

9.5

Lab#3 Exercise

Modulation Transfer Function

Title:

Thermal Printer



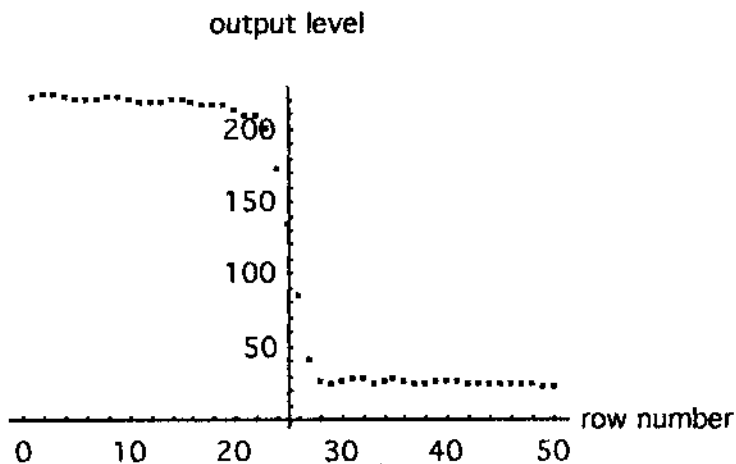
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Course:	Image Evaluation
Instructor:	Jack Holm
Due date:	May 4, 1993

```
<<Statistics`DescriptiveStatistics`
```

```
esf = Table[N[Mean[scanner[[i]]]], {i, 1, 50}]
```

```
{221.039, 223.34, 223.214, 220.738,
 219.252, 218.883, 219.728, 222.252,
 222.408, 220.262, 218.583, 218.35,
 218.709, 219.718, 219.437, 217.223,
 215.748, 216.971, 216.621, 212.68,
 208.728, 208.408, 199.641, 172.447,
 134.301, 84.8447, 40.9709, 25.5437,
 23.8058, 25.3883, 28.3301, 26.9515,
 24.5922, 25.4466, 27.3495, 26.0485,
 23.8544, 23.7767, 24.9126, 25.1553,
 24.7864, 24.534, 24.5534, 23.8058,
 23., 23.301, 24.4563, 23.9515,
 21.7184, 21.8252}
```

```
ListPlot[esf, AxesLabel -> {"row number", "output level"},
AxesOrigin -> {25, 0}]
```

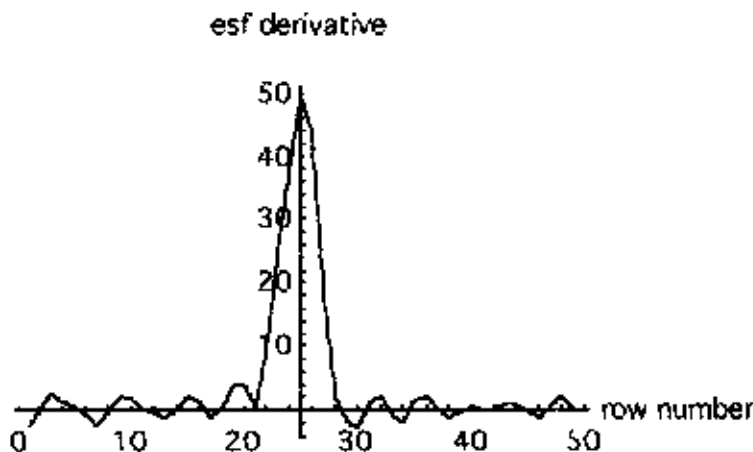


```
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```

```
Insf = Table[(esf[[i]] - esf[[i+1]]), {i, 1, 49}]
```

```
{-2.30097, 0.126214, 2.47573,
 1.48544, 0.368932, -0.84466,
 -2.52427, -0.15534, 2.14563,
 1.67961, 0.23301, -0.359223,
 -1.00971, 0.281553, 2.21359,
 1.47573, -1.2233, 0.349515,
 3.94175, 3.95146, 0.320388,
 8.76699, 27.1942, 38.1456, 49.4563,
 43.8738, 15.4272, 1.73786,
 -1.58252, -2.94175, 1.37864,
 2.35922, -0.854369, -1.90291,
 1.30097, 2.19417, 0.0776699,
 -1.13592, -0.242718, 0.368932,
 0.252427, -0.0194175, 0.747573,
 0.805825, -0.300971, -1.15534,
 0.504854, 2.23301, -0.106796}
```

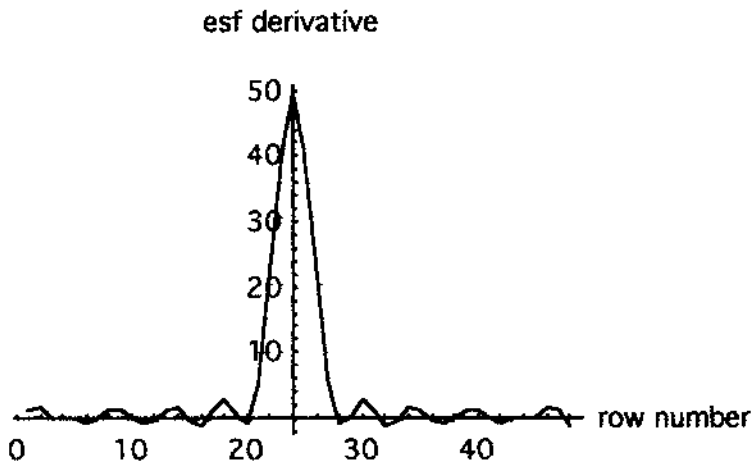
```
ListPlot[Insf, PlotRange -> All, PlotJoined -> True,
 AxesLabel -> {"row number", "esf derivative"},
 AxesOrigin -> {25, 0}]
```



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```
symInsf = Table[(Insf[[i]] + Insf[[50-i]])/2, {i, 2, 49}];
```

```
ListPlot[symIsf, PlotRange -> All, PlotJoined -> True,
AxesLabel -> {"row number", "esf derivative"},
AxesOrigin -> {24, 0}]
```



