

The Per-Unit System

Electrical Engineering

Every quantity as a fraction of a chosen base, so turns ratios drop out.

Per-unit expresses each quantity as a fraction of a chosen base, so transformer ratios disappear.

$$Z_{pu} = Z_{actual}/Z_{base} \cdot Z_{base} = V_{base}^2/S_{base}$$

100 MVA, 11 kV base

$V^2 \div S$.

$Z_{base} = 1.21 \Omega$

A 0.6 Ω line

$0.6 \div 1.21$.

0.496 pu

Changing base

And by $(V_{old}/V_{new})^2$.

Scale by S_{new}/S_{old}

THE COMMON MISTAKE

✗ **Combining impedances quoted on different bases**

✓ **Converting everything to one common base first**

Makers quote transformer impedance on that transformer's own rating, so two machines of different rating are not directly comparable.

Educational reference. Across an ideal transformer the per-unit impedance is identical on both sides — the whole point of the method.