Results of tests

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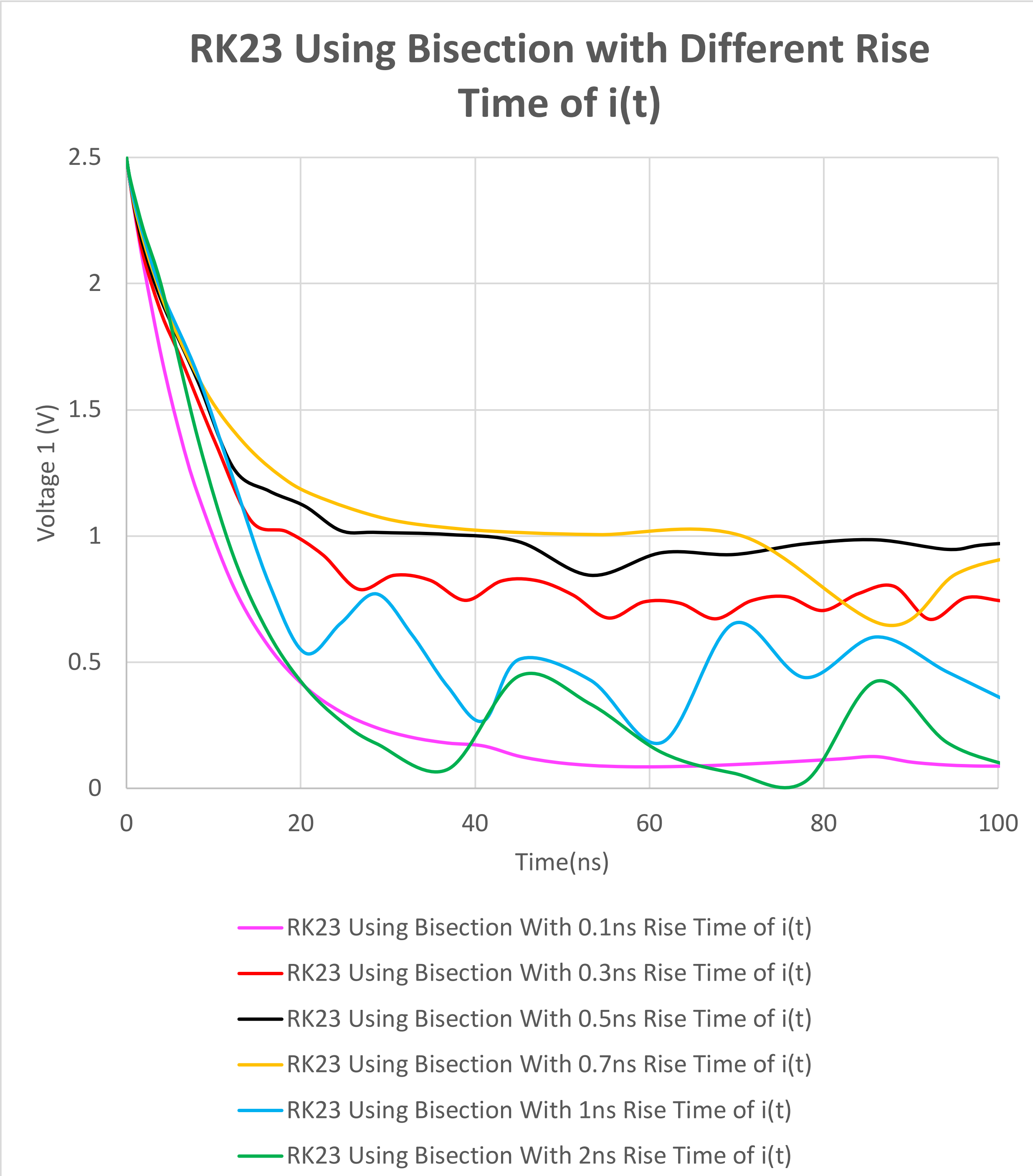
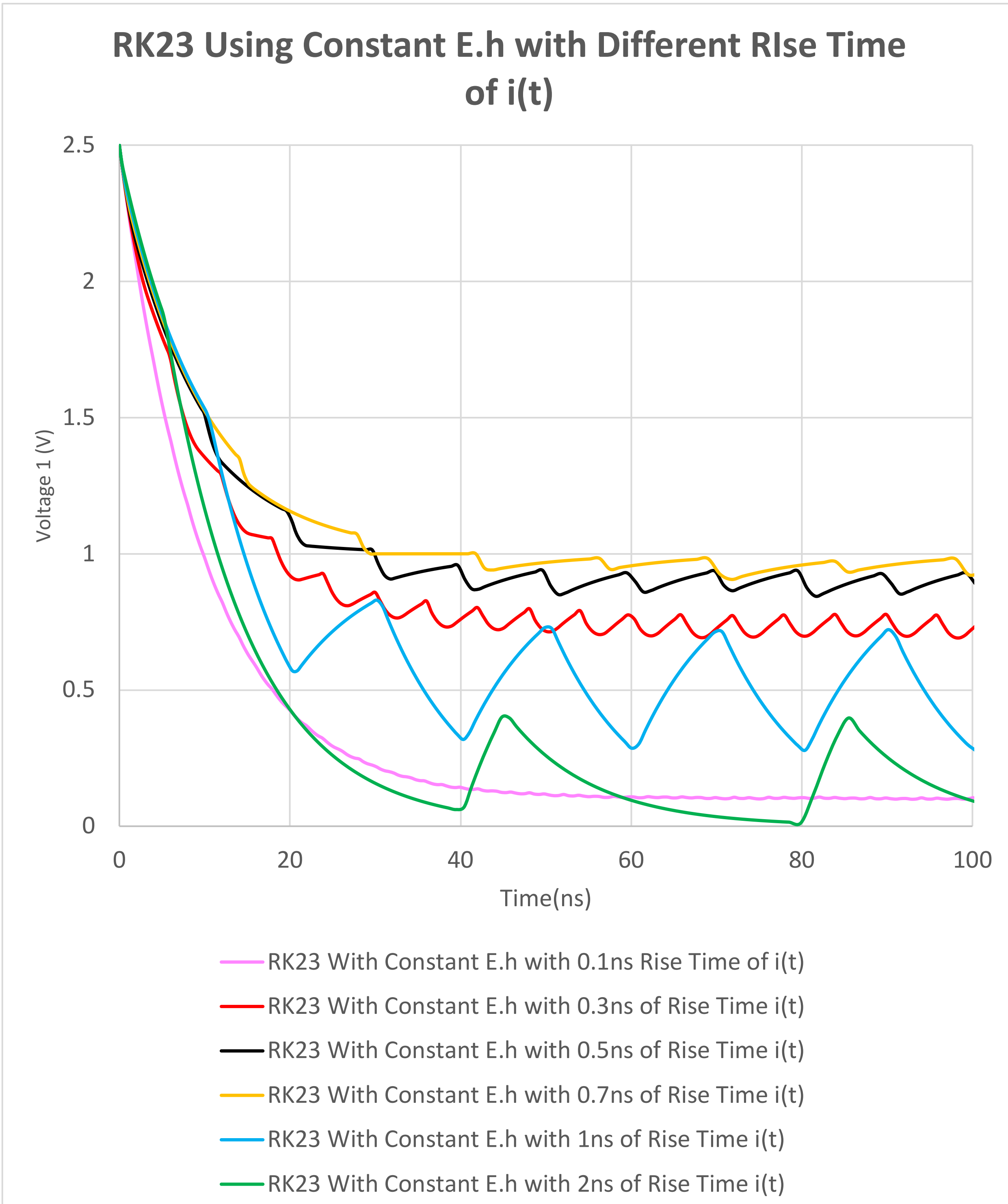
