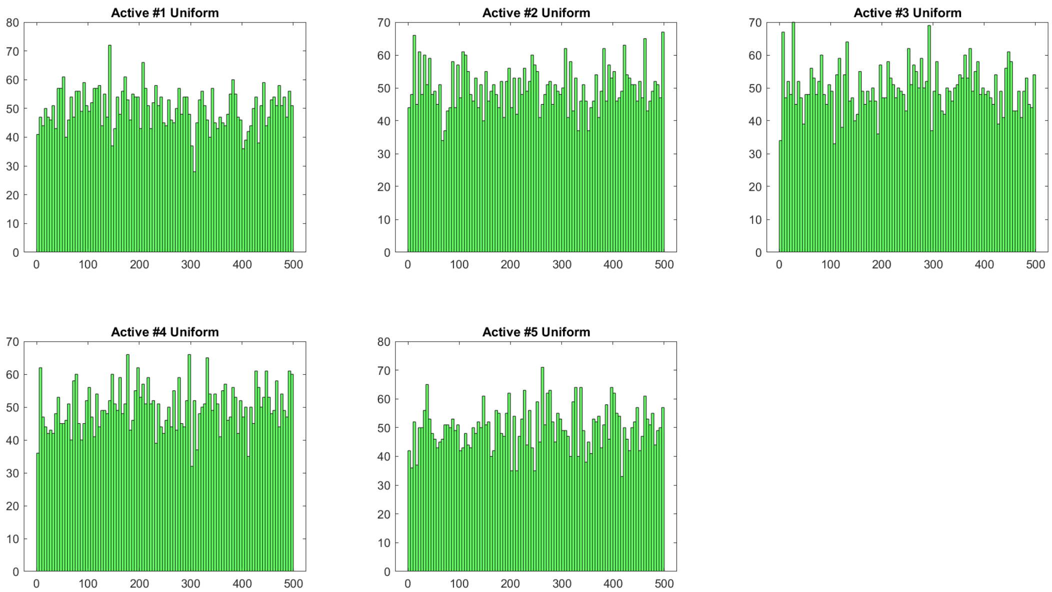
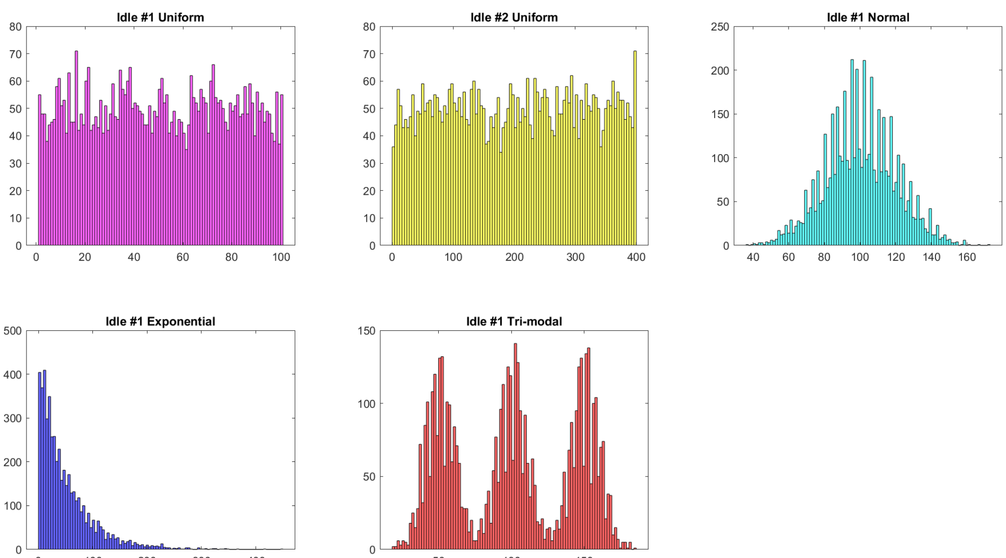
Assignment 1 report:
Part 1:
At first, 5 active period vectors, uniformly distributed, are generated using MATLAB random generator function “randi()”. Fig. (1.1 to 1.5)

