NS2 Project Report

This report is brought to you by:

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Section: A

Introduction:

NS2, short for Network Simulator 2, is a simulation software made for researchers to study and analyze various network protocols. The user provides inputs in approved formats in special files and then compile it to create and simulate the topology. Nam is also provided with ns2 which provides a visual simulation as well.

NS2 consists of the following four parts:

1. Tcl file: It consists of all the instructions, written in otcl, which determines all the properties of the network and simulation such as topology,time of simulation,networking layers etc.It produces a trace file with all the data of the simulation.
2. Awk file: The trace file is pretty big so in order to extract useful info from it, an awk file is written to provide the required parameters in an output text file.
3. Shell script: A shell script is used for making the executions of tcl and awk quicker and then calculating all the required values.
4. C++ files: These are the files which determine the protocols of ns2, which we have been asked to slightly modify in our project.

Network Topologies under Simulation:

My roll is 57 so my roll%8 is 1 .
Hence, I have been asked to simulate for 802.11 wireless static and 802.15.4 wireless static networks.

Parameters under Variation:

The parameters I have been asked to modify are :
1.Number of Nodes: 20,40,60,80,100
2.Number of packets per second: 100,200,300,400,500

3. Speed of Nodes: 5m/s,10m/s,15m/s,20m/s,25m/s
4.Number of flows : 10,20,30,40,50
5. Coverage Area: TX_Range,2 X TX_Range,3 X TX_Range,4 X TX_Range,5 X TX_Range

Modifications made in the Simulator:

We have conducted the following changes in simulator with references to research papers:

1. Modification has been done based on the paper “Simulation and Performance Analysis of Various IEEE 802.11 Backoff Algorithms by B.Nithya,C.Mala* and Vijay Kumar B” and “Enhanced binary exponential backoff algorithm for fair channel access in the IEEE 802.11 medium access control protocol.”

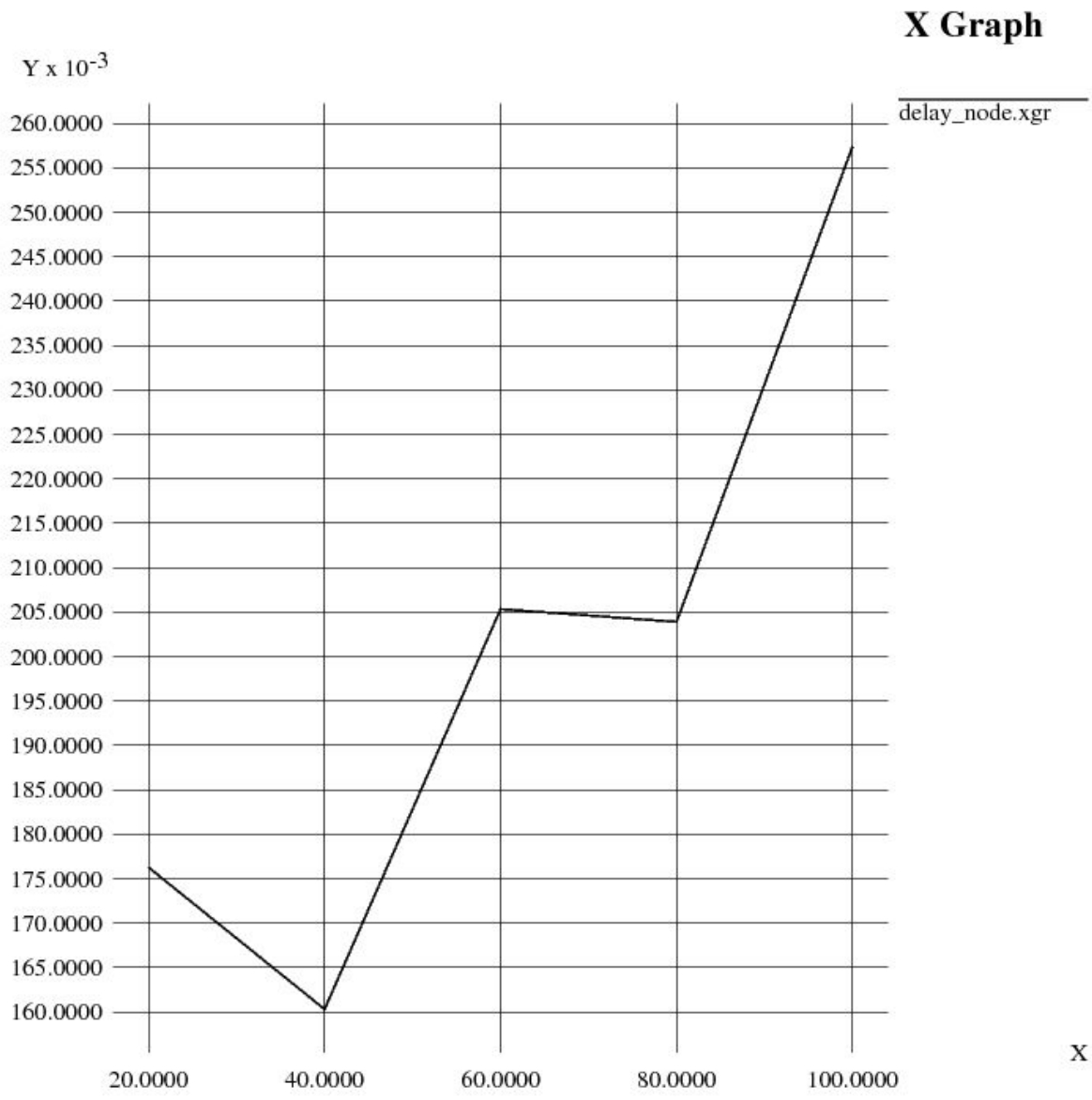
This paper illustrated the various concepts of changing the contention window and thereby the backoff algorithm used for calculation of contention window and thereby, the backoff time period or the contention period of Mac Protocol 802.11. The first paper illustrated many concepts but I choose to illustrate the Enhanced Binary Exponential Backoff (EBEB). The second paper was used to further clarify the algorithm and a certain portion of it was implemented in the ns2 simulation.

2. Modification has been done based on the paper “Improvement of AODV Routing Protocol Algorithm with Link Stability and Energy Efficient Routing for MANET” on the Ad-hoc On Demand Vector (AODV) routing protocol. We implemented a simple version of the algorithm present on the paper where RREQ packets are dropped based on a discard limit that is calculated with the current data of RREQ packets received from various nodes,stored in a data structure.

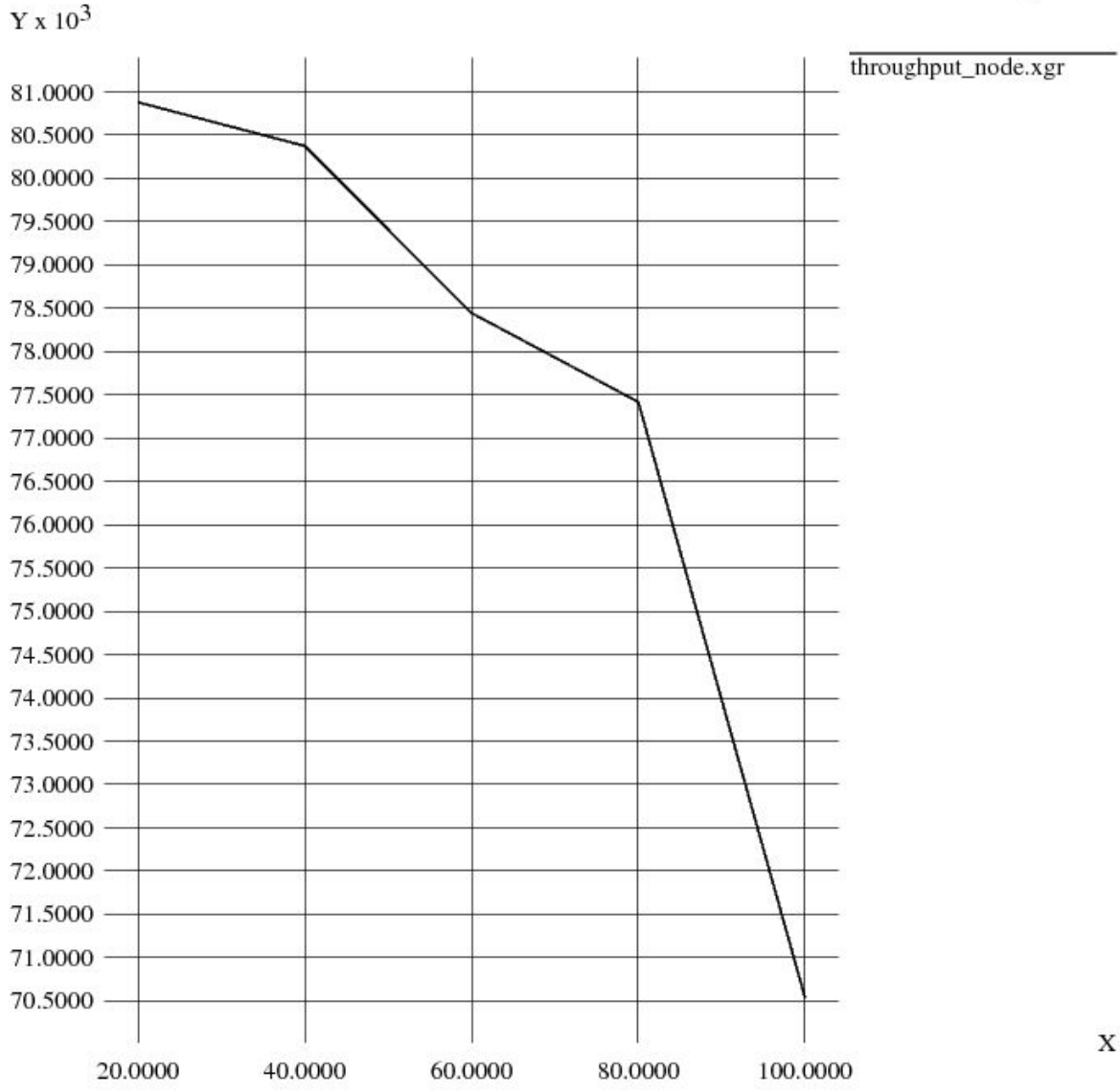
Results with Graphs:

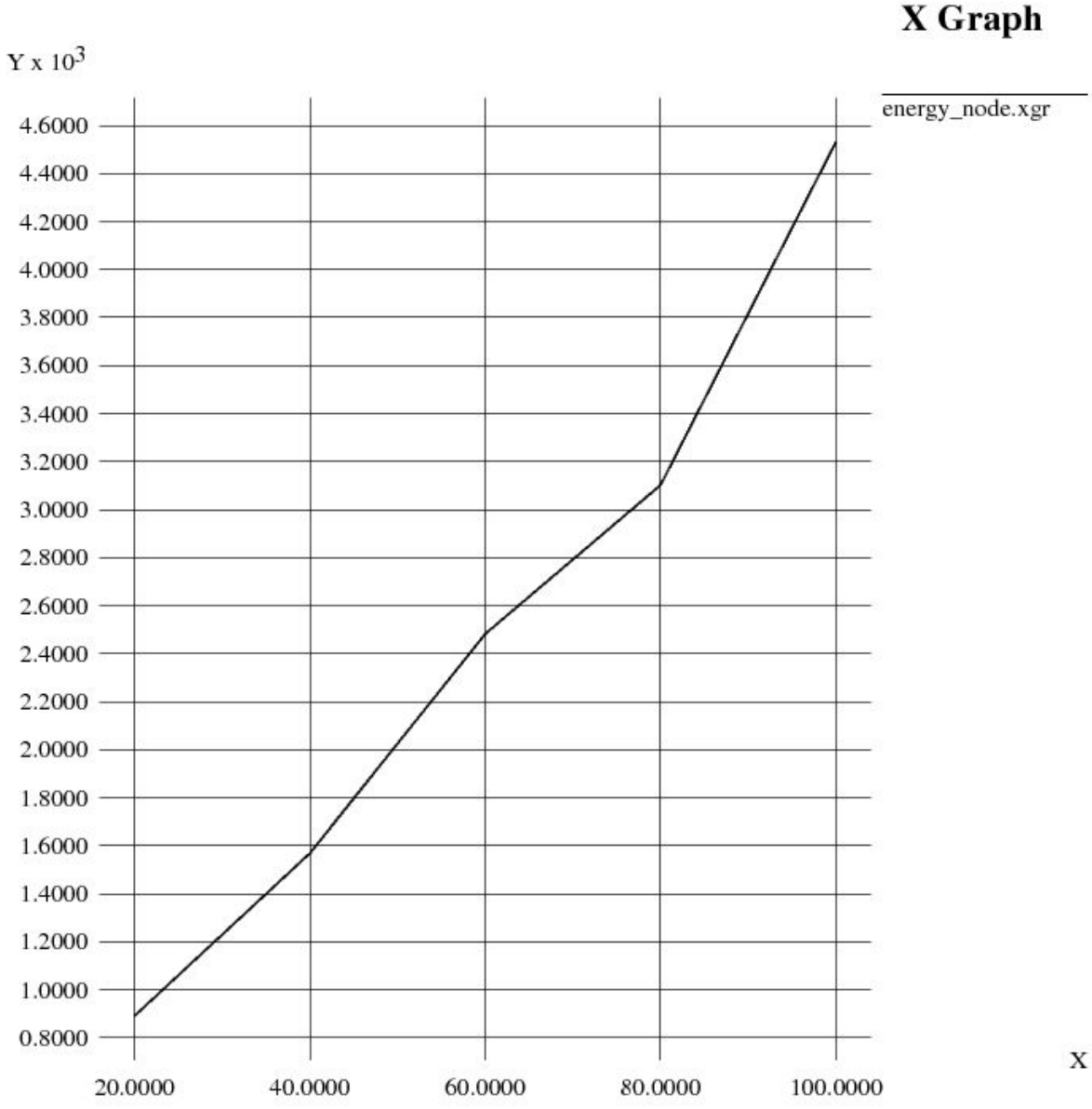
802.11:

Before Modification:

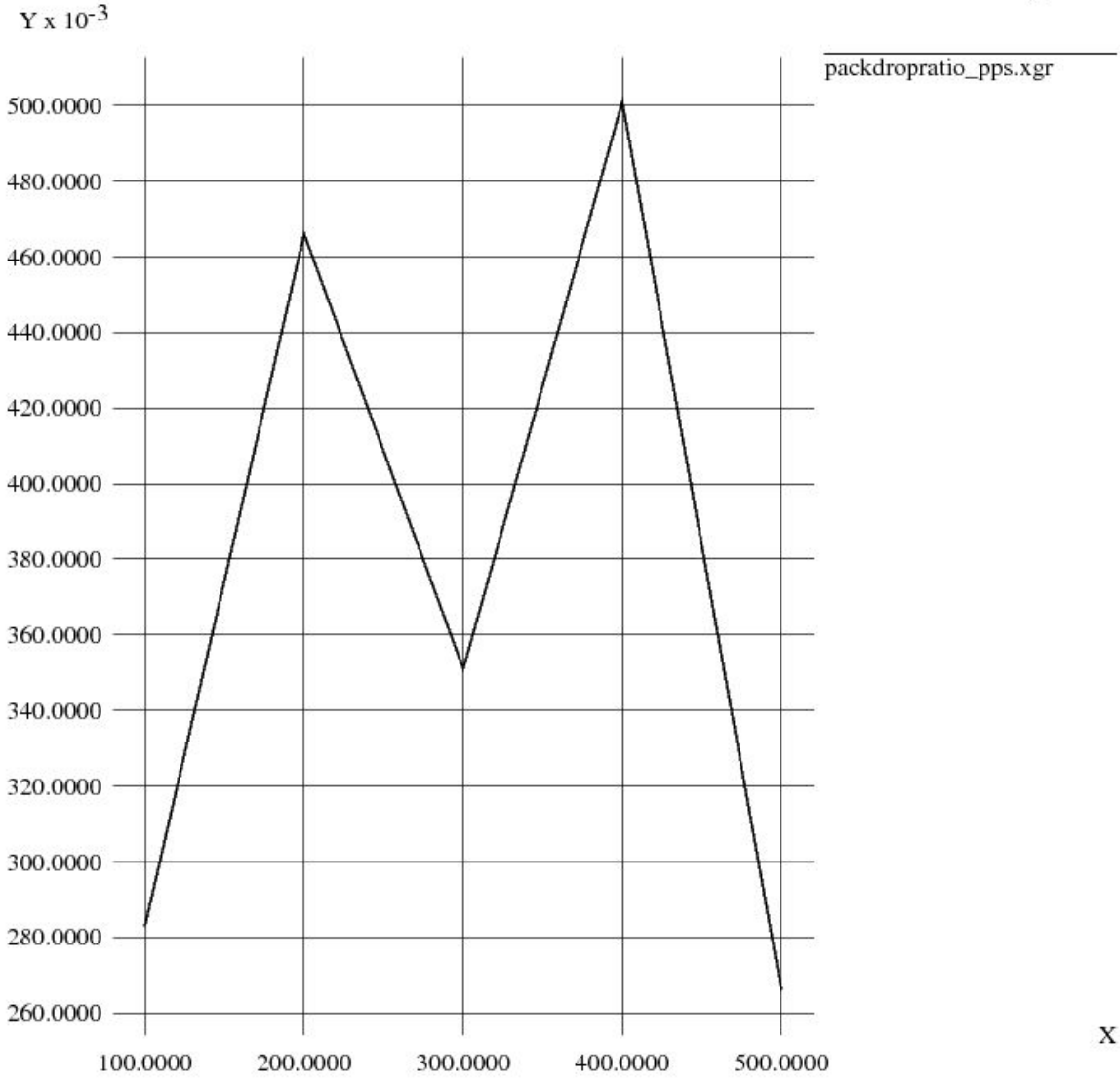


X Graph

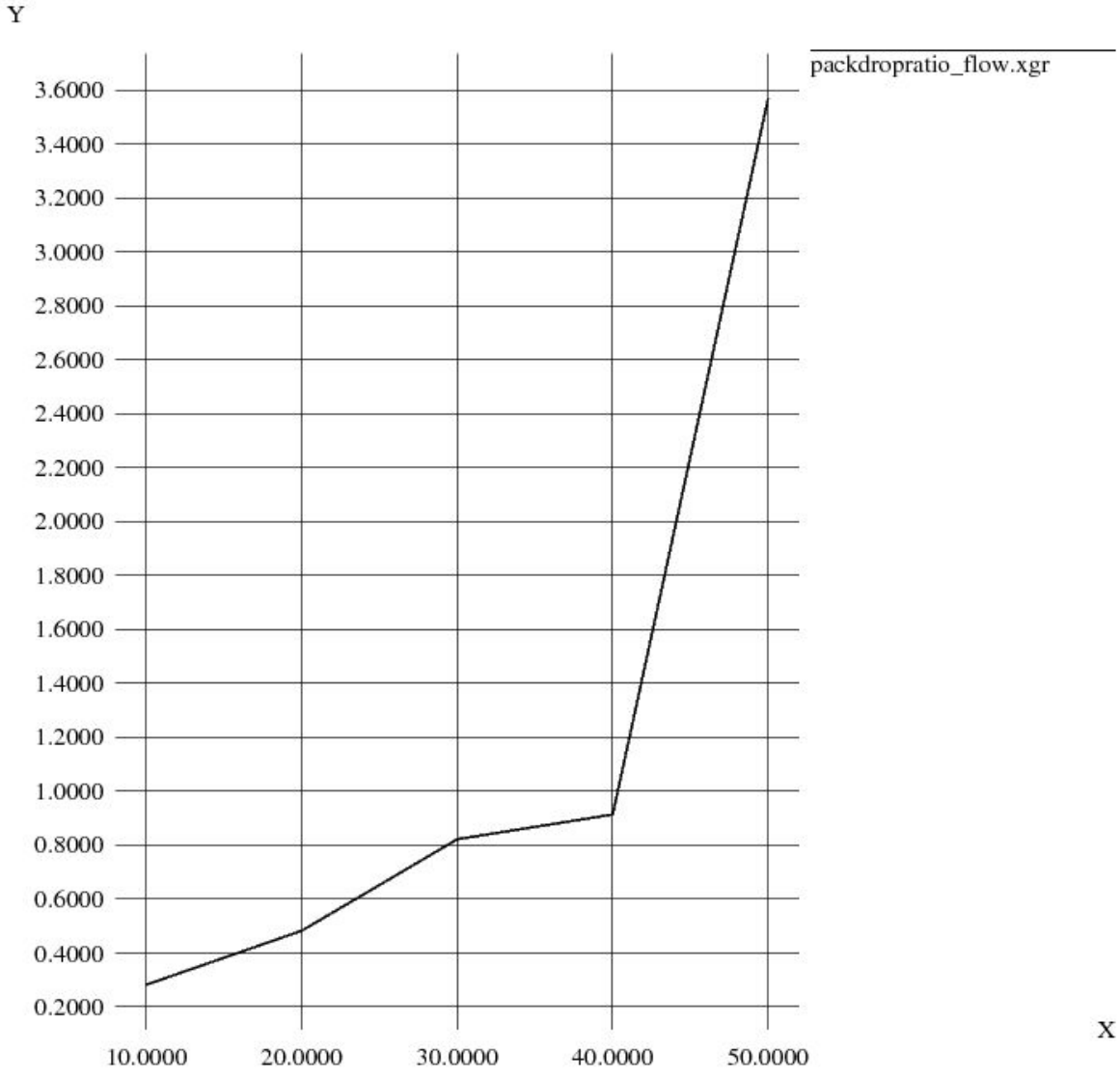

Y x 10^3
throughput_node.xgr
81.0000
80.5000
80.0000
79.5000
79.0000
78.5000
78.0000
77.5000
77.0000
76.5000
76.0000
75.5000
75.0000
74.5000
74.0000
73.5000
73.0000
72.5000
72.0000
71.5000
71.0000
70.5000
20.0000
40.0000
60.0000
80.0000
100.0000
X


X Graph
Y x 10^3
energy_node.xgr
4.6000
4.4000
4.2000
4.0000
3.8000
3.6000
3.4000
3.2000
3.0000
2.8000
2.6000
2.4000
2.2000
2.0000
1.8000
1.6000
1.4000
1.2000
1.0000
0.8000
20.0000
40.0000
60.0000
80.0000
100.0000
X

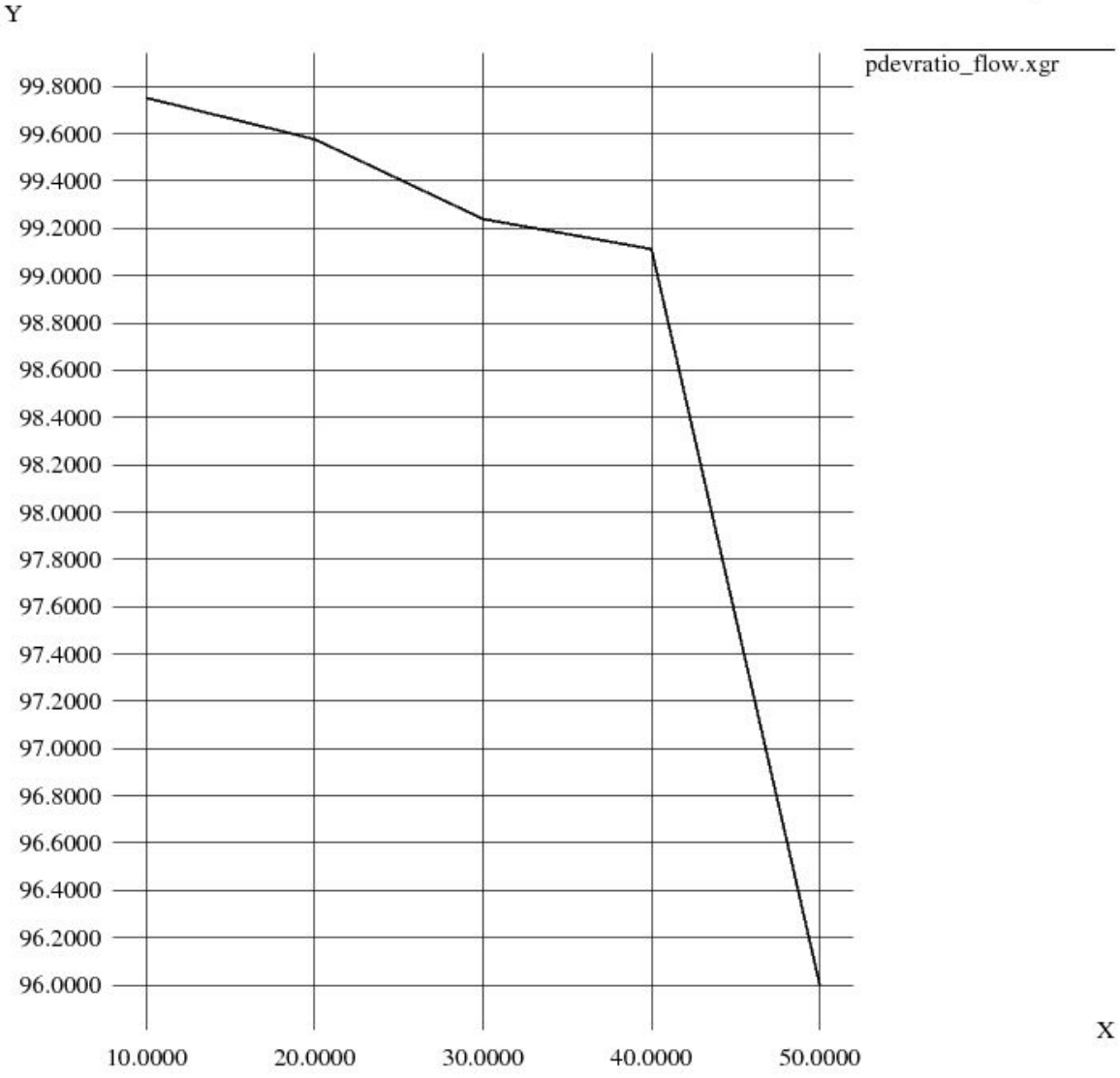
X Graph


Y x 10-3
packdropratio_pps.xgr
500.0000
480.0000
460.0000
440.0000
420.0000
400.0000
380.0000
360.0000
340.0000
320.0000
300.0000
280.0000
260.0000
100.0000
200.0000
300.0000
400.0000
500.0000
X