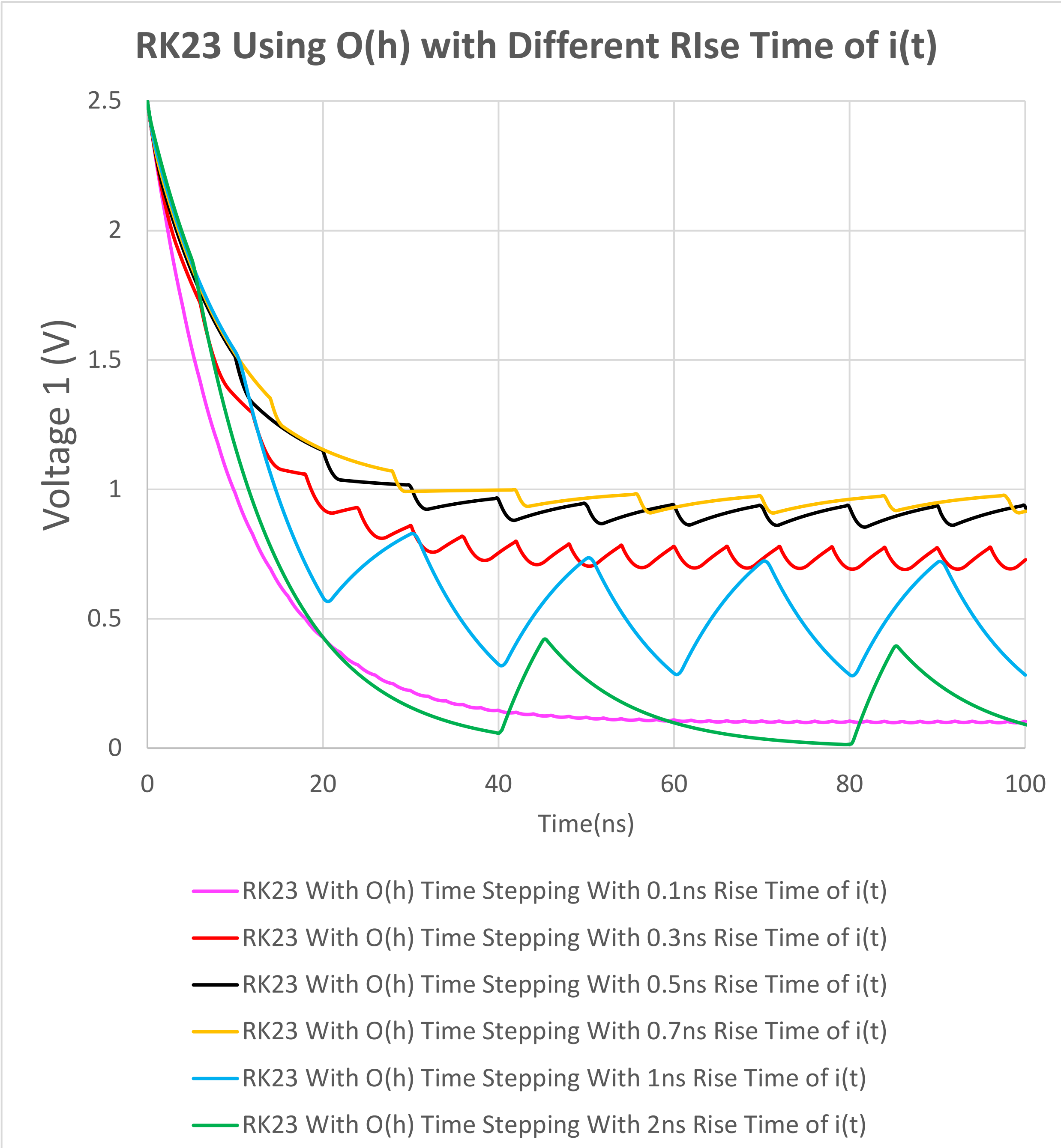
The motive of the project was to understand the effects of RK23 and RK34 and the different time stepping methods and how they work with stiff equations in case of CS Amplifiers. The stiff equation situation is reached when the frequency of i(t) is close to cut-off frequency.

