LE2.1.1: Analog signaling

4/4 points (ungraded)

Consider an analog image processing system built entirely from COPY blocks, which when given V volts on their input are designed to produce V volts on their output. Armo, an inexpensive brand of COPY blocks, comes close to meeting the specification, but produces an output with up to a 1% error. So for a V volt input, an Armo COPY block will produce an output voltage in the range $0.99 \cdot V$ to $1.01 \cdot V$.

If an Armo COPY block has an input of 0.5 volts, what are the smallest and largest voltages we might measure on its output? Please give a numeric answer to the nearest .001 volt.

Smallest output voltage (volts): | 0.495 | ✔ Answer: .495

Largest output voltage (volts): | 0.505 | ✔ Answer: .505

Explanation
Smallest voltage = 0.99 ∗ 0.5, largest voltage = 1.01 ∗ 0.5

Now consider a system that uses 50 Armo COPY blocks connected in series, i.e., the output of one block is connected to the input of the next block. If a signal of 0.5 volts is input to the first block in the series, what is the range of voltages we might measure on the output of the fiftieth block? Please give a numeric answer to the nearest .001 volt. Hint: the answer is *not* simply an increase or decrease of $0.01 \cdot 0.5 \cdot 50$ volts.

Smallest output voltage (volts): | 0.3025030335687682 | ✔ Answer: .303

Largest output voltage (volts): | 0.8223159109219413 | ✔ Answer: .822

Explanation
The errors compound, i.e., the second block's error is calculated using the already corrupted output of the first block, not the nominal input voltage of 0.5 volts. Smallest voltage = (0.99^50) * 0.5, largest voltage = (1.01^50) * 0.5

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