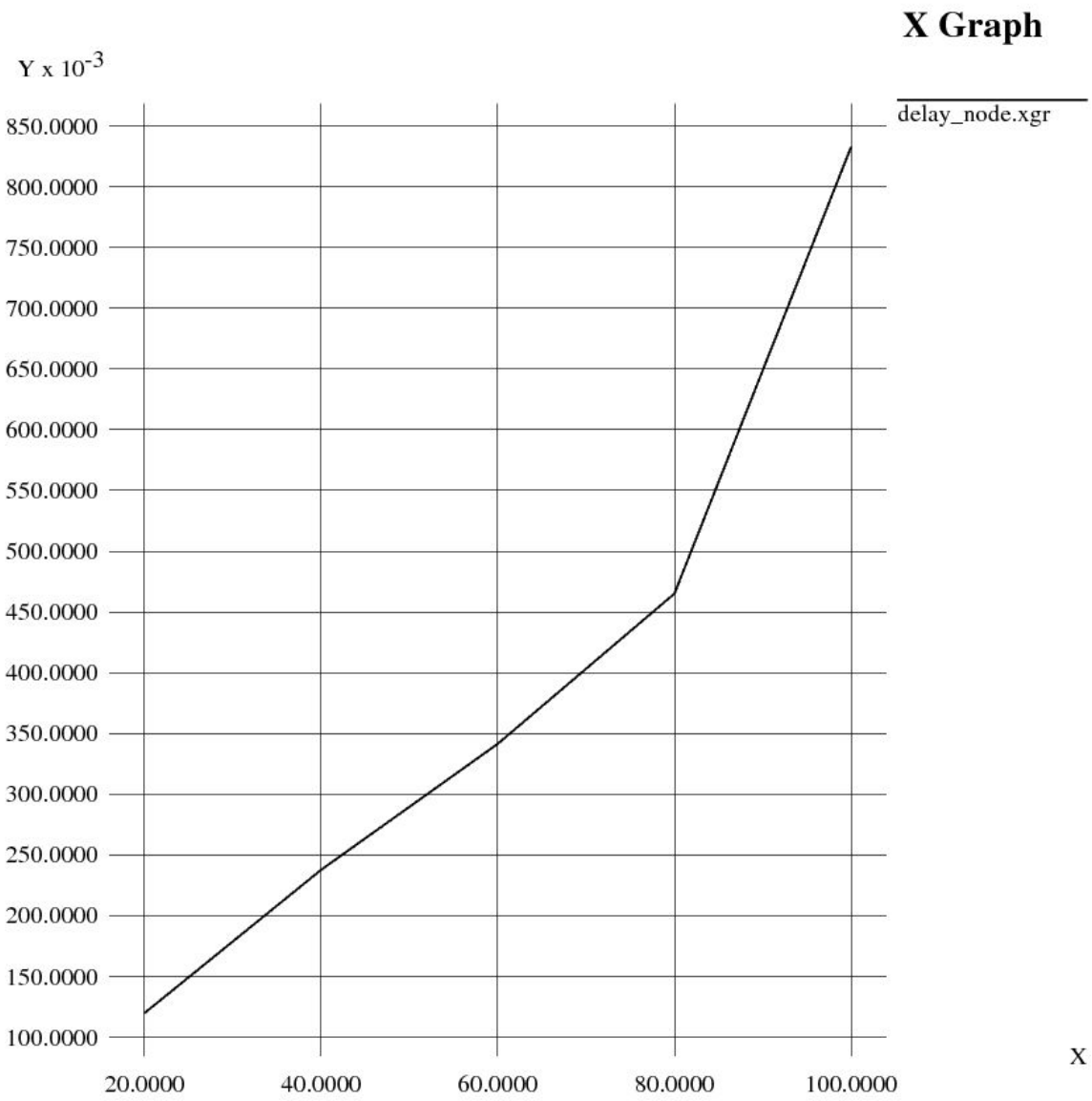
X Graph

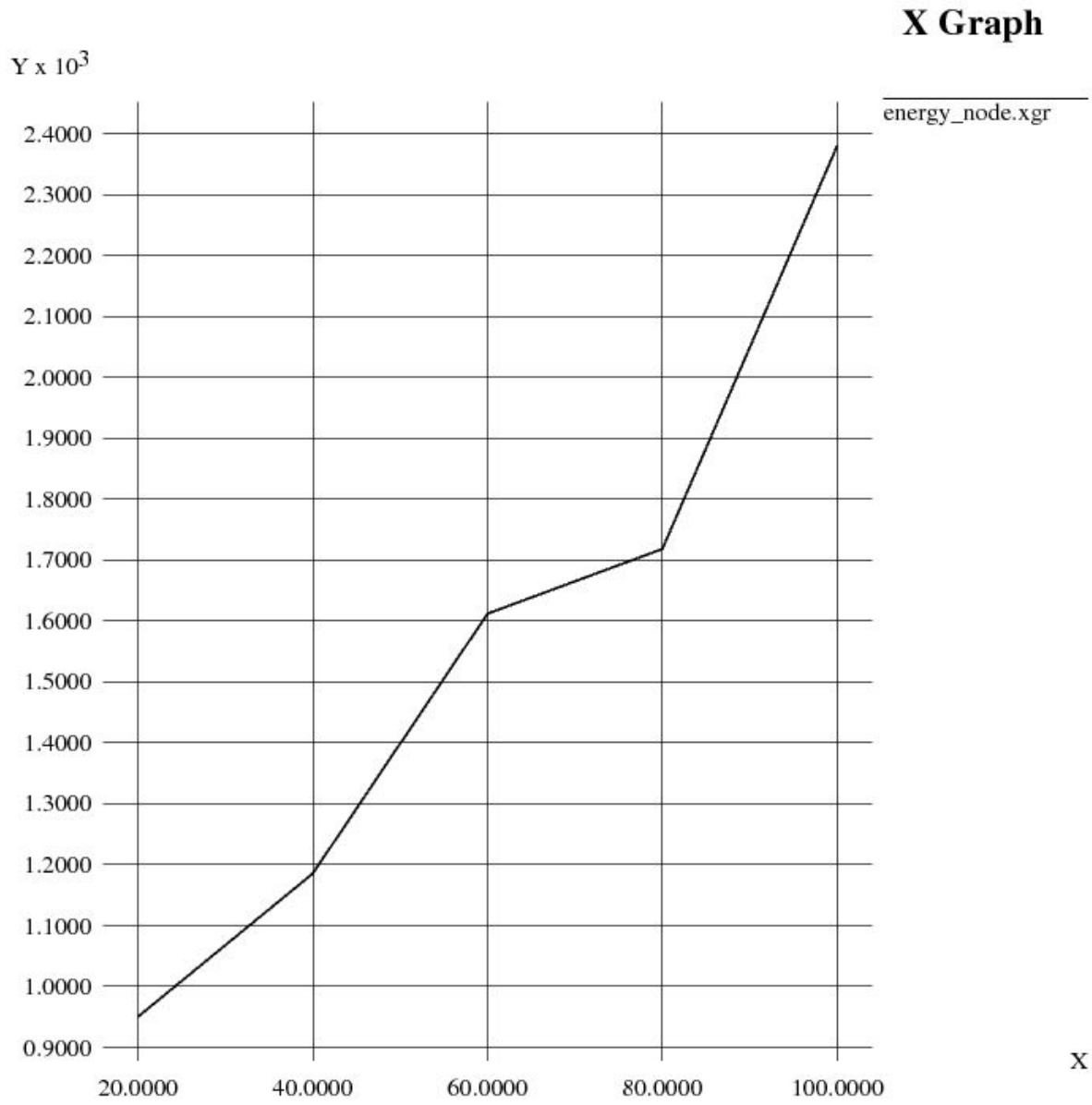

Y
packdropratio_flow.xgr
3.6000
3.4000
3.2000
3.0000
2.8000
2.6000
2.4000
2.2000
2.0000
1.8000
1.6000
1.4000
1.2000
1.0000
0.8000
0.6000
0.4000
0.2000
10.0000
20.0000
30.0000
40.0000
50.0000
X

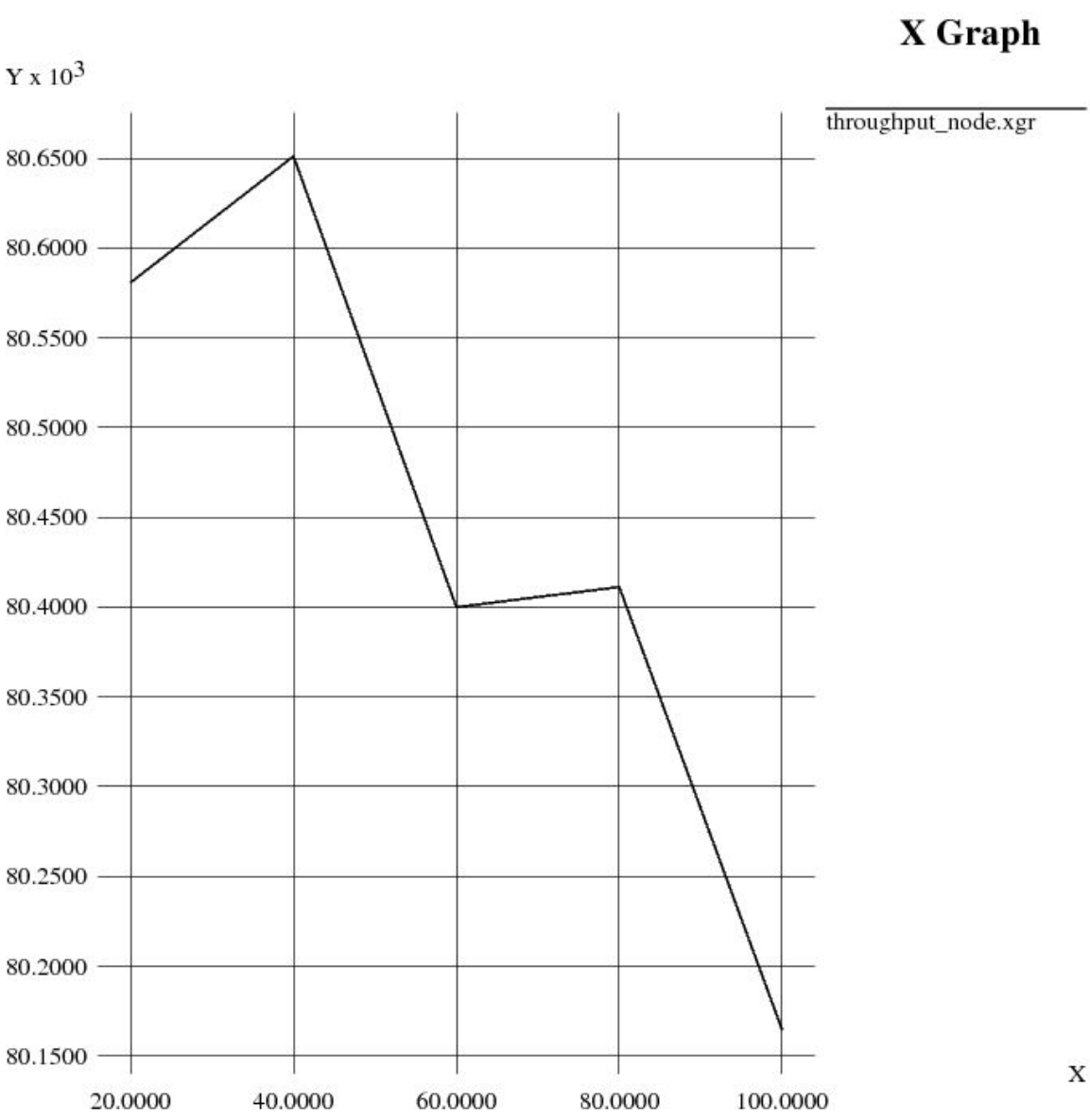
X Graph


Y
pdevratio_flow.xgr
99.8000
99.6000
99.4000
99.2000
99.0000
98.8000
98.6000
98.4000
98.2000
98.0000
97.8000
97.6000
97.4000
97.2000
97.0000
96.8000
96.6000
96.4000
96.2000
96.0000
10.0000
20.0000
30.0000
40.0000
50.0000
X