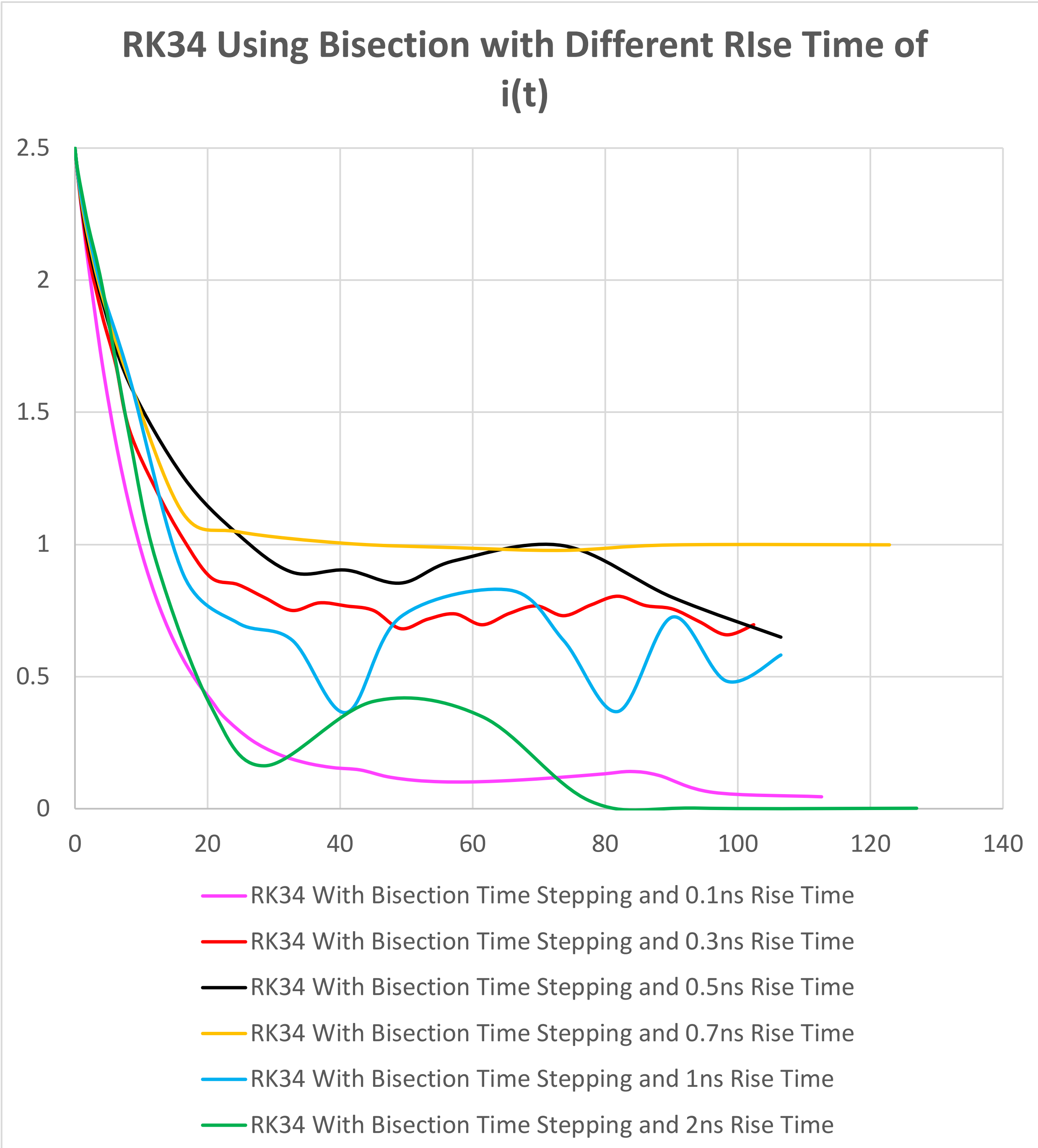
The following graph shows how the different time stepping methods work at different frequencies of i(t).

