Bouhadjar 2023 paper - Analog Synapse

Considering $G_{max} = 50\mu s$, $G_{min} = 10\mu s$.

Run = 0 — Initial State

A→B	$G = 10\mu s$	
A→E	$G = 10\mu s$	
A→D	$G = 10\mu s$.	

Run = 1

T = 0ms (input A fires)

A→B	$G = 10-1 = 9 \simeq$ clipped to $10\mu s$	
A→E	$G = 10-1 = 9 \simeq 10\mu s$	
A→D	$G = 10-1 = 9 \simeq 10\mu s$	

T = 40ms (input B fires)

A→B	$G = 10+5 = 15\mu s$	
A→E	$G = 10\mu s$	
A→D	$G = 10\mu s$	
B→C	$G = 10-1 = 9\mu s \simeq 10\mu s$.	

T = 80ms (input C fires)

A→B	$G = 15\mu s$	
A→E	$G = 10\mu s$	
A→D	$G = 10\mu s$	
B→C	$G = 10+5 = 15\mu s$	
C→F		

Run = 2

T = 180ms (input A fires)

A→B	$G = 15-1 = 14\mu s$	
A→E	$G = 10-1 = 9\mu s \simeq 10\mu s$	
A→D	$G = 10-1 = 9\mu s \simeq 10\mu s$	

[after ΔT_{refrac} = 100ms]

T = 220ms (input B fires)

A→B	$G = 14+5 = 19\mu s$	
A→E	$G = 10\mu s$	
A→D	$G = 10\mu s$	
B→C	$G = 15-1 = 14\mu s$	

T = 260ms (input C fired)

A→B	$G = 19\mu s$	
A→E	$G = 10$	
A→D	$G = 10$	
B→C	$G = 14+5 = 19\mu s$	
C→F	$G = 10-1 = 9 \simeq 10\mu s$.	

Run 3

T = 360ms	A→B	$G = 19-1 = 18\mu s$
	B→C	$G = 19\mu s$
T = 400ms	A→B	$G = 18+5 = 23\mu s$
	B→C	$G = 19-1 = 18\mu s$
T = 440ms	A→B	$G = 23\mu s$
	B→C	$G = 18+5 = 23\mu s$.

Run 4

T = 540ms	A→B	$G = 23-1 = 22\mu s$
	B→C	$G = 23\mu s$
T = 580ms	A→B	$G = 22+5 = 27\mu s$
	B→C	$G = 23-1 = 22\mu s$
T = 620ms	A→B	$G = 27\mu s$
	B→C	$G = 22+5 = 27\mu s$.

Run 5

T = 720ms	A→B	$G = 27-1 = 26\mu s$
	B→C	$G = 27\mu s$
T = 760ms	A→B	$G = 26+5 = 31\mu s$
	B→C	$G = 27-1 = 26\mu s$
T = 800ms	A→B	$G = 31\mu s$
	B→C	$G = 26+5 = 31\mu s$

Run 6

T = 900ms	A→B	$G = 31-1 = 30\mu s$
	B→C	$G = 31\mu s$
T = 940ms	A→B	$G = 30+5 = 35\mu s$
	B→C	$G = 31-1 = 30\mu s$
T = 980ms	A→B	$G = 35\mu s$
	B→C	$G = 30+5 = 35\mu s$

Run 7

T = 1080ms	A→B	$G = 34\mu s$
	B→C	$G = 35\mu s$
T = 1120ms	A→B	$G = 39\mu s$
	B→C	$G = 34\mu s$
T = 1160ms	A→B	$G = 39\mu s$
	B→C	$G = 39\mu s$

Run 8

T = 1260ms	A→B	$G = 38\mu s$
	B→C	$G = 39\mu s$
T = 1300ms	A→B	$G = 43\mu s$
	B→C	$G = 38\mu s$
T = 1340ms	A→B	$G = 43\mu s$
	B→C	$G = 43\mu s$

Run 9

T = 1440ms	A→B	$G = 42\mu s$
	B→C	$G = 43\mu s$
T = 1480ms	A→B	$G = 47\mu s$
	B→C	$G = 42\mu s$
T = 1520ms	A→B	$G = 47\mu s$
	B→C	$G = 47\mu s$

Run 10

T = 1620ms	A→B	$G = 46\mu s$
	B→C	$G = 47\mu s$
T = 1660ms.	A→B	$G = 51\mu s$
	B→C	$G = 46\mu s$
T = 1700ms	A→B	$G = 51\mu s \simeq 50\mu s$
	B→C	$G = 51\mu s \simeq 50\mu s$

Run 11

T = 1800ms	A→B	$G = 50-1 = 49\mu s$
	B→C	$G = 50\mu s$
T = 1840ms.	A→B	$G = 49+5 = 54\mu s \simeq 50\mu s$
	B→C	$G = 49\mu s$
T = 1880ms	A→B	$G = 50\mu s$
	B→C	$G = 49+5 = 54 = 50\mu s$.

Run 12

T = 1980ms	A→B	$G = 49\mu s$
	B→C	$G = 50\mu s$
T = 2020ms.	A→B	$G = 49+5 = 54 \simeq 50\mu s$
	B→C	$G = 49\mu s$
T = 2060ms	A→B	$G = 50\mu s$
	B→C	$G = 49+5 = 54 \simeq 50\mu s$.

In the analog model, the "STRONG" connection isn't a flip but gradual increment until it hits G_{max}. Then the value just wobbles between 49 to 50μs but cannot go beyond G_{max}. Hence remains saturated ⇒ "STRONG" connection.