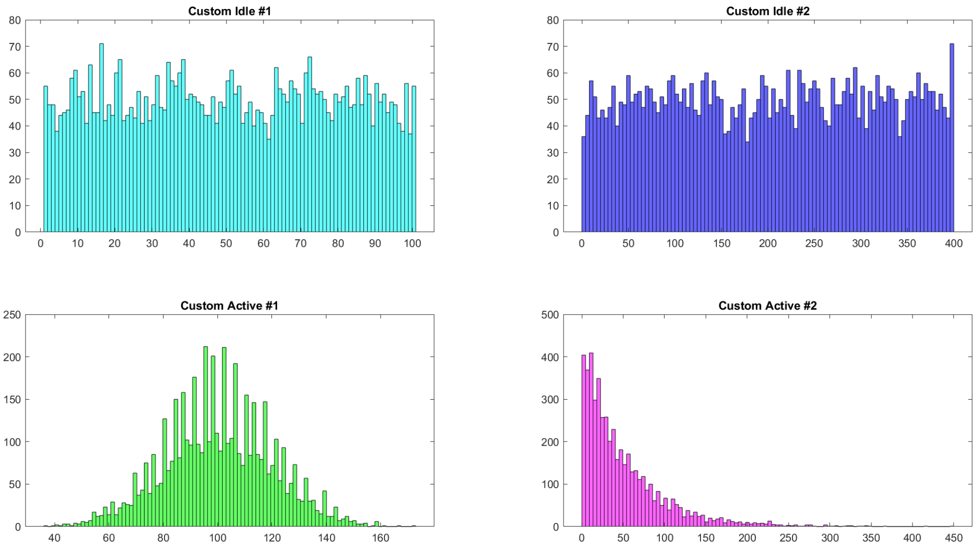
Then 5 different idle vectors are generated:
1. Uniform distribution, min = 1us, max=100us (high utilization) : for this vector 5000 random integer values between 1 to 100 using MATLAB random generator function “randi()”. Fig. (2.1)
2. Uniform distribution, min=1us, max=400us (low utilization): for generating this vector like previous one, 5000 random number between 1 to 400 has generated using MATLAB random generator function “randi()”. Fig. (2.2)
3. Normal distribution, mean=100us, standard deviation=20: for generating this vector, 5000 Normally distributed float numbers has generated, using MATLAB random generator function “random('Normal', ...)”, then using “Ceil()” function they rounded to up(to avoid ‘0’). Fig. (2.3)
4. Exponential distribution, mean=50us: 5000 random number generated using MATLAB random generator function “random(' Exponential', ...)”. Fig. (2.4)
5. Tri-modal distribution, mean = 50, 100, 150us, standard deviation=10: this vector generated by combining 5000 numbers which has made in this way: an integer number generated between 1-3, then based on this random number one of 3 normal distribution with different means used to generate this new number. Fig. (2.5)

   All these vectors histograms are shown in Fig. 1 & Fig. 2.
   Also, custom vectors histograms are in Fig. 3.

   The code to generate, make histogram, save result in workloadProfile file are in “Workload_profile_generation.m” which is attached.


Active #1 Uniform
Active #2 Uniform
Active #3 Uniform
Active #4 Uniform
Active #5 Uniform


Idle #1 Uniform
Idle #2 Uniform
Idle #1 Normal
Idle #1 Exponential
Idle #1 Tri-modal


Custom Idle #1
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100
Custom Idle #2
80
70
60
50
40
30
20
10
0
0 50 100 150 200 250 300 350 400
Custom Active #1
250
200
150
100
50
0
40 60 80 100 120 140 160
Custom Active #2
500
400
300
200
100
0
0 50 100 150 200 250 300 350 400 450

Part 2:

First case (only idle state):

In this case different timeouts have tested in 7 different workloads and result of energy overhead **Fig. 4** and saved energy **Fig. 5** using transitions are calculated. From the figures this result could be observed:

I. for custom_workload_1 as timeout increases saved energy decreases until overhead is dominated the saving and it even gets negative. This workload has the most saved energy between others.

II. for custom_workload_2 is somehow the same as previous but with the less saved energy in lower timeouts and more overhead in higher.