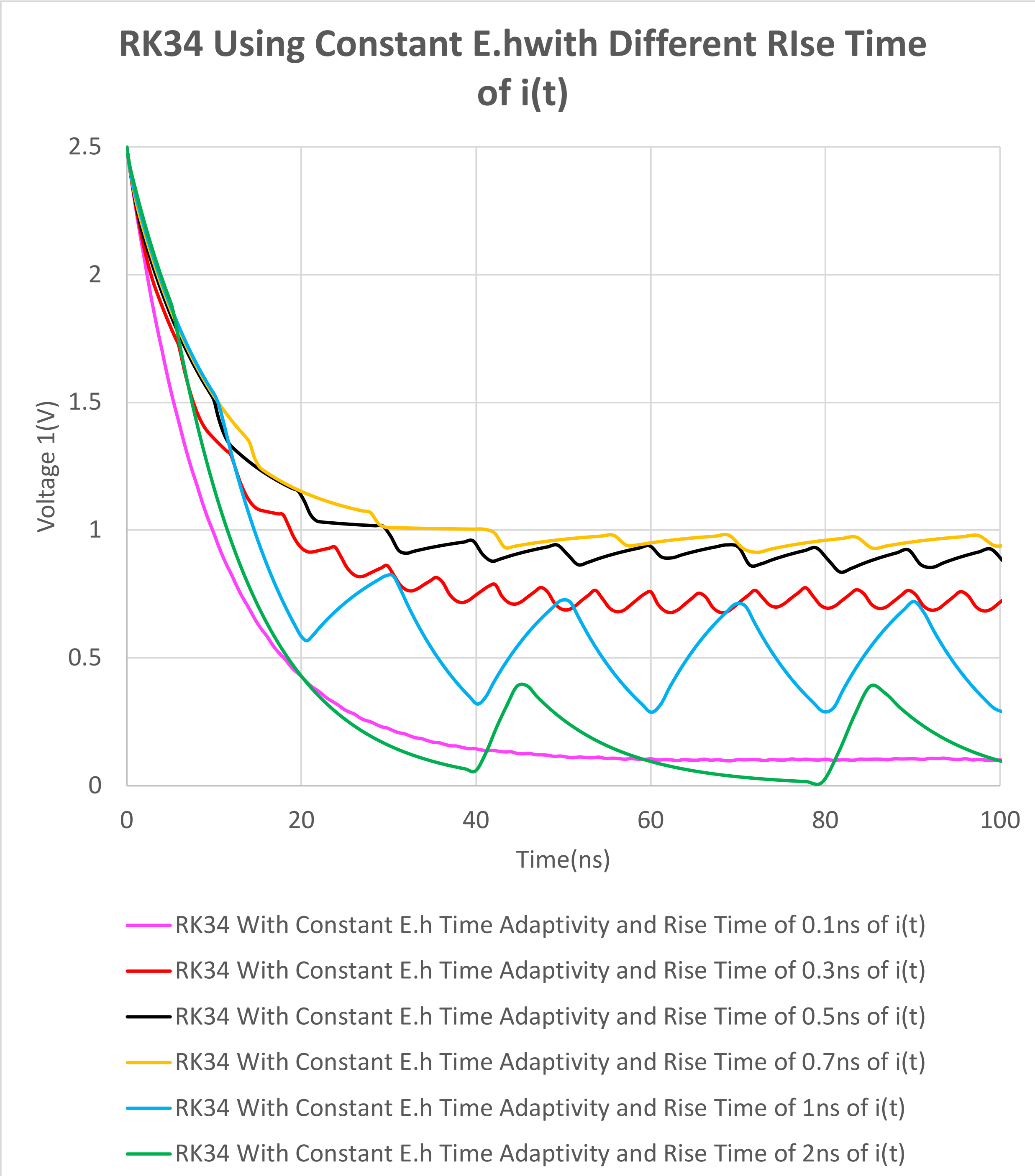
i(t) is change proportionally. This means that if rise time was 1ns and then the signal stayed up for 9ns, then it was changed to 0.1ns rise time and time it was up was 0.9ns.

