

Convolution

Electrical Engineering

Flip, shift, multiply, integrate — the graphical method in order.

The overlap region changes as the shift moves, so the answer is piecewise.

1 Rewrite both in τ

Rename the variable so the shift parameter t is left free to move.

2 Flip one signal

Reflect $h(\tau)$ about the origin to get $h(-\tau)$. Flip the simpler of the two.

3 Shift it by t

$h(t - \tau)$ slides across $x(\tau)$ as t runs from far negative to far positive.

4 Multiply and integrate

For each t , integrate the product across the overlapping region only.

5 Collect the regions

Each new overlap geometry gives a new piece of the final expression.

Durations add: convolving a 3 ms pulse with a 5 ms response gives an 8 ms output. That is a fast sanity check.