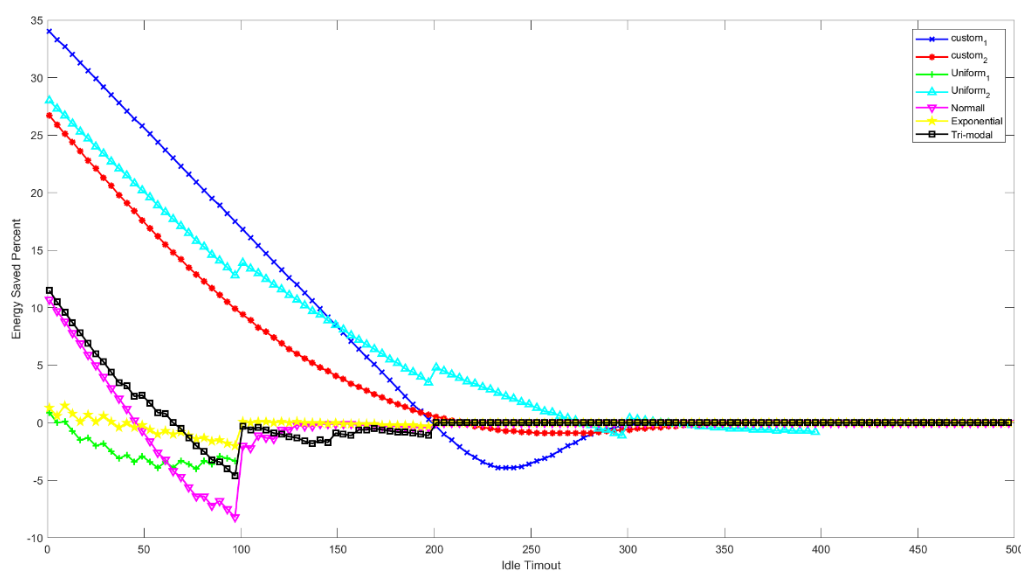
III. for high utilization uniform distribution with any timeout value overhead is dominated so transitions are worsen the saved energy. However, for low utilization, this policy seems useful.

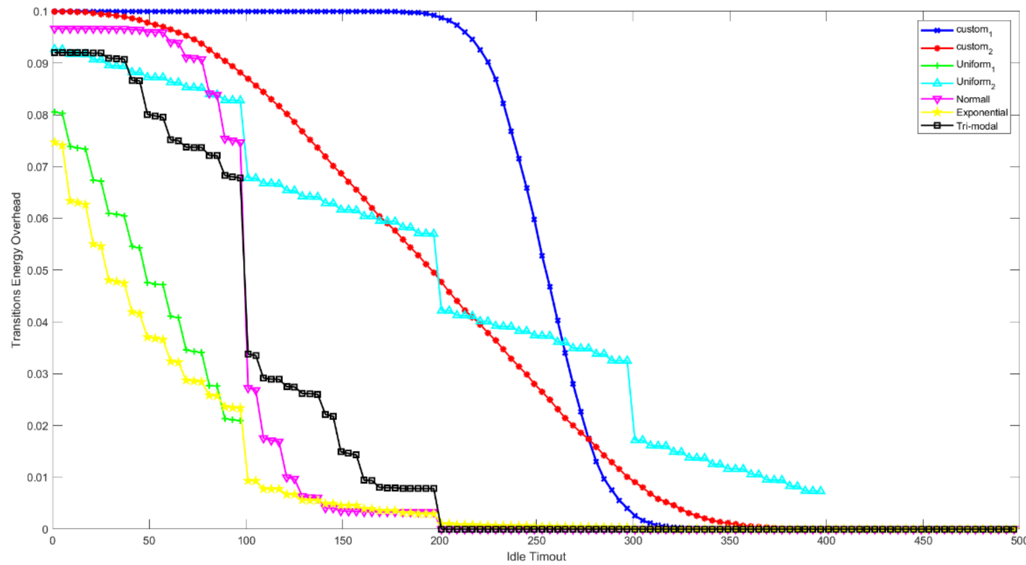
IV. For normal distribution, low timeous works much better, cause it include most of the short idles. as it increases, power saving decreases until overhead dominated the saving. In This case worse power lose has happened.

V. For exponential, as a result most of idles are small, so saving is not that much to be considered.

VI. For Tri-modal distribution, low timeouts include most of idles until timeout passes the first hill. Then it saving will decreases until it hit negative peak near the second hill. In this model, same as normal distribution, getting close to hills lowers the overhead as a result of decrees in translons (lower overhead), but missing lots of idles before the hill decrees the overal the efficiency.

Consequently, this model works better with workloads in which there is more long idles than shorts. Except, Exponential model and high utilization, all other models has better saving with low timeouts due to their sudo-convex shape.





