



ハードディスクベンチマーク問題 Ver.2 & Seekdemo

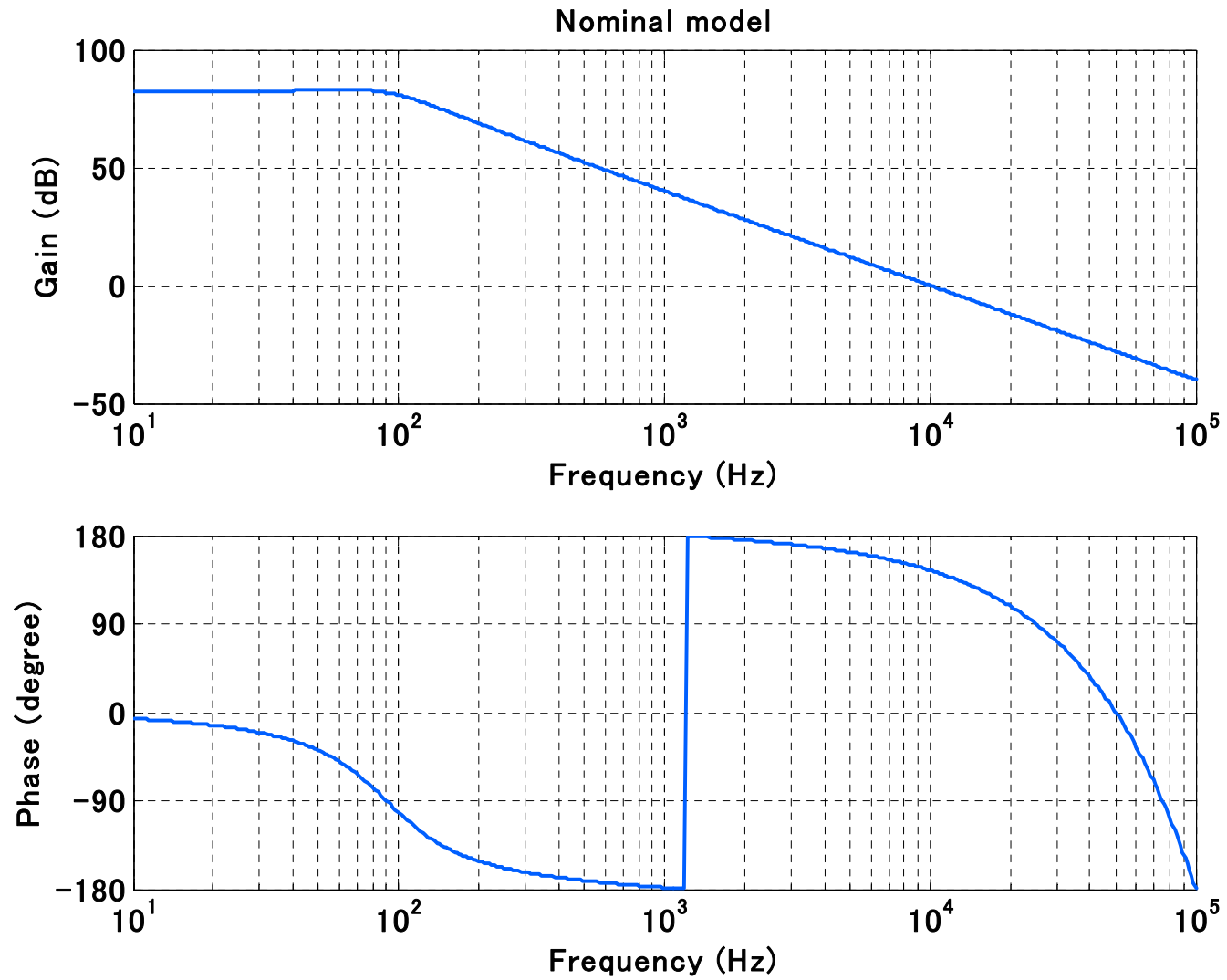
HDDベンチマークWG
宇都宮大学工学部
平田光男



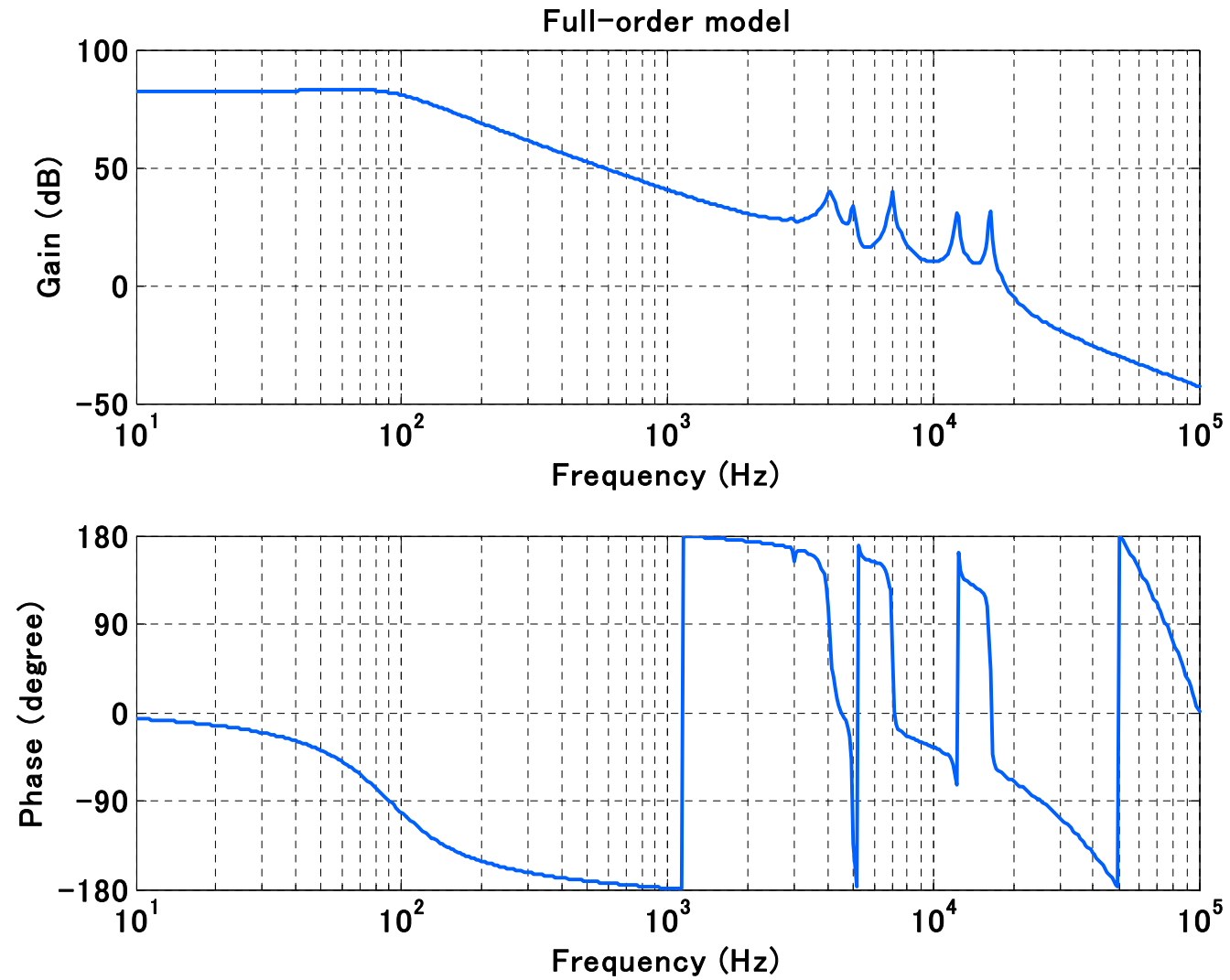
Ver.1.xとVer.2.xの違い

- 制御対象のメカモデルを変更
- 外乱のサンプリング時間を外乱毎に設定可能とした
- 外乱毎の外乱生成コマンドを分けた

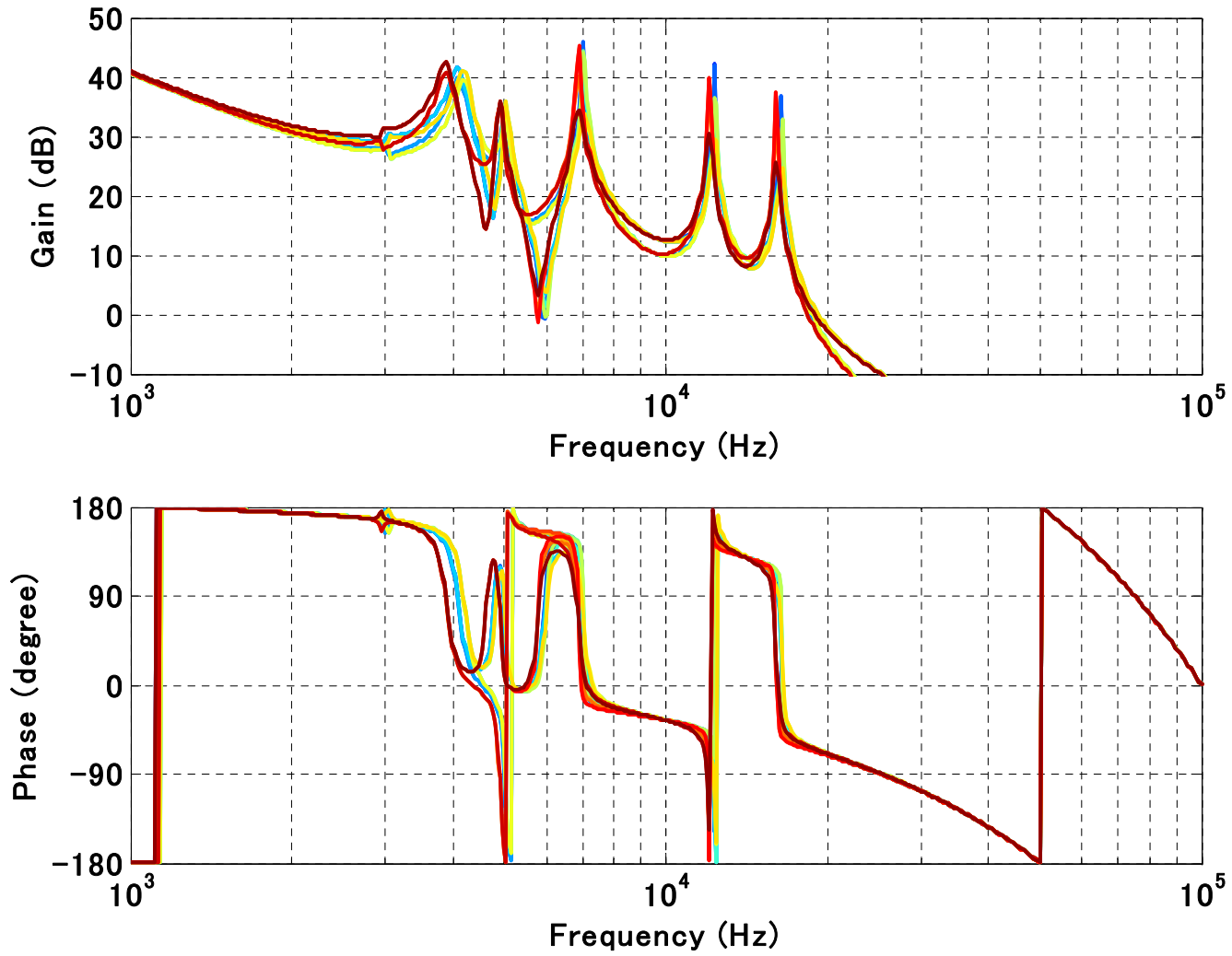
ノミナル制御対象



フルオーダーモデル



変動モデル



外乱のサンプリング周期

■ サンプリング周期の定義

PlantData = SetPlantModel;

PlantData.Ts - PESのサンプリング周期

PlantData.Tc - 制御器から出力される制御入力の
サンプリング周期

PlantData.Ty - 制御対象の出力のサンプリング周期

PlantData.Tu - 制御入力のサンプリング周期

■ サンプリング周期のデフォルト設定

$T_s = T_c = T_y = T_u$

■ 各外乱のサンプリング周期

- フラッタ外乱 T_y
- カ外乱 T_u
- RRO T_s
- センサーノイズ T_s

外乱パラメータの定義

```
function [DistParam] = SetDistParam(PlantData);
```

```