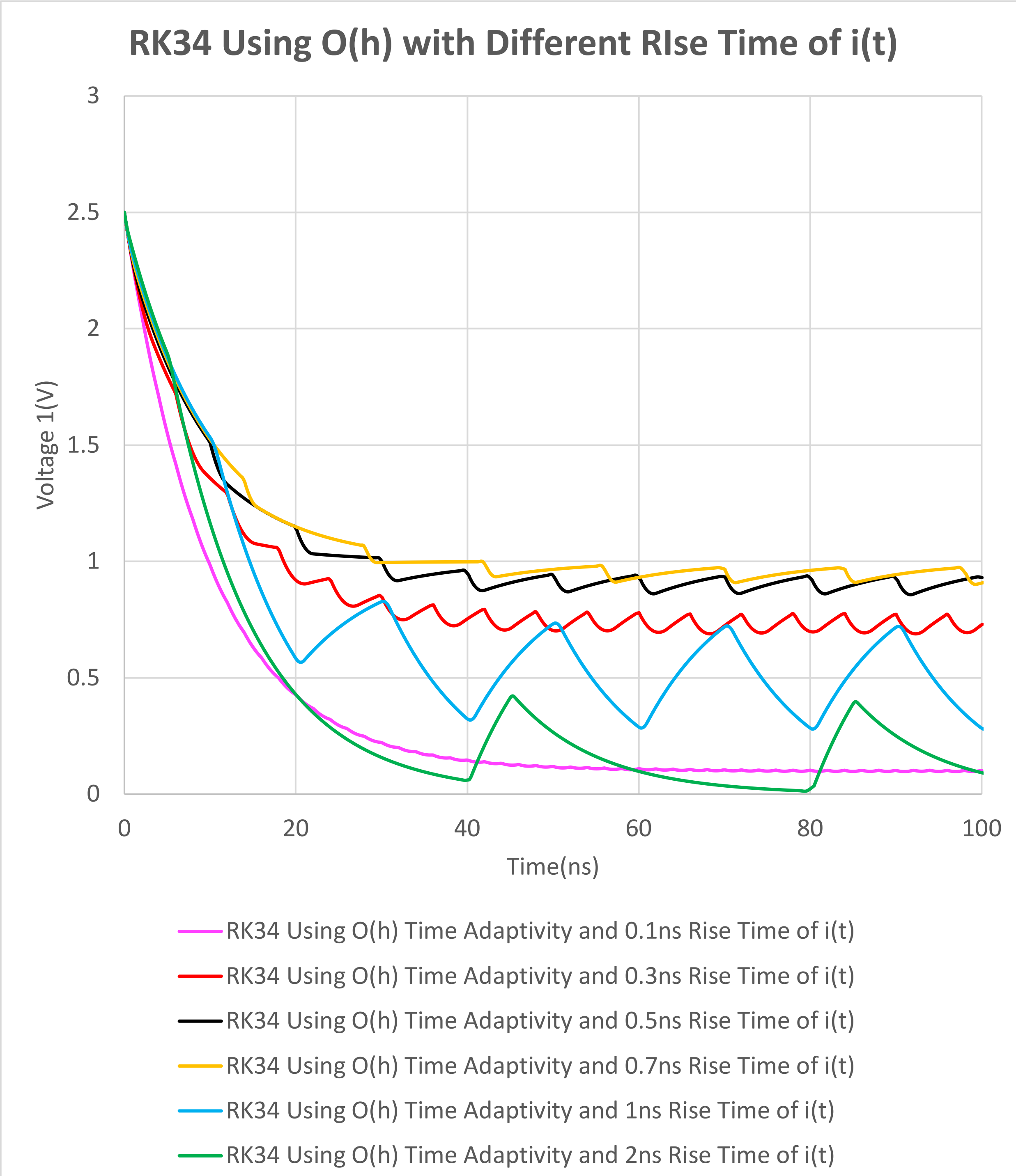

RK23 Using Bisection with Different Rise Time of i(t)
2.5
2
1.5
1
0.5
0
Voltage 1 (V)
0
20
40
60
80
100
Time(ns)
RK23 Using Bisection With 0.1ns Rise Time of i(t)
RK23 Using Bisection With 0.3ns Rise Time of i(t)
RK23 Using Bisection With 0.5ns Rise Time of i(t)
RK23 Using Bisection With 0.7ns Rise Time of i(t)
RK23 Using Bisection With 1ns Rise Time of i(t)
RK23 Using Bisection With 2ns Rise Time of i(t)


RK23 Using Constant E.h with Different RIse Time of i(t)
2.5
2
1.5
1
0.5
0
Voltage 1 (V)
0
20
40
60
80
100
Time(ns)
RK23 With Constant E.h with 0.1ns Rise Time of i(t)
RK23 With Constant E.h with 0.3ns of Rise Time i(t)
RK23 With Constant E.h with 0.5ns of Rise Time i(t)
RK23 With Constant E.h with 0.7ns of Rise Time i(t)
RK23 With Constant E.h with 1ns of Rise Time i(t)
RK23 With Constant E.h with 2ns of Rise Time i(t)


RK23 Using O(h) with Different RIse Time of i(t)
Voltage 1 (V)
2.5
2
1.5
1
0.5
0
0
20
40
60
80
100
Time(ns)
RK23 With O(h) Time Stepping With 0.1ns Rise Time of i(t)
RK23 With O(h) Time Stepping With 0.3ns Rise Time of i(t)
RK23 With O(h) Time Stepping With 0.5ns Rise Time of i(t)
RK23 With O(h) Time Stepping With 0.7ns Rise Time of i(t)
RK23 With O(h) Time Stepping With 1ns Rise Time of i(t)
RK23 With O(h) Time Stepping With 2ns Rise Time of i(t)