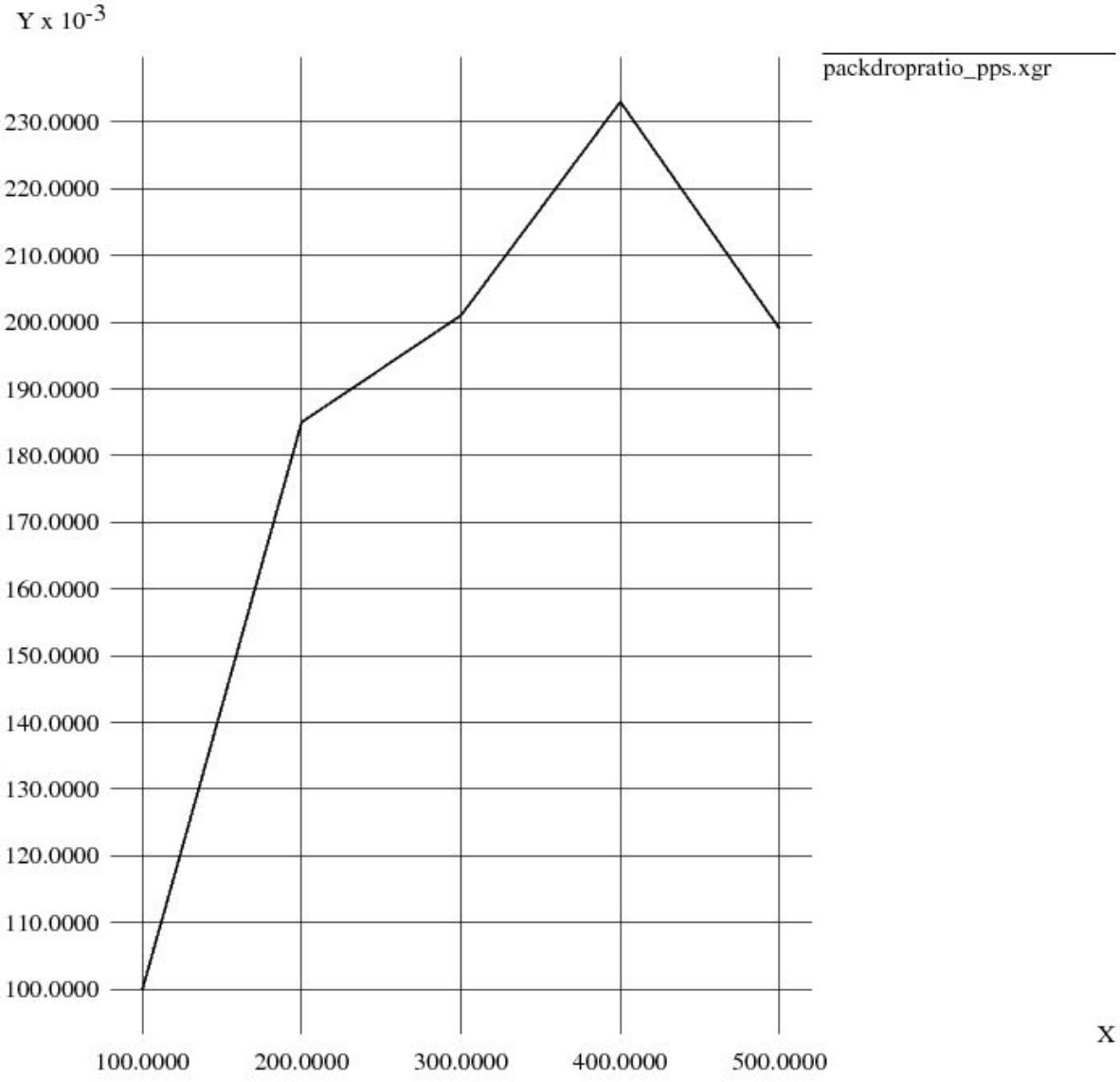
After modification:



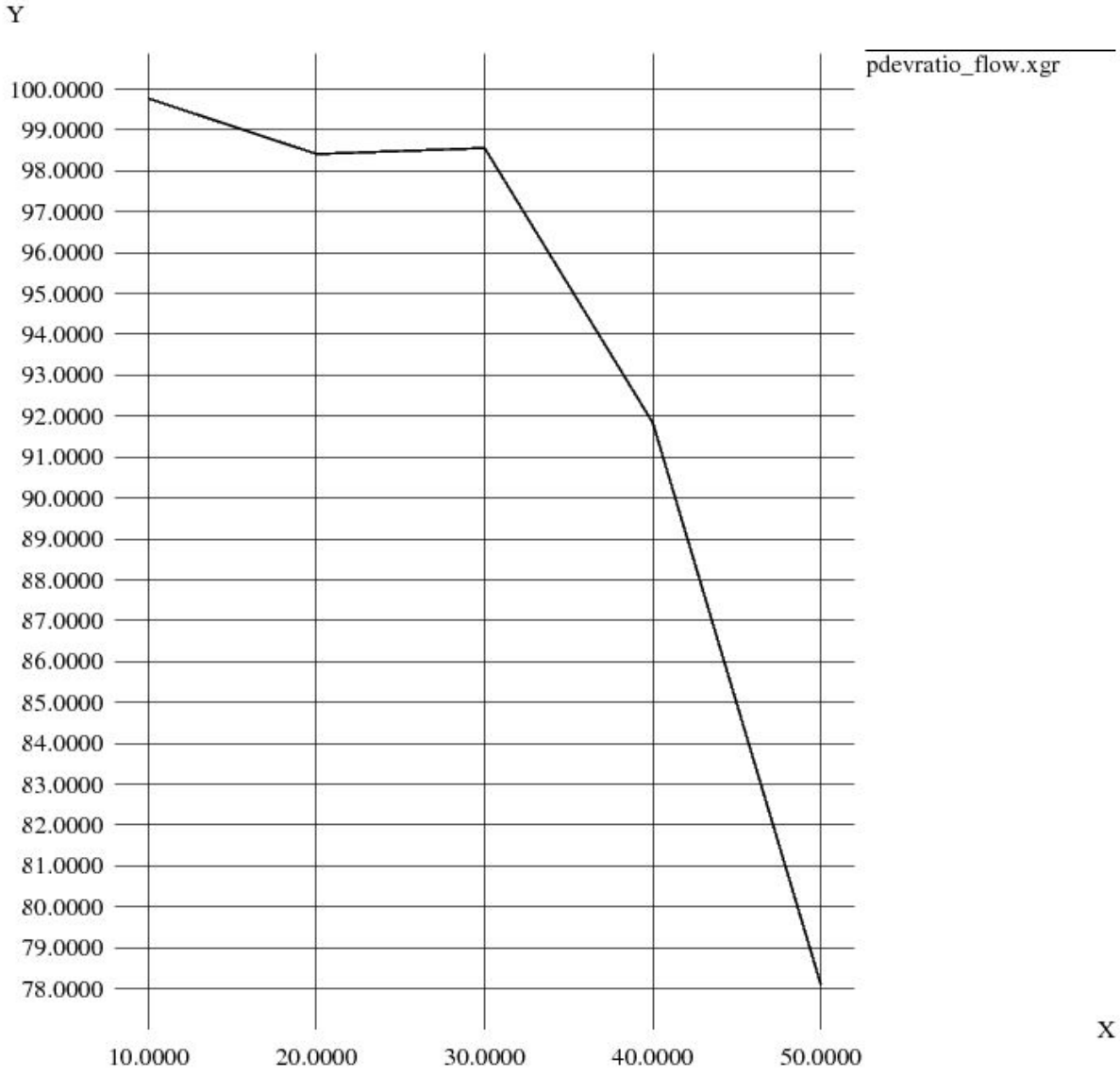

X Graph
Y x 10^3
energy_node.xgr
2.4000
2.3000
2.2000
2.1000
2.0000
1.9000
1.8000
1.7000
1.6000
1.5000
1.4000
1.3000
1.2000
1.1000
1.0000
0.9000
20.0000
40.0000
60.0000
80.0000
100.0000
X

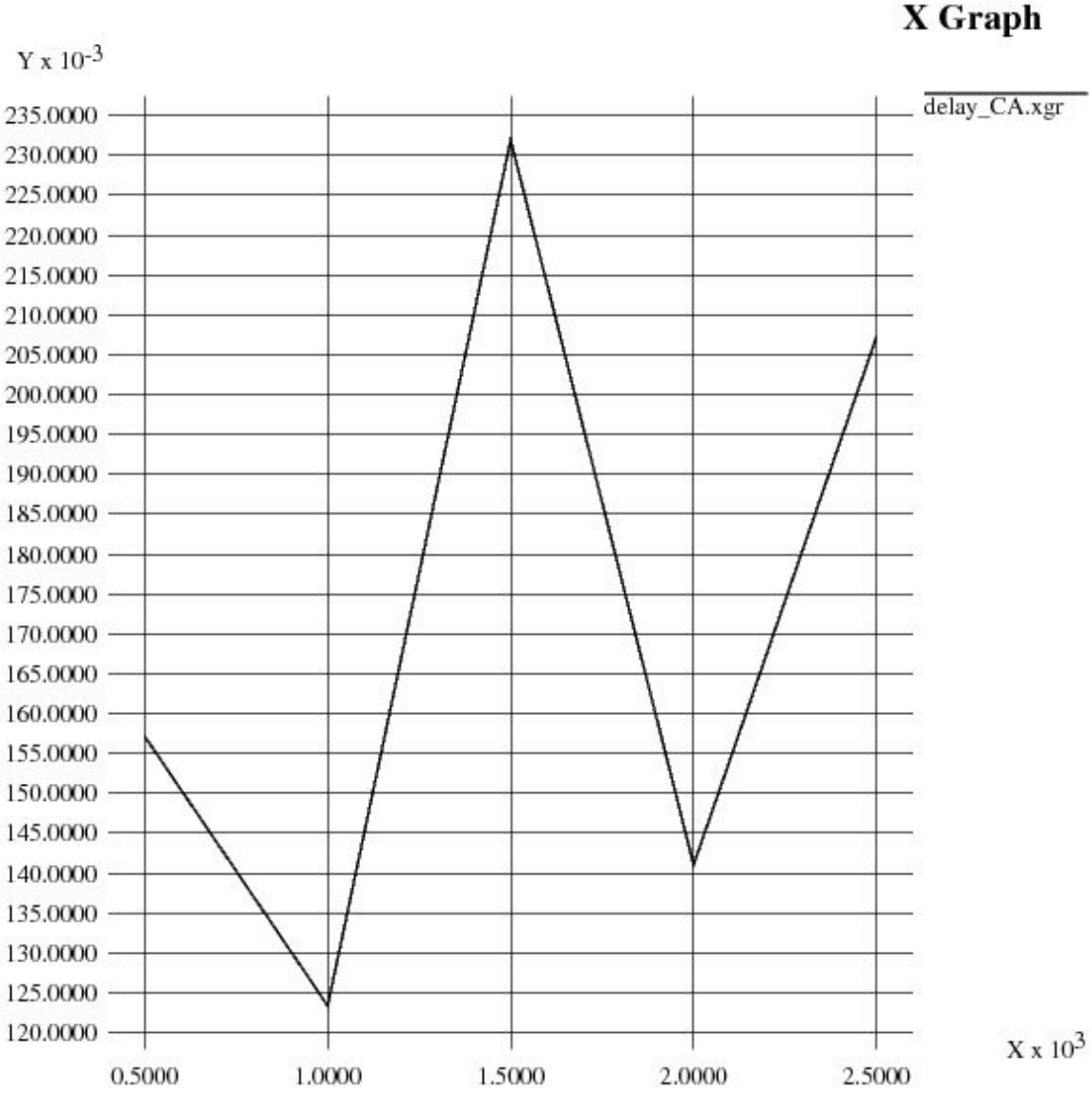

X Graph
Y x 10^3
throughput_node.xgr
80.6500
80.6000
80.5500
80.5000
80.4500
80.4000
80.3500
80.3000
80.2500
80.2000
80.1500
20.0000
40.0000
60.0000
80.0000
100.0000
X

X Graph


Y x 10-3
packdropratio_pps.xgr
230.0000
220.0000
210.0000
200.0000
190.0000
180.0000
170.0000
160.0000
150.0000
140.0000
130.0000
120.0000
110.0000
100.0000
100.0000
200.0000
300.0000
400.0000
500.0000
X