% The length of simulation
DistParam.num_sim_revolution = num_sim_revolution;
% Frequency vector
DistParam.Nums           = Nums;
DistParam.Numu           = Numu;
DistParam.Numy           = Numy;
DistParam.dFs            = dFs;
DistParam.dFu            = dFu;
DistParam.dFy            = dFy;
DistParam.Freqs          = Freqs;
DistParam.Frequ          = Frequ;
DistParam.Freqy          = Freqy;
% Sensor noise
DistParam.AmpSensorNoise = AmpSensorNoise;
% Force disturbance
DistParam.AmpForceDist   = AmpForceDist;
% Flutter disturbance
DistParam.AmpFlutterDist = AmpFlutterDist;
DistParam.FlutterFreq    = FlutterFreq;
% DistParam.FlutterFreqSigma = FlutterFreqSigma; % used ???
DistParam.FlutterFreqZeta = FlutterFreqZeta;
% RRO disturbance
DistParam.FreqRRO        = FreqRRO;
DistParam.AmpRRO         = AmpRRO;
DistParam.RROSequence   = RROSequence;
% Seeds for random signal
DistParam.Seed_ForceDist = 1;
DistParam.Seed_SensorNoise = 2;
DistParam.Seed_FlutterDist = 3;
DistParam.Seed_RRODist   = 4;
```



フラッタ外乱

```
[Flutter] = SetFlutterDist (PlantData, DistParam) ;
```

```
% Output parameters in time domain
```

```
Flutter.Dist      = Dist;  
Flutter.DistT     = DistT;  
Flutter.DistTs    = Ty;  
Flutter.DistAtPes = DistAtPes;  
Flutter.DistAtPesT = DistAtPesT;  
Flutter.DistAtPesTs = DistAtPesTs;
```

```
% Output parameters in frequency