Convex Optimization

Tutorial 7

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In [ ]:
```
#Importing required Libraries
import numpy as np
import matplotlib.pyplot as plt
import cvxpy as cp
import math
```

In [ ]:
```
from pv_output_data import *
```

In [ ]:
```
total_num = 24 * 12
val_lambda = 1
```

In [ ]:
```
#Variables of size T x 1
c = cp.Variable(T)
s = cp.Variable(T)
r = cp.Variable(T)
```

In [ ]:
```
#Laplacian to calculate the smoothness of c
Laplacian_C = 0
for i in range(1, total_num):
    Laplacian_C += cp.square(c[i-1] - c[i])

Laplacian_C += cp.square(c[total_num-1] - c[0])
```

In [ ]:
```
MyObjective = cp.Minimize(Laplacian_C + val_lambda * np.ones(T) @ s)
MyConstraints = [
    s >= 0,
    c >= 0,
    p == c - s + r,
    s <= c,
    cp.norm(r, 1) / T <= 4.0
]
```

In [ ]:
```
for t in range(T - total_num):
    MyConstraints += [c[t + total_num] == c[t]]
```

In [ ]:
```
MyProblem = cp.Problem(MyObjective, MyConstraints)
Op_value = MyProblem.solve()
print("The optimal value of the function: {}".format(Op_value))
```

```
The optimal value of the function: 98130.29461447048
```

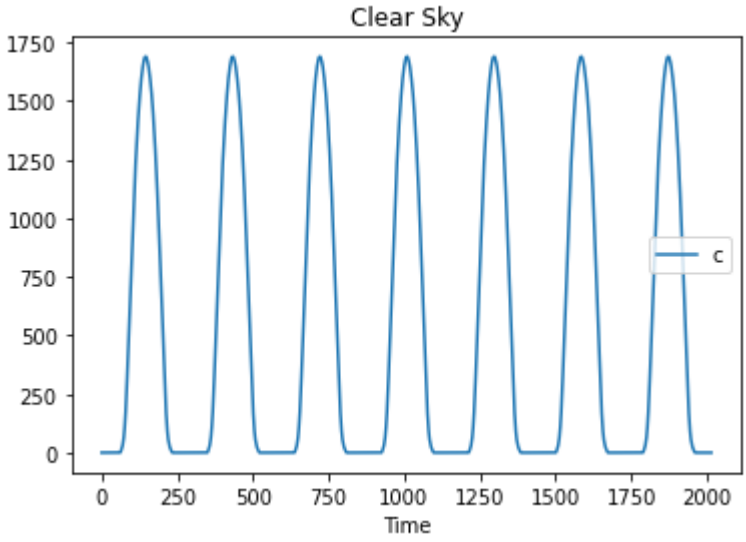
In [ ]:
```
print("The average value of s: {}".format((np.mean(s.value))))
print("The average value of c: {}".format(np.mean(c.value)))
print("The average value of p: {}".format(np.mean(p)))
print("The average absolute value of r: {}".format(np.mean(np.abs(r.value)))))
```

```
The average value of s: 4.478406110661431
```

```
The average value of c: 529.5158667139498
The average value of p: 529.0375009330357
The average absolute value of r: 4.000349357587738
```

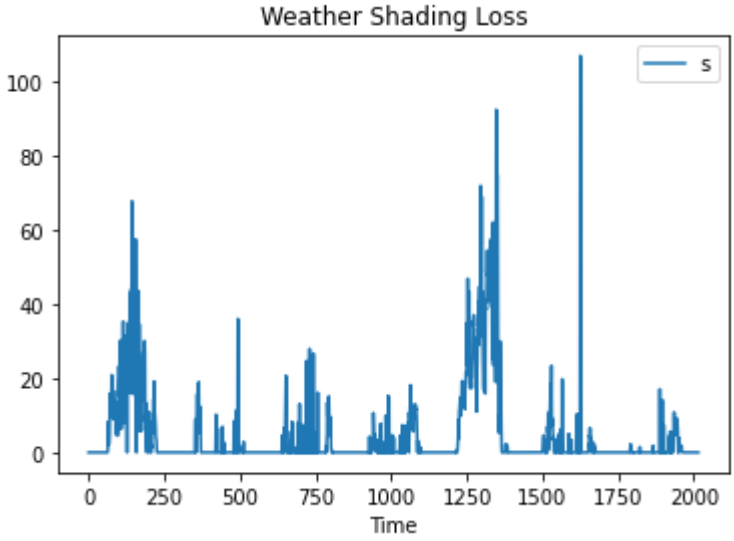
In [ ]:

```
plt.figure()
plt.plot(np.arange(T), c.value, label='c')
plt.xlabel('Time')
plt.title('Clear Sky')
plt.legend()
plt.show()
```



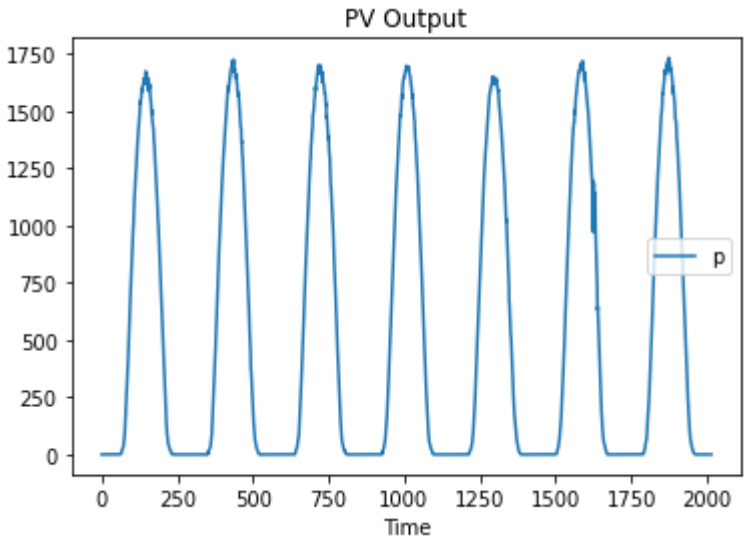
In [ ]:

```
plt.figure()
plt.plot(np.arange(T), s.value, label='s')
plt.xlabel('Time')
plt.title('Weather Shading Loss')
plt.legend()
plt.show()
```



In [ ]:

```
plt.figure()
plt.plot(np.arange(T), p, label='p')
plt.xlabel('Time')
plt.title('PV Output')
plt.legend()
plt.show()
```



In [ ]:

```
plt.figure()
plt.plot(np.arange(T), r.value, label='r')
plt.xlabel('Time')
plt.title('Residual')
plt.legend()
plt.show()
```