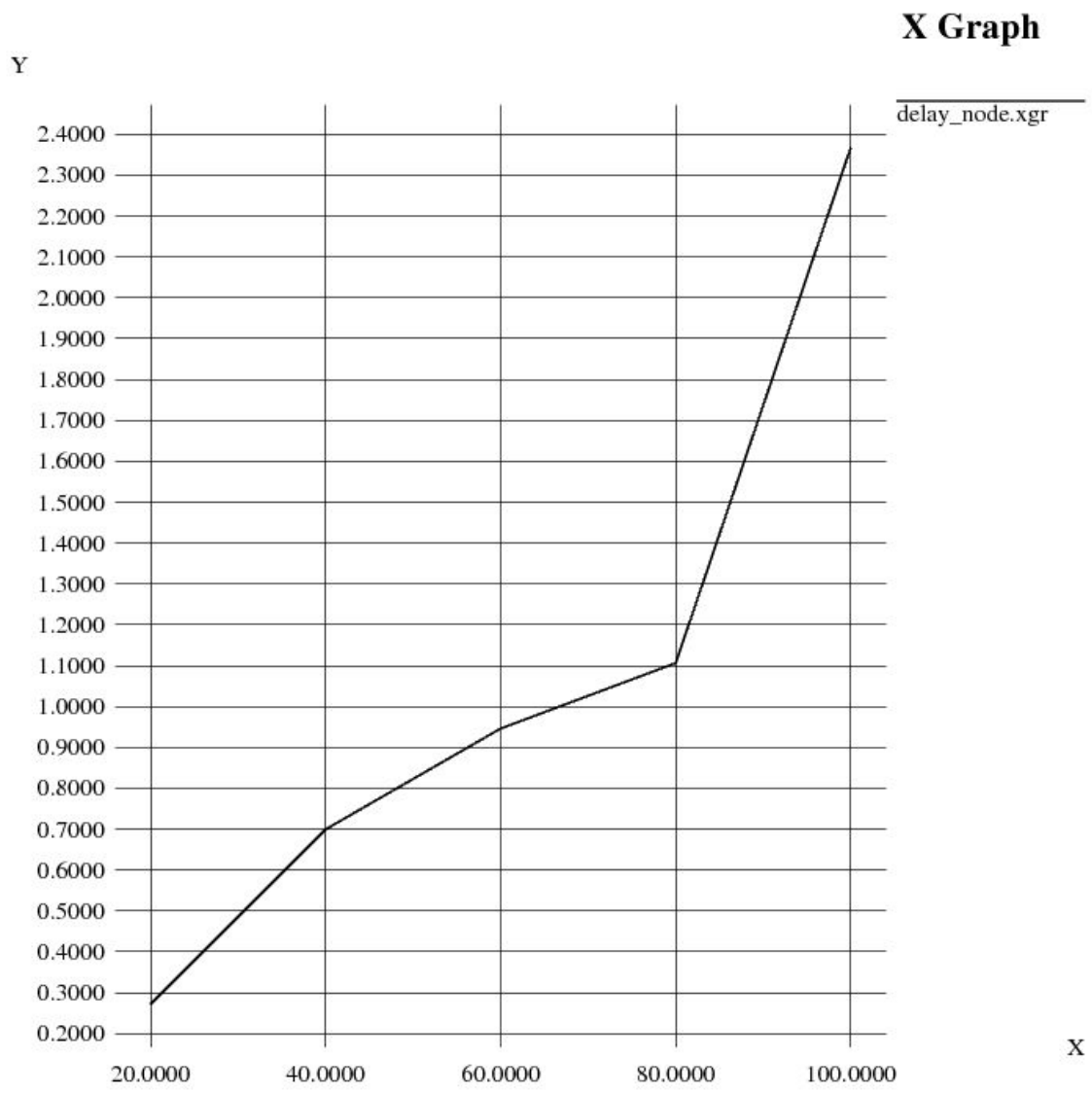
X Graph

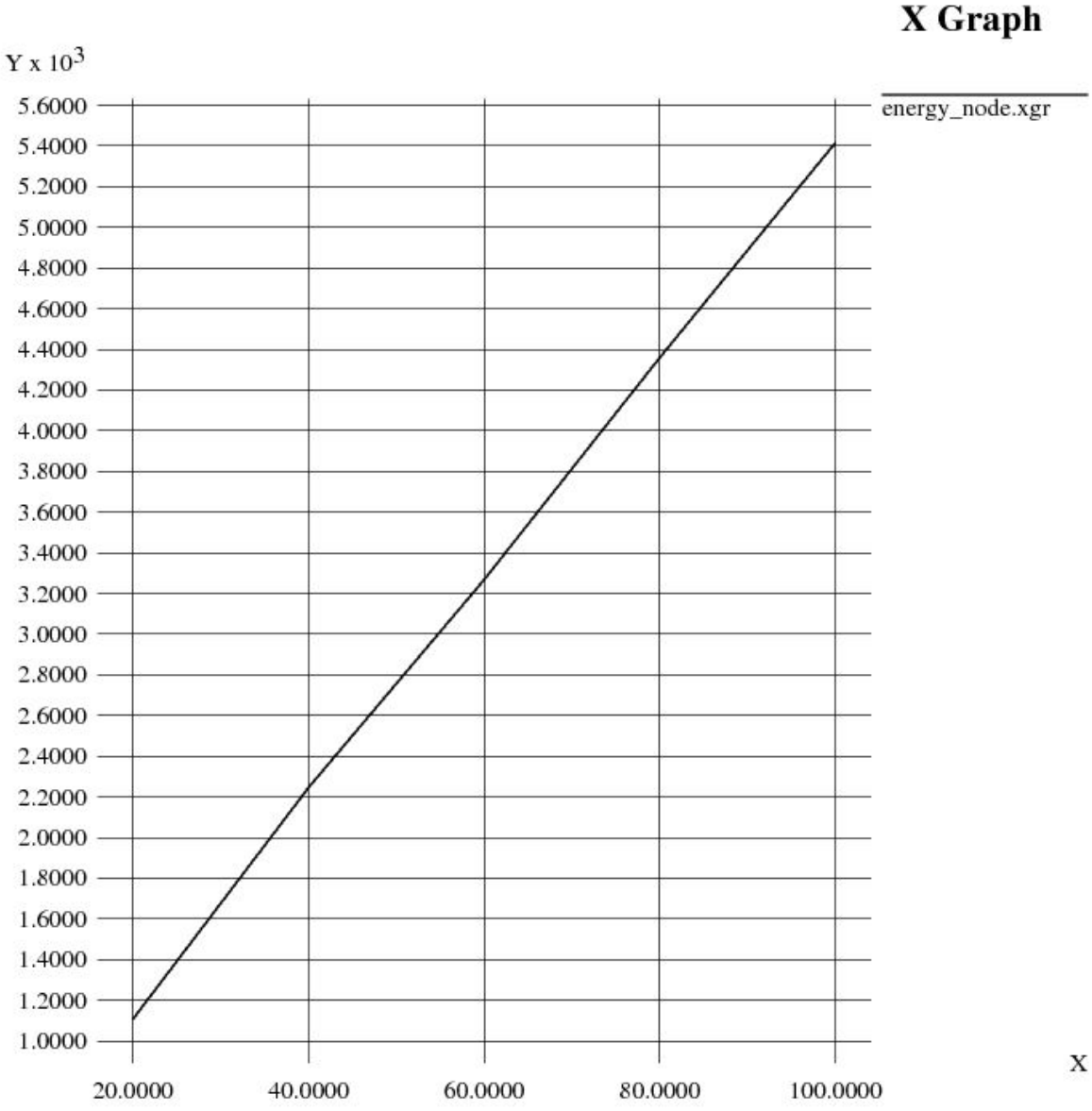

Y
pdevratio_flow.xgr
100.0000
99.0000
98.0000
97.0000
96.0000
95.0000
94.0000
93.0000
92.0000
91.0000
90.0000
89.0000
88.0000
87.0000
86.0000
85.0000
84.0000
83.0000
82.0000
81.0000
80.0000
79.0000
78.0000
10.0000
20.0000
30.0000
40.0000
50.0000
X

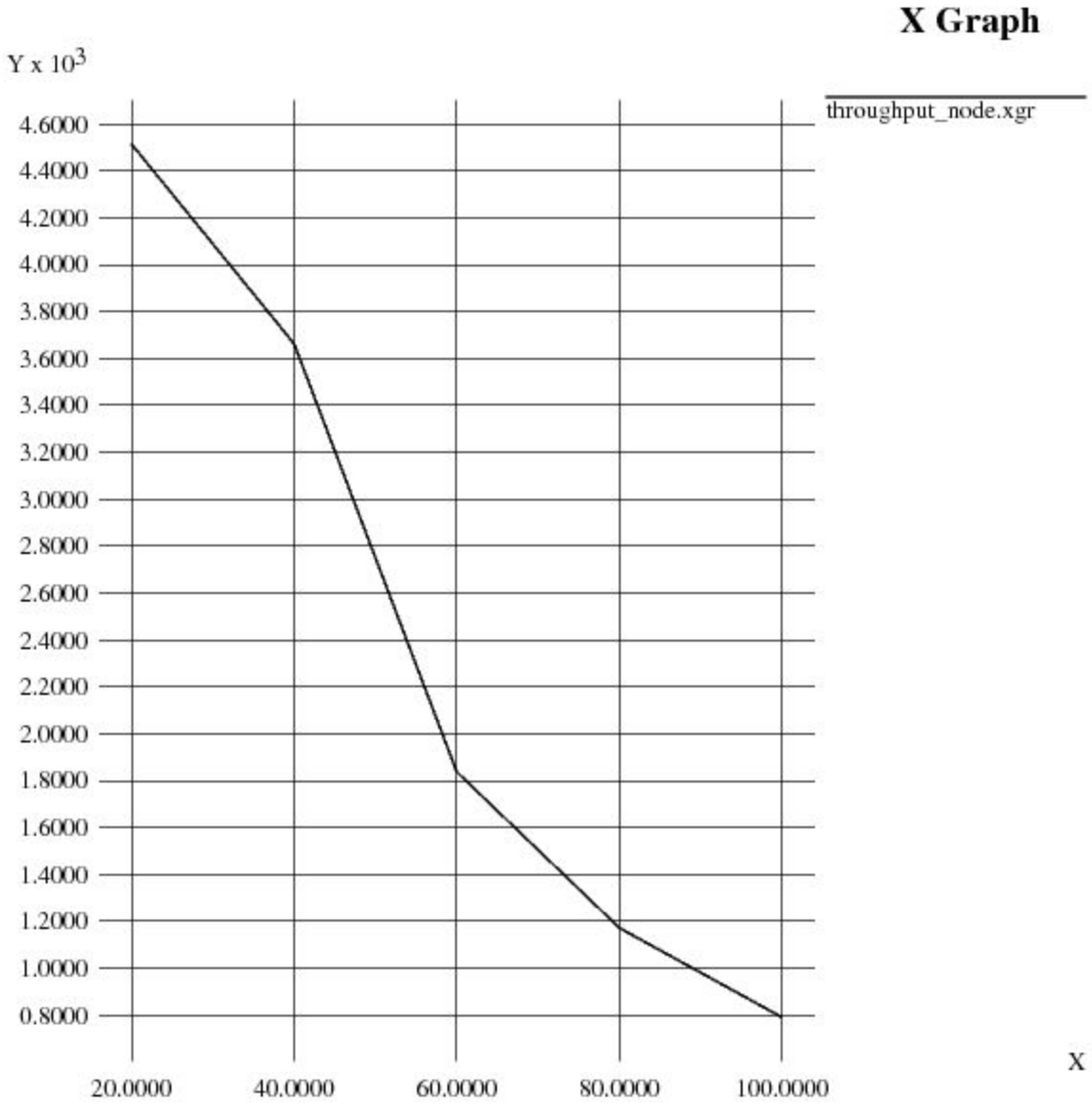

X Graph
Y x 10-3
delay_CA.xgr
235.0000
230.0000
225.0000
220.0000
215.0000
210.0000
205.0000
200.0000
195.0000
190.0000
185.0000
180.0000
175.0000
170.0000
165.0000
160.0000
155.0000
150.0000
145.0000
140.0000
135.0000
130.0000
125.0000
120.0000
0.5000
1.0000
1.5000
2.0000
2.5000
X x 10^3

802.15.4

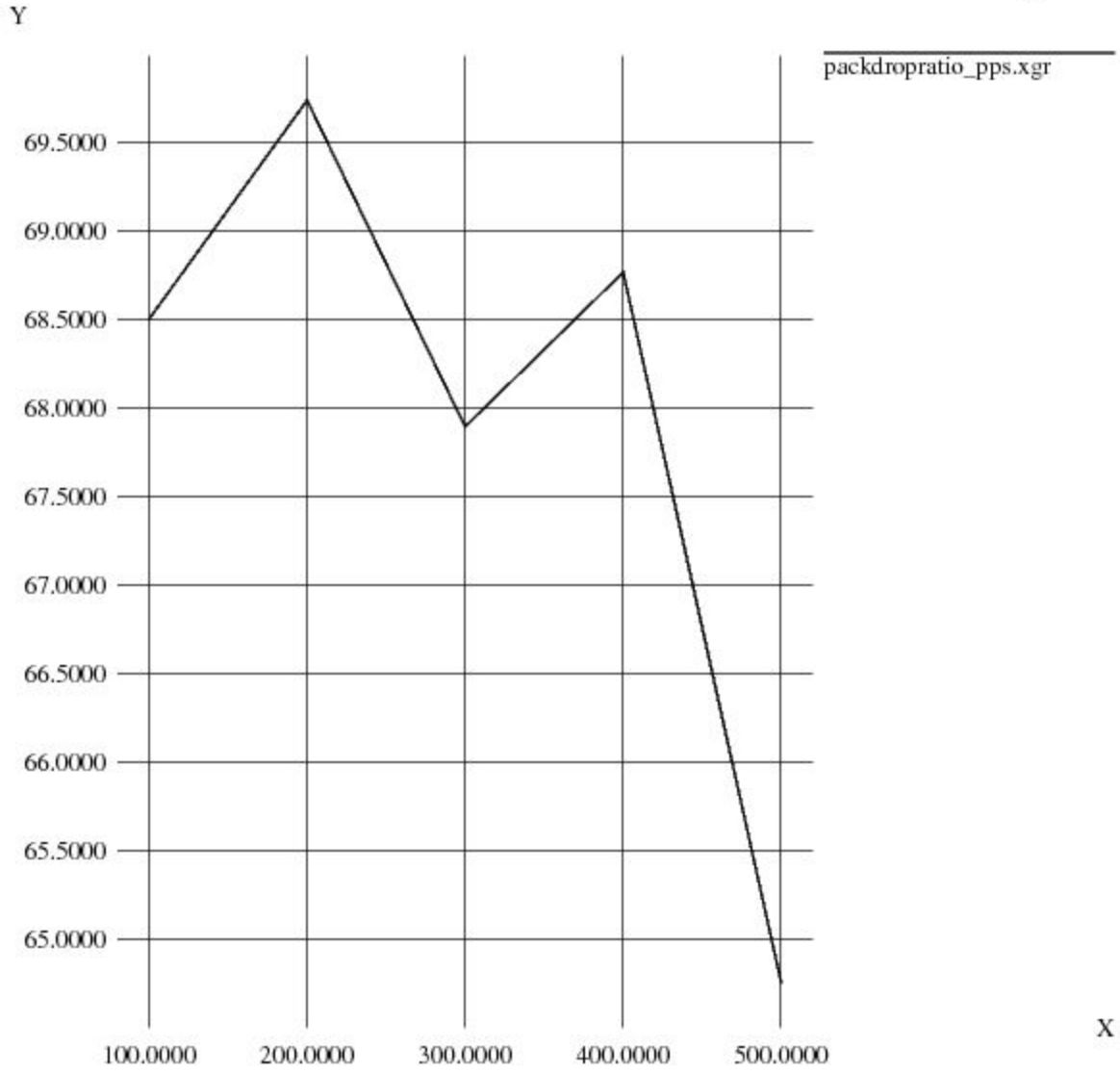
Before Modification:



