

Steady-State Error

Mechanical Engineering

How many integrators a loop needs to track a step, a ramp or a parabola.

System type is the number of open-loop poles at the origin.

Case	Steady-state error
Type 0, step input	$1 \div (1 + \text{position constant})$
Type 0, ramp input	Infinite: it never catches up
Type 1, step input	Zero
Type 1, ramp input	$1 \div \text{velocity constant}$
Type 2, ramp input	Zero
Type 2, parabola input	$1 \div \text{acceleration constant}$

Each integrator removes one order of error and costs 90 degrees of phase. That is the whole trade.