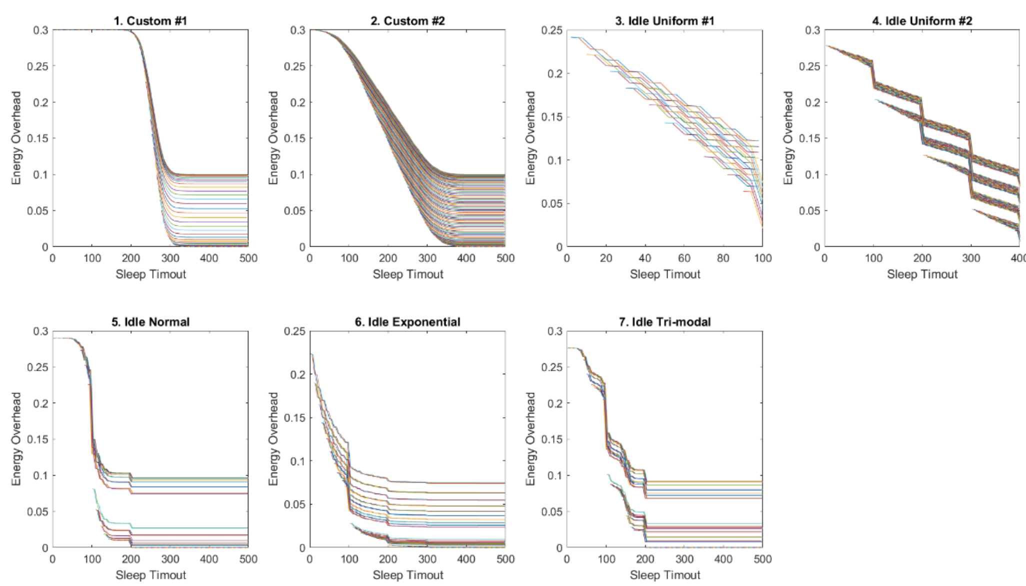
Second case (both idle and sleep state):

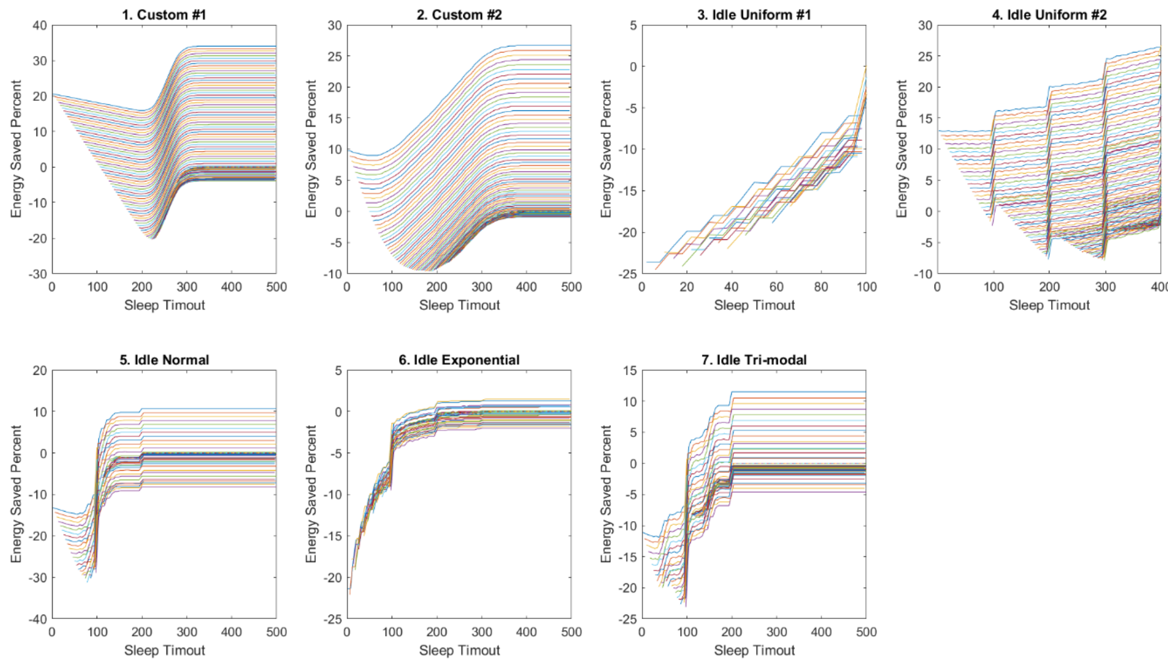
In this case different idle timeouts each with different sleep timeout have tested in 7 different workloads and result of energy overhead **Fig. 6** and saved energy **Fig. 7** using transitions are calculated.

As it shows in figures, in all of cases (with this PSM transition energy and delay to sleep state) sleep is nothing but overhead.

In High utilization uniform model is worst than others; in low utilization uniform is much tolerable.

Unless a better sleep state with lower overhead (in both time and energy) is introduced, this sleep state only gives worse result with respect to the “only idle” case.





Assignment 3 report:

- Description of implemented predictive policy
- Result of implemented predictive policy with the profiles
- Analysis on window size vs. energy saving
- Analysis on coefficient values vs. energy saving (model order)
- Comparison between predictive and timeout policies
- Analysis on timing and energy overhead

A single