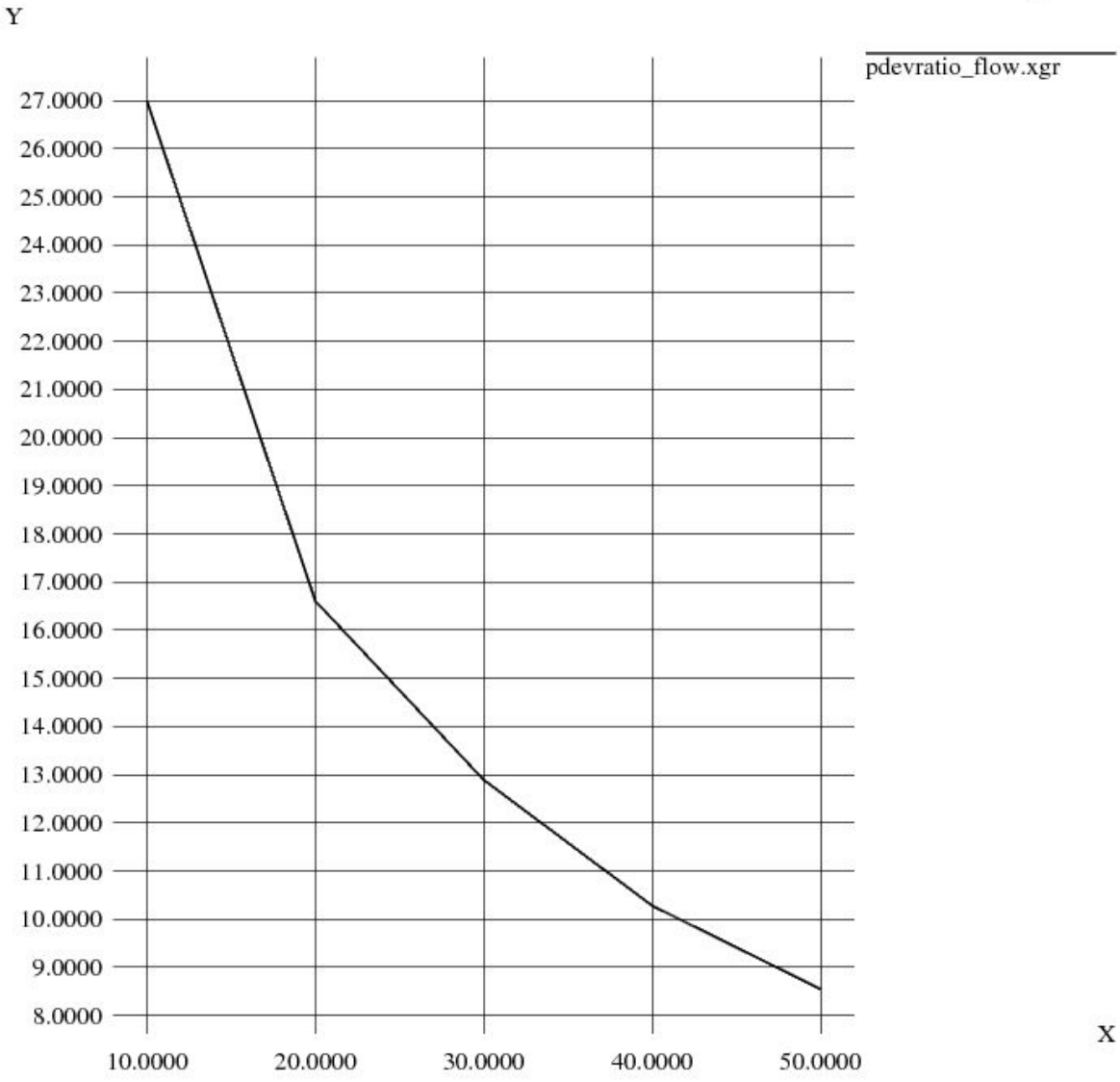

X Graph
Y x 10^3
5.6000
5.4000
5.2000
5.0000
4.8000
4.6000
4.4000
4.2000
4.0000
3.8000
3.6000
3.4000
3.2000
3.0000
2.8000
2.6000
2.4000
2.2000
2.0000
1.8000
1.6000
1.4000
1.2000
1.0000
20.0000
40.0000
60.0000
80.0000
100.0000
X
energy_node.xgr

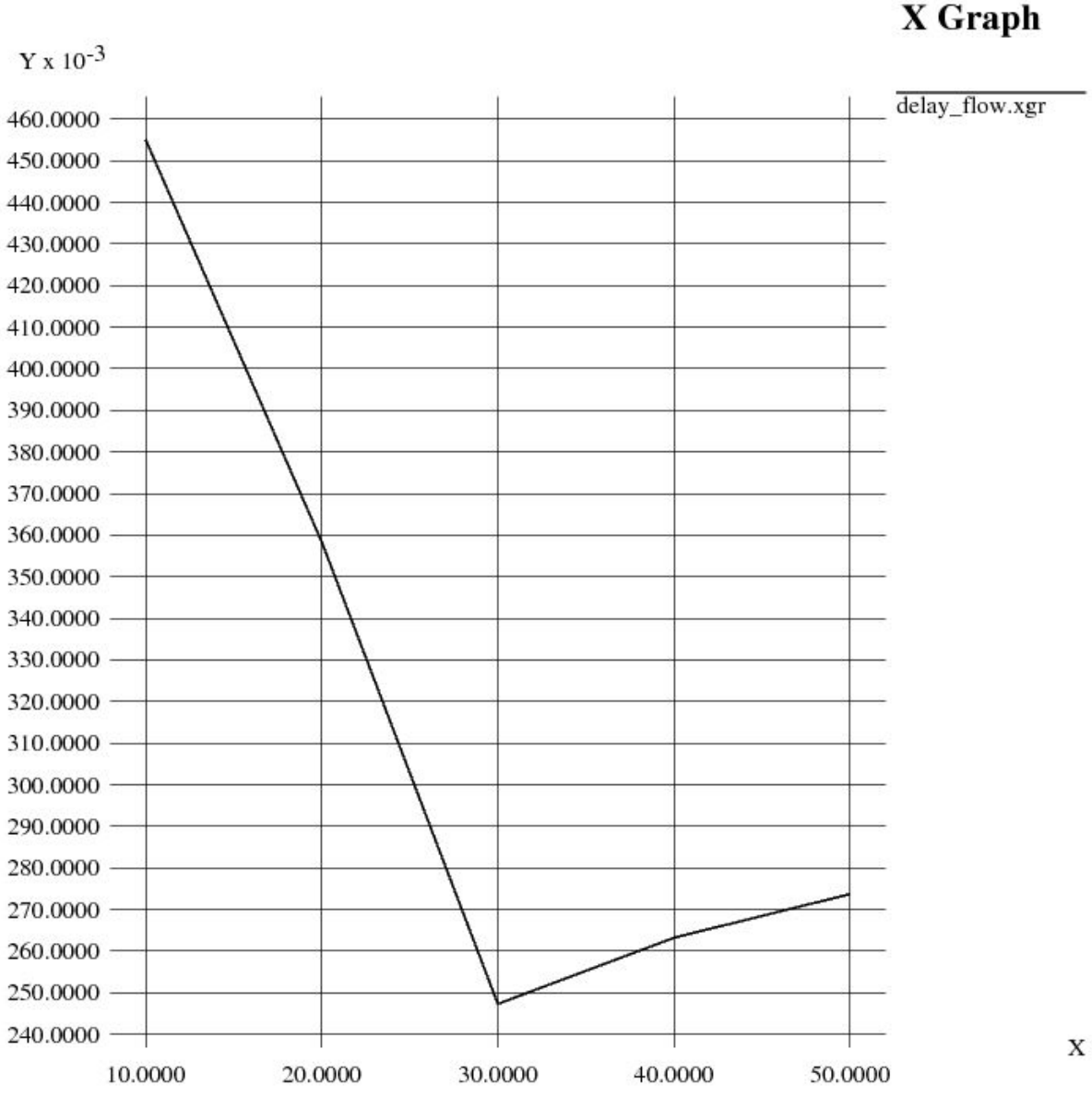

X Graph
Y x 10^3
throughput_node.xgr
4.6000
4.4000
4.2000
4.0000
3.8000
3.6000
3.4000
3.2000
3.0000
2.8000
2.6000
2.4000
2.2000
2.0000
1.8000
1.6000
1.4000
1.2000
1.0000
0.8000
20.0000
40.0000
60.0000
80.0000
100.0000
X

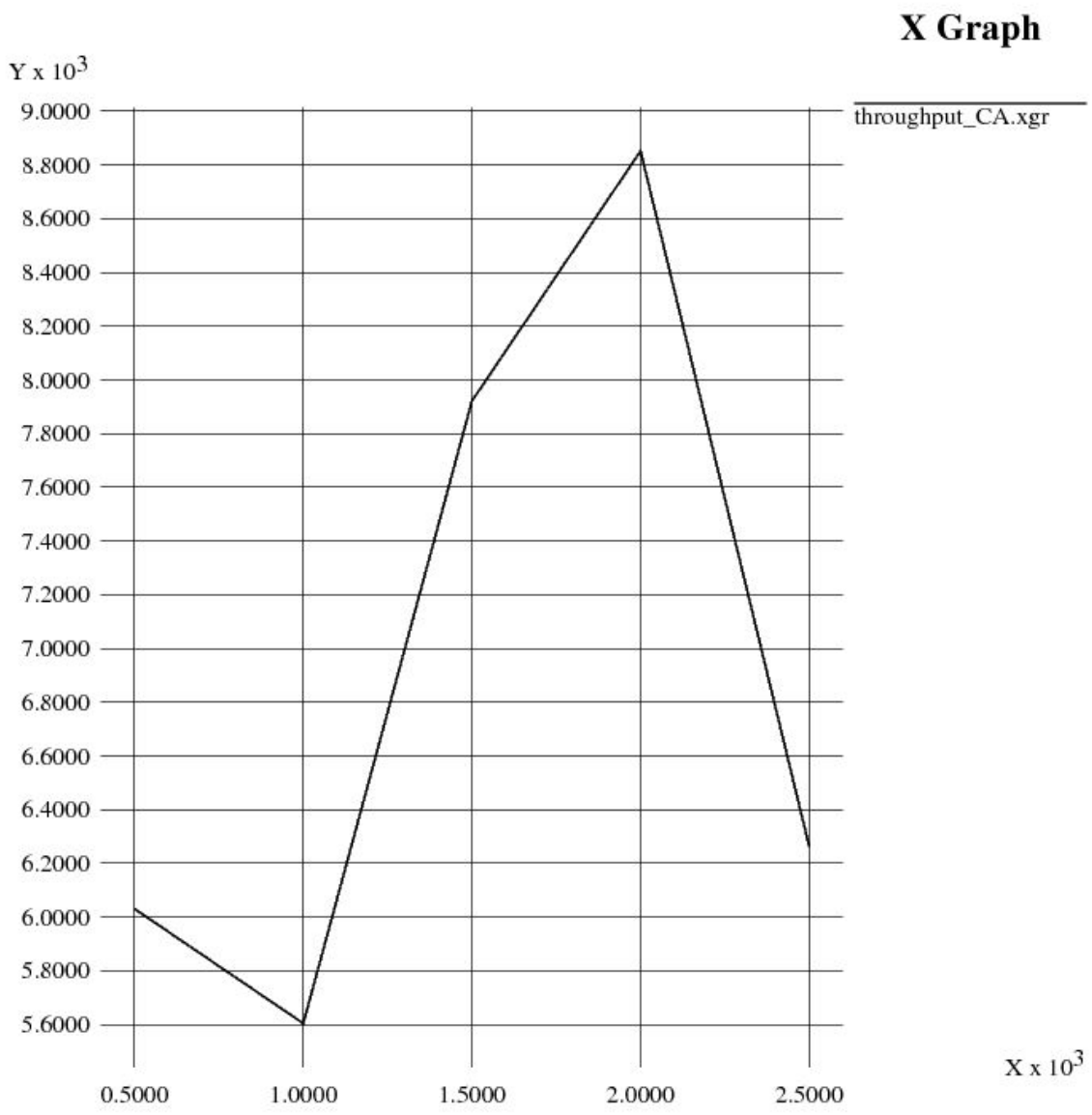
X Graph


Y
packdropratio_pps.xgr
69.5000
69.0000
68.5000
68.0000
67.5000
67.0000
66.5000
66.0000
65.5000
65.0000
100.0000
200.0000
300.0000
400.0000
500.0000
X