RK34 Using Bisection with Different RIse Time of i(t)
2.5
2
1.5
1
0.5
0
0
20
40
60
80
100
120
140
RK34 With Bisection Time Stepping and 0.1ns Rise Time
RK34 With Bisection Time Stepping and 0.3ns Rise Time
RK34 With Bisection Time Stepping and 0.5ns Rise Time
RK34 With Bisection Time Stepping and 0.7ns Rise Time
RK34 With Bisection Time Stepping and 1ns Rise Time
RK34 With Bisection Time Stepping and 2ns Rise Time


RK34 Using Constant E.hwith Different RIse Time of i(t)
Voltage 1(V)
2.5
2
1.5
1
0.5
0
0
20
40
60
80
100
Time(ns)
RK34 With Constant E.h Time Adaptivity and Rise Time of 0.1ns of i(t)
RK34 With Constant E.h Time Adaptivity and Rise Time of 0.3ns of i(t)
RK34 With Constant E.h Time Adaptivity and Rise Time of 0.5ns of i(t)
RK34 With Constant E.h Time Adaptivity and Rise Time of 0.7ns of i(t)
RK34 With Constant E.h Time Adaptivity and Rise Time of 1ns of i(t)
RK34 With Constant E.h Time Adaptivity and Rise Time of 2ns of i(t)



From the Graphs above, it can be clearly seen that Constant E.h and O(h) Time stepping methods have been closely able to follow i(t) from 0.3ns to 2ns rise time of i(t). However, they cant follow at 0.1ns and hence that is the cutoff frequency.

Bisection is however unstable in all these rise times and hence shows that it performs very bad in case of stiff equations.