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```
n = 48;
redft = 1/(n^.5) Re[Fourier[symIsf]];
imdft = 1/(n^.5) Im[Fourier[symIsf]];
cbd[x_] := (-1)^x
checkerboard = DiagonalMatrix[N[Table[cbd[x], {x,0, (n-1)}]]];
recbdft = checkerboard.redft;
imcbdft = checkerboard.imdft;
repardft = Partition[recbdft, (n/2)];
impardft = Partition[imcbdft, (n/2)];
realdft = Flatten[{repardft[[2]],repardft[[1]]}];
imagdft = Flatten[{impardft[[2]],impardft[[1]]}];
ftrans = Table[(realdft[[i]] + I imagdft[[i]]), {i, 1, n}];
modulation = Abs[ftrans];
```

PercentModulation = modulation 100/(modulation[[25]])

{1.10933, 0.475997, 0.889363,
0.231113, 1.05828, 0.100159,
1.42832, 0.656515, 2.60863,
4.51578, 0.793409, 2.20505,
3.09548, 0.838435, 12.7385,
30.0282, 29.3005, 40.1869, 52.0217,
57.9984, 69.682, 75.267, 85.5969,
90.8245, 100., 90.8245, 85.5969,
75.267, 69.682, 57.9984, 52.0217,
40.1869, 29.3005, 30.0282, 12.7385,
0.838435, 3.09548, 2.20505,
0.793409, 4.51578, 2.60863,
0.656515, 1.42832, 0.100159,
1.05828, 0.231113, 0.889363,
0.475997}

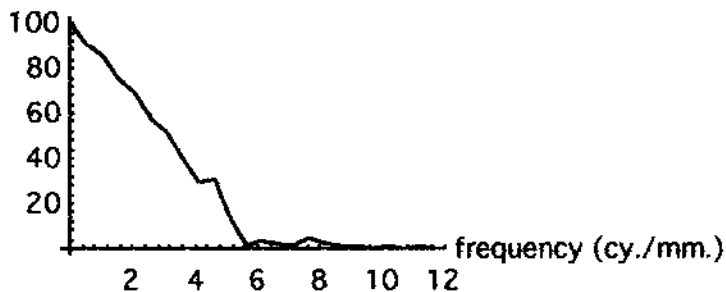
```
Frequencies = Table[.5102 i, {i, -24, 23}]
```

```
{-12.2448, -11.7346, -11.2244,  
-10.7142, -10.204, -9.6938,  
-9.1836, -8.6734, -8.1632, -7.653,  
-7.1428, -6.6326, -6.1224, -5.6122,  
-5.102, -4.5918, -4.0816, -3.5714,  
-3.0612, -2.551, -2.0408, -1.5306,  
-1.0204, -0.5102, 0, 0.5102,  
1.0204, 1.5306, 2.0408, 2.551,  
3.0612, 3.5714, 4.0816, 4.5918,  
5.102, 5.6122, 6.1224, 6.6326,  
7.1428, 7.653, 8.1632, 8.6734,  
9.1836, 9.6938, 10.204, 10.7142,  
11.2244, 11.7346}
```

```
MTF = Table[  
{Frequencies[[i]], PercentModulation[[i]]}, {i, 25, 48}];
```

```
ListPlot[MTF, PlotJoined -> True, PlotRange -> All,  
AxesLabel -> {"frequency (cy./mm.)", "% modulation"},  
AxesOrigin -> {0, 0}]
```

% modulation



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```
scanner = {0,  
0.51019999999999999999, 1.0204,  
1.5306, 2.0408, 2.551, 3.0612,  
3.5714, 4.0816, 4.5918,  
5.10199999999999999999, 5.6122,  
6.1224, 6.63259999999999999999,  
7.1428, 7.653, 8.1632, 8.6734,  
9.1836, 9.6938, 10.204, 10.7142,  
11.2244, 11.7346};
```