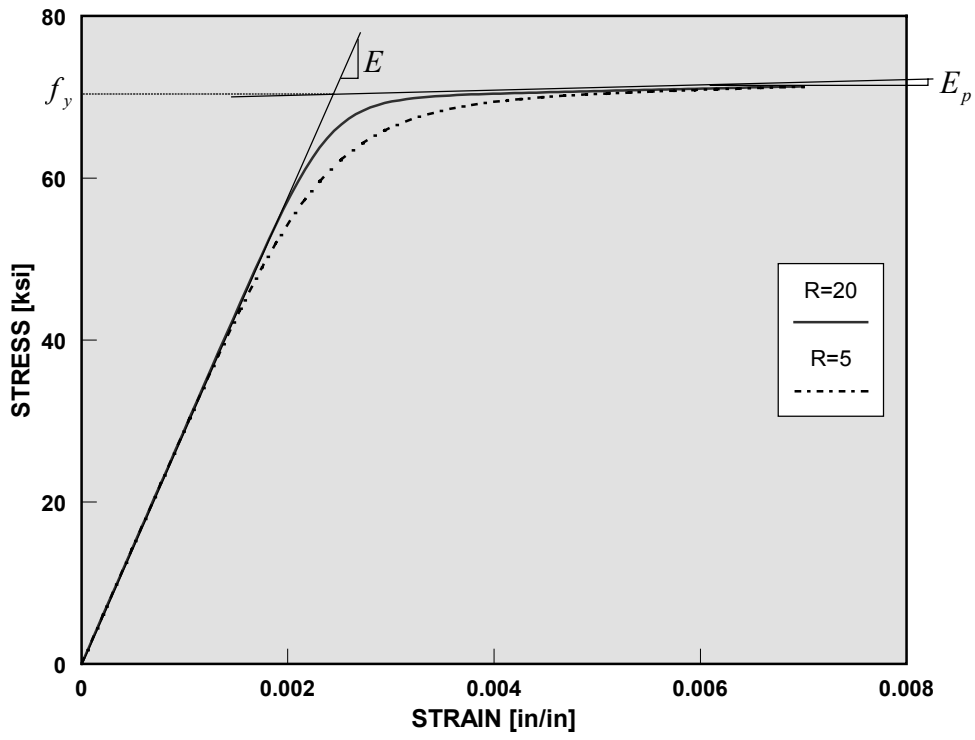


Figure 15. Material Parameters of Monotonic Envelope of Steel_2 Model

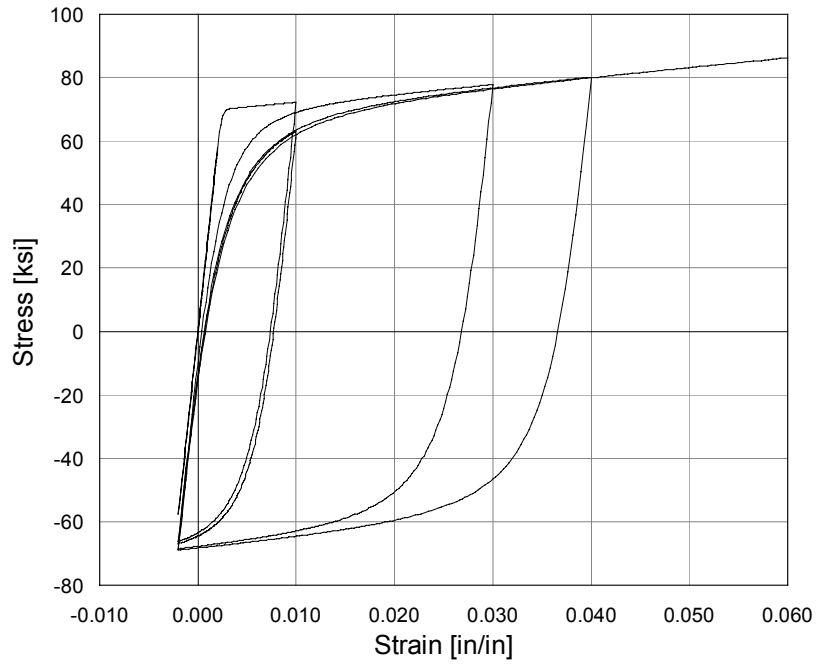


Figure 16. Hysteretic Behavior of Steel_2 Model w/o Isotropic Hardening

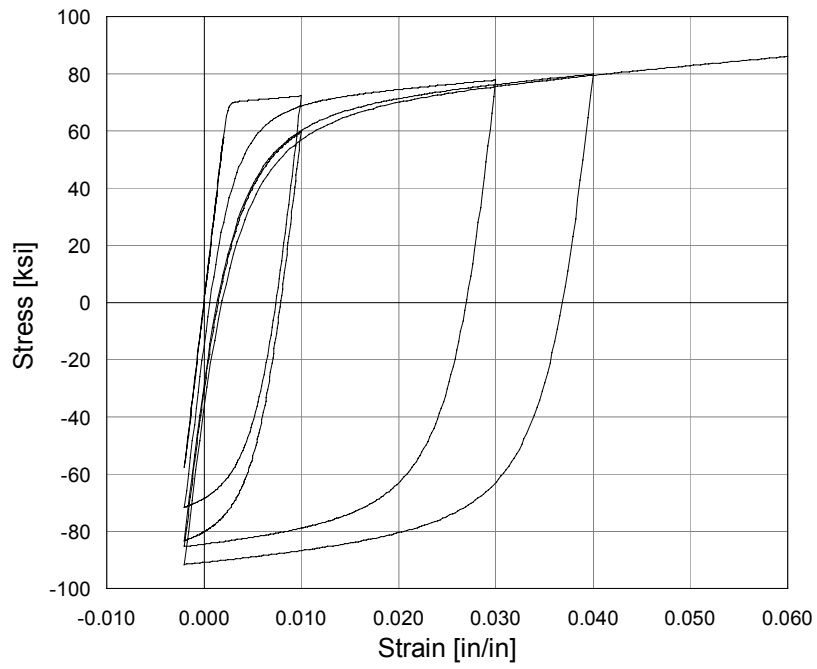


Figure 17. Hysteretic Behavior of Steel_2 Model with Isotropic Hardening in Compression

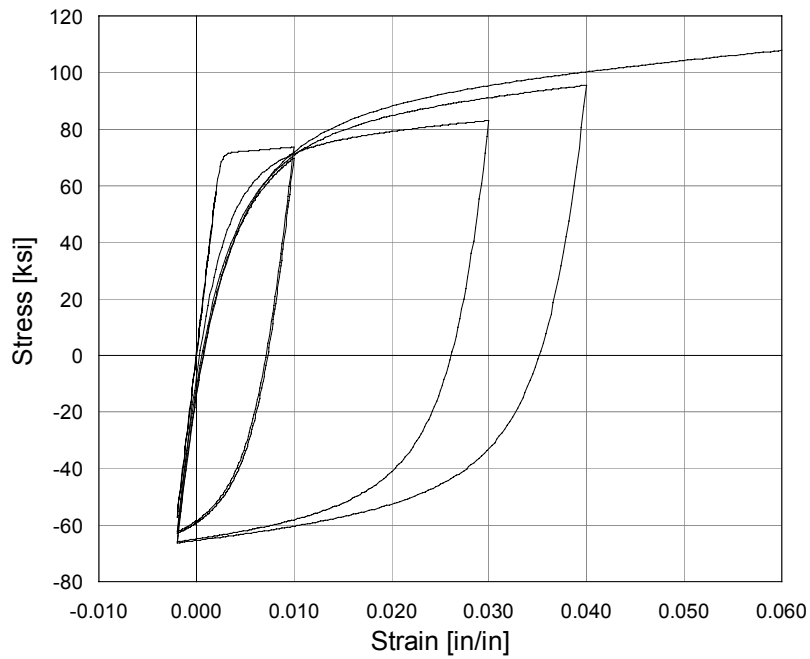


Figure 18. Hysteretic Behavior of Steel_2 Model with Isotropic Hardening in Tension