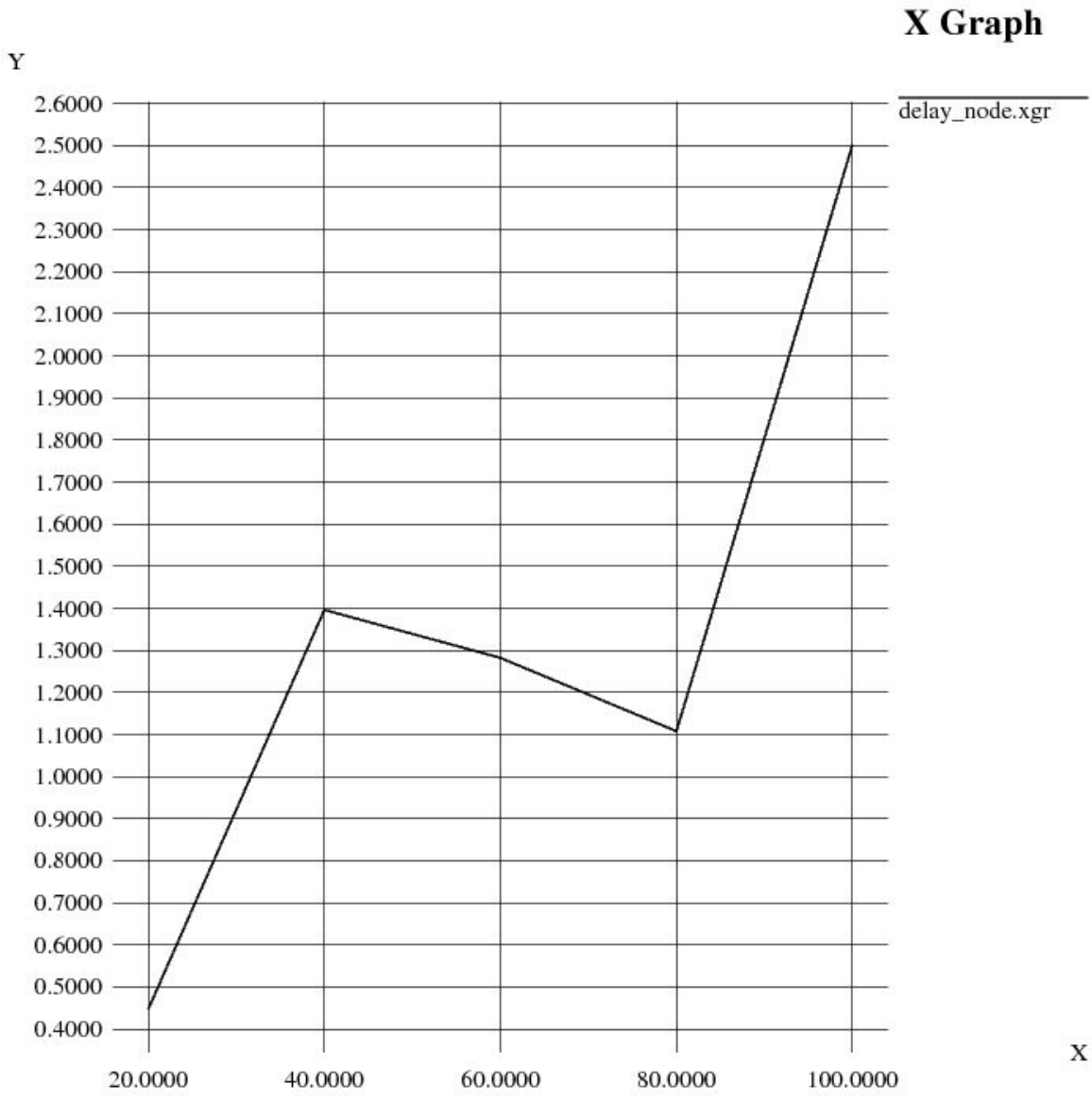
X Graph


Y
pdevratio_flow.xgr
27.0000
26.0000
25.0000
24.0000
23.0000
22.0000
21.0000
20.0000
19.0000
18.0000
17.0000
16.0000
15.0000
14.0000
13.0000
12.0000
11.0000
10.0000
9.0000
8.0000
10.0000
20.0000
30.0000
40.0000
50.0000
X

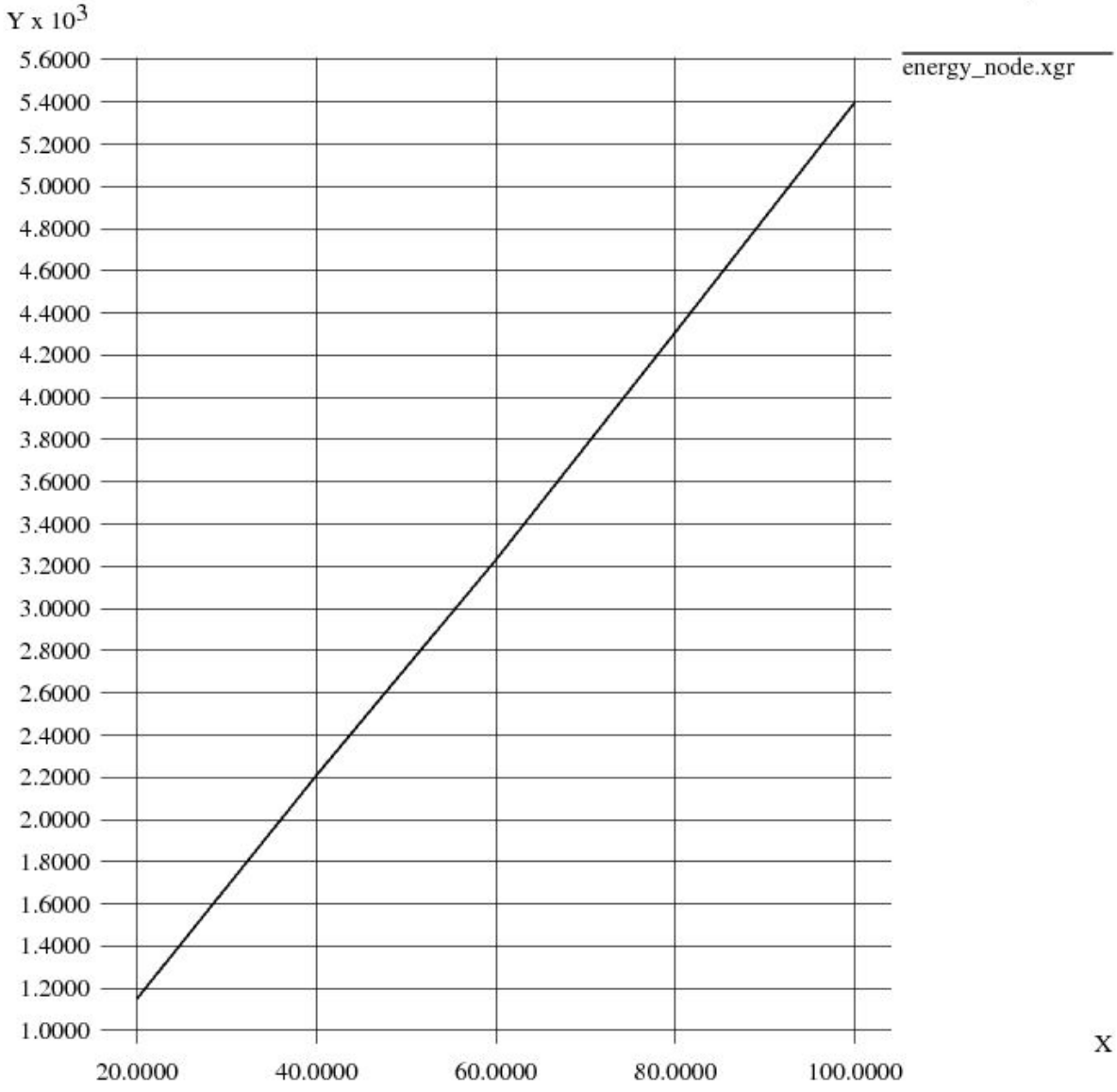

X Graph
Y x 10-3
delay_flow.xgr
460.0000
450.0000
440.0000
430.0000
420.0000
410.0000
400.0000
390.0000
380.0000
370.0000
360.0000
350.0000
340.0000
330.0000
320.0000
310.0000
300.0000
290.0000
280.0000
270.0000
260.0000
250.0000
240.0000
10.0000
20.0000
30.0000
40.0000
50.0000
X


X Graph
Y x 10^3
9.0000
8.8000
8.6000
8.4000
8.2000
8.0000
7.8000
7.6000
7.4000
7.2000
7.0000
6.8000
6.6000
6.4000
6.2000
6.0000
5.8000
5.6000
0.5000
1.0000
1.5000
2.0000
2.5000
throughput_CA.xgr
X x 10^3

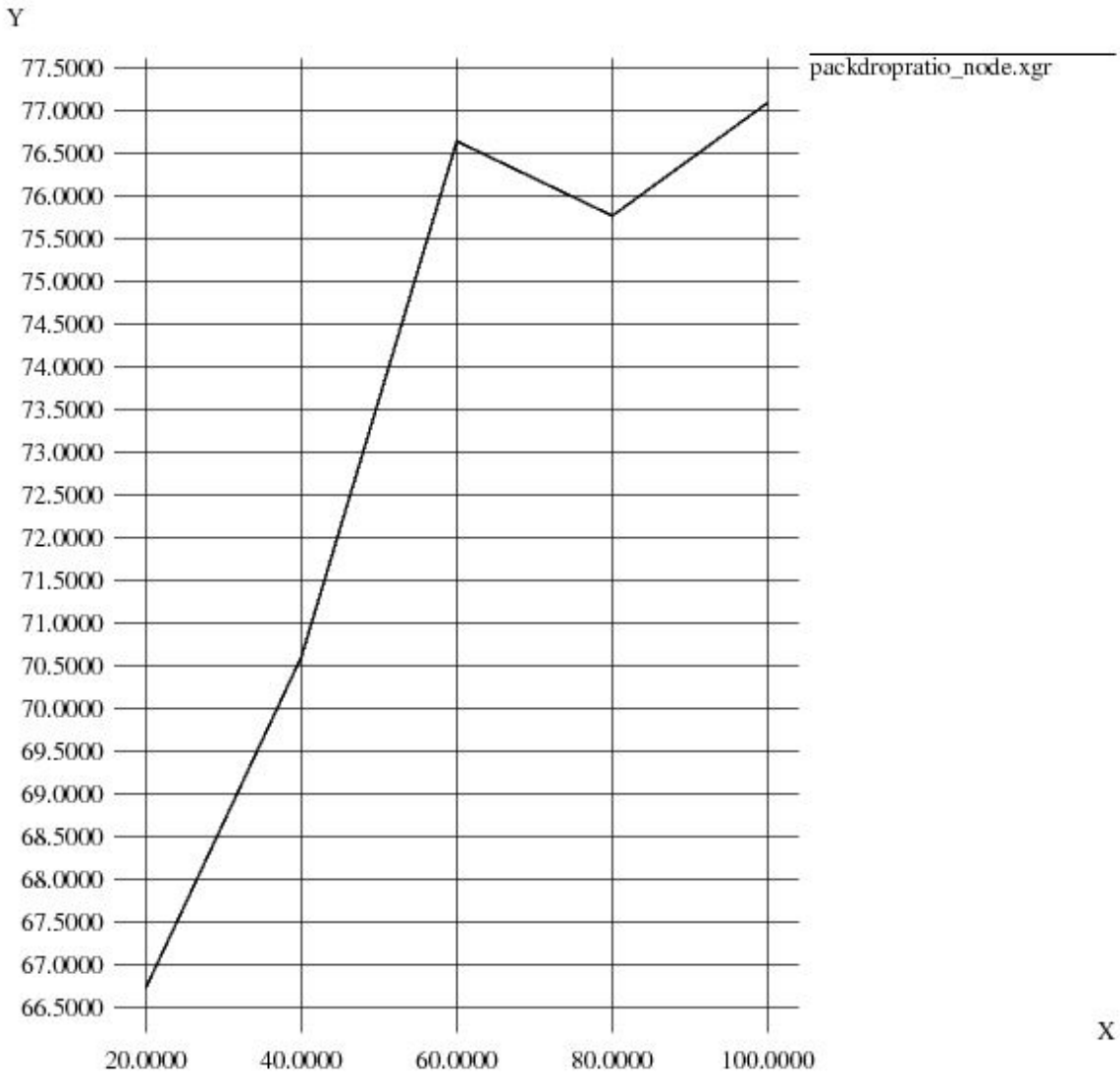
After Modification:



