TOPIC
Materials – Section IX – Question 13

QUESTION
Engineering normal stress is
    (A) always higher than the true stress
    (B) always lower than the true stress
    (C) the same as the true stress in all deformation regimes
    (D) all of the above

HINT
True stress takes into account the sample apparent cross-sectional area during loading.

SOLUTION
True normal stress is defined as the ratio of the load on the sample and the apparent cross-sectional area. Even during elastic deformation the apparent sample cross-sectional area is reduced due to the Poisson's effect, thus the engineering stress, which is the ratio of the load on the sample and the original cross-sectional area, is always lower than the true stress. During elastic and plastic deformation, this difference is rather small, although it cannot be ignored during strain hardening and necking.

ANSWER
(B)

CONTRIBUTOR
Alex Volinsky