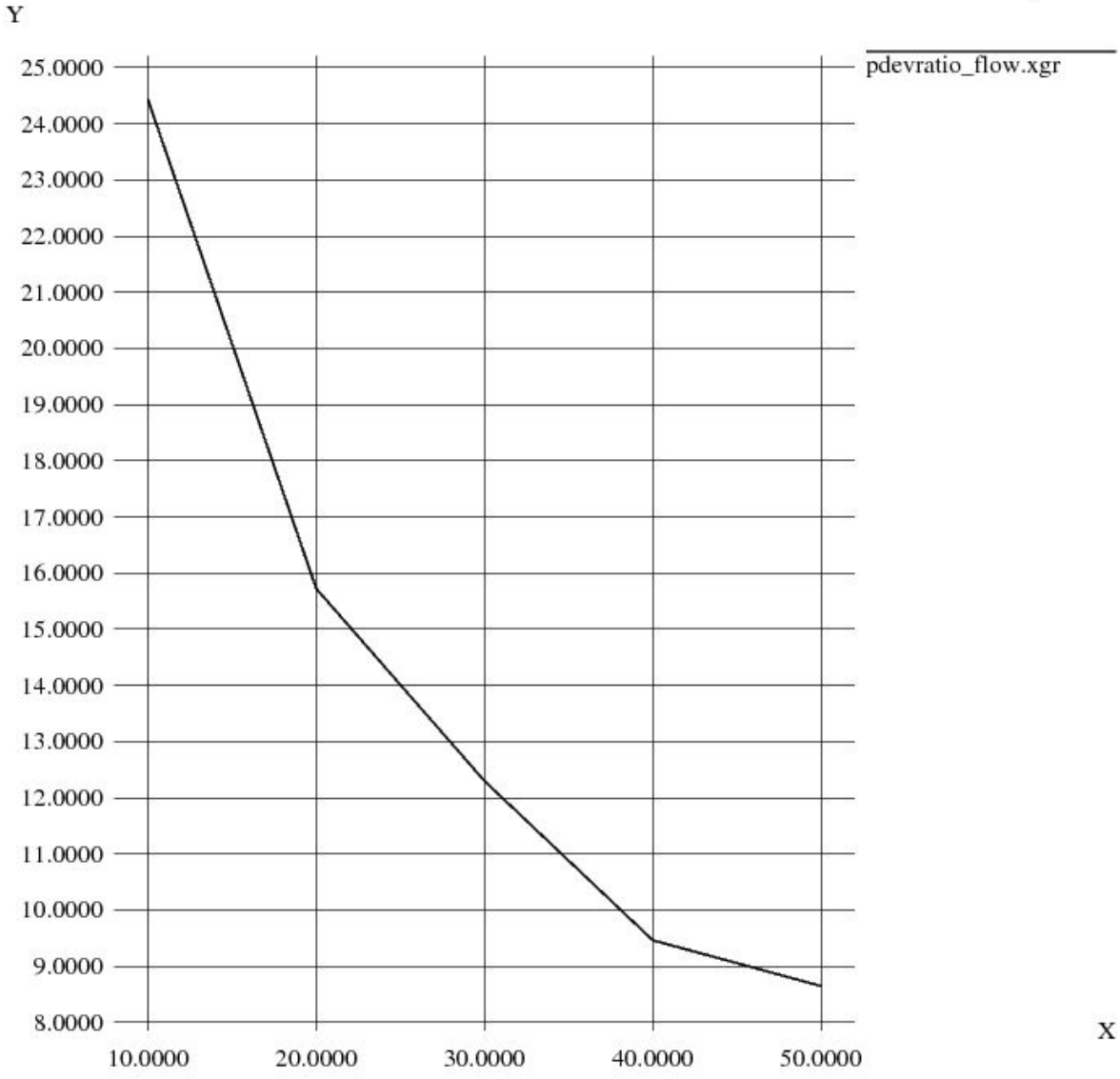
X Graph

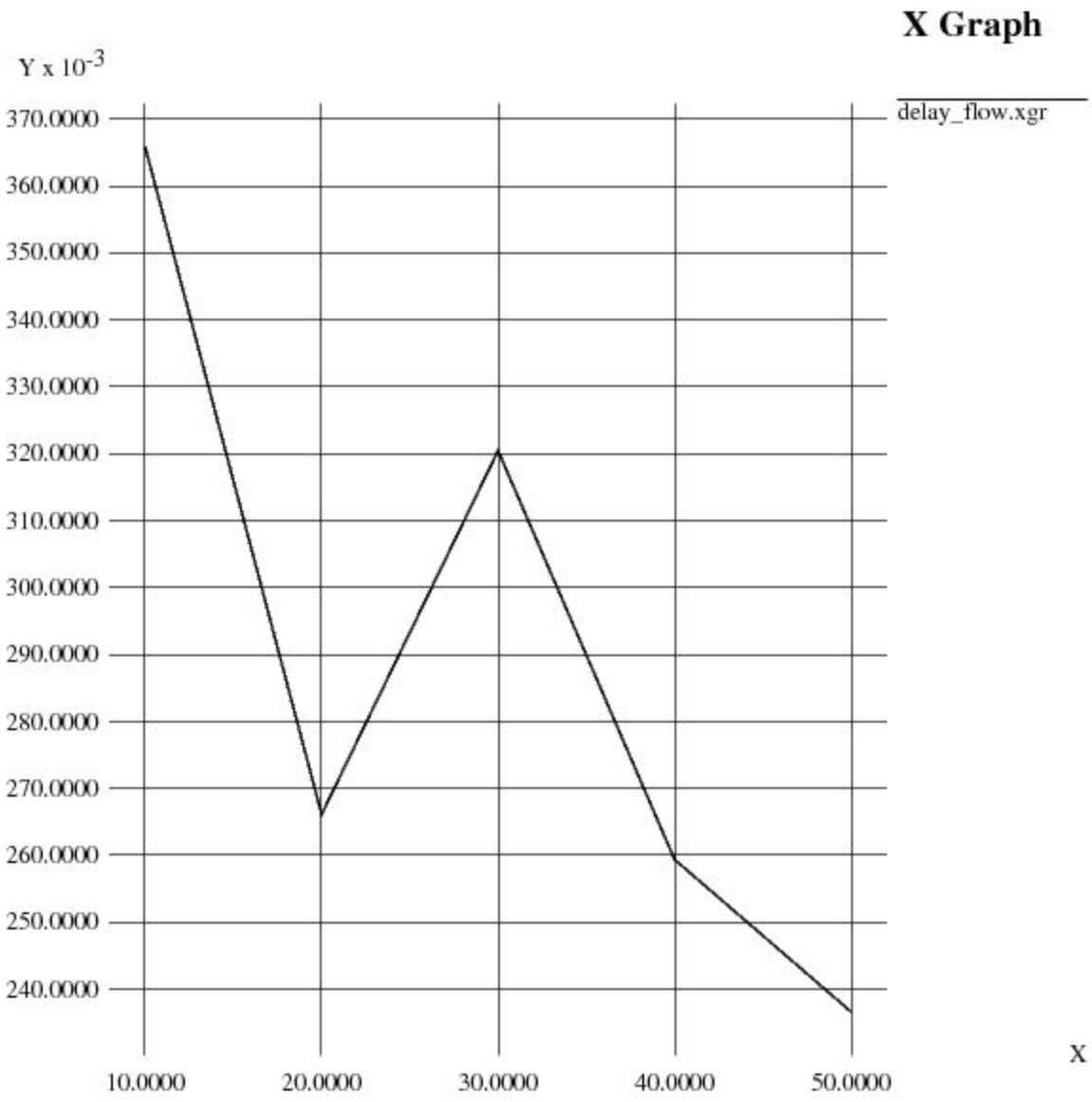

Y x 10^3
5.6000
5.4000
5.2000
5.0000
4.8000
4.6000
4.4000
4.2000
4.0000
3.8000
3.6000
3.4000
3.2000
3.0000
2.8000
2.6000
2.4000
2.2000
2.0000
1.8000
1.6000
1.4000
1.2000
1.0000
20.0000
40.0000
60.0000
80.0000
100.0000
X
energy_node.xgr

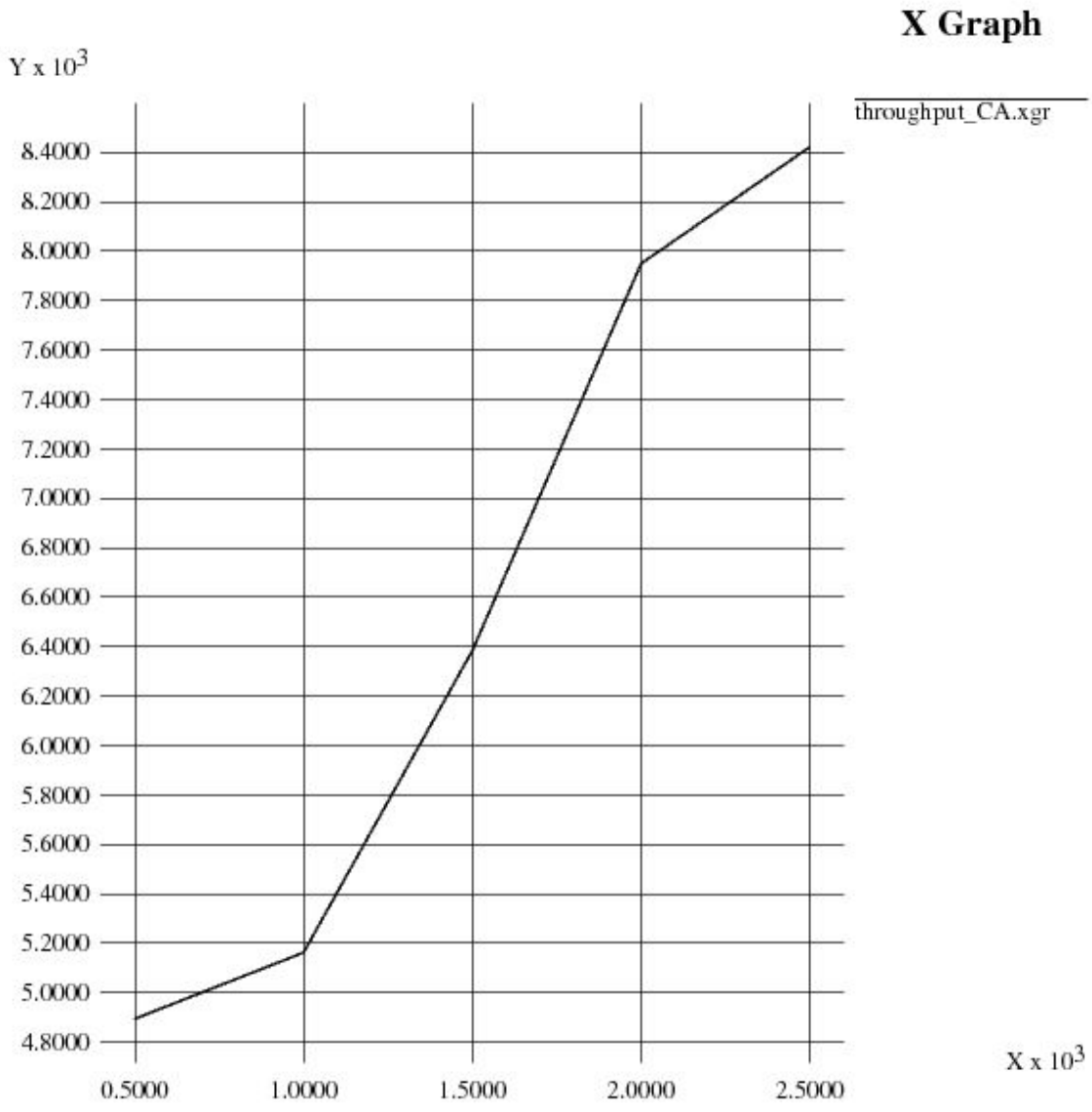
X Graph


Y
77.5000
77.0000
76.5000
76.0000
75.5000
75.0000
74.5000
74.0000
73.5000
73.0000
72.5000
72.0000
71.5000
71.0000
70.5000
70.0000
69.5000
69.0000
68.5000
68.0000
67.5000
67.0000
66.5000
20.0000
40.0000
60.0000
80.0000
100.0000
packdropratio_node.xgr
X

X Graph


Y
25.0000
24.0000
23.0000
22.0000
21.0000
20.0000
19.0000
18.0000
17.0000
16.0000
15.0000
14.0000
13.0000
12.0000
11.0000
10.0000
9.0000
8.0000
10.0000
20.0000
30.0000
40.0000
50.0000
X
pdevratio_flow.xgr


X Graph
Y x 10-3
delay_flow.xgr
370.0000
360.0000
350.0000
340.0000
330.0000
320.0000
310.0000
300.0000
290.0000
280.0000
270.0000
260.0000
250.0000
240.0000
10.0000
20.0000
30.0000
40.0000
50.0000
X


X Graph
throughput_CA.xgr
Y x 10^3
8.4000
8.2000
8.0000
7.8000
7.6000
7.4000
7.2000
7.0000
6.8000
6.6000
6.4000
6.2000
6.0000
5.8000
5.6000
5.4000
5.2000
5.0000
4.8000
0.5000
1.0000
1.5000
2.0000
2.5000
X x 10^3

Summary Findings:

1. It is seen that the first modification, which occurred in the contention window, caused the delay to change and increase in some extent when there are more nodes in the case of 802.11 .

2. In case of energy required, it falls rapidly after modification of 802.11 suggesting that the second modification has significant effect.

3. There is no significant change in the packet delivery ratio due to the modifications done.

4. Due to our second modification in AODV, the throughput vs coverage are of 802.15.4 shows that there is overall increase in maximum throughput but it falls rapidly as coverage increases.

5. The energy as nodes increases changes the same way for 802.15.4 after modification. It may be due to the fact that small mobile routers already have low energy usage and cannot be more efficient.

6. The second modification has caused the delay to increase in 802.15.4 but only by a very slight amount.

7. The second modification seems to have caused a huge increase in packet drop ratio as flow increases in the case of 802.11.

Overall conclusion seems to be that the modifications have worked well in the case of 802.11. The EBEM has caused delay to increase but the other overall factors seem somewhat appreciable. In case of 802.15.4, the AODV modification could not act much in reducing energy consumption due to it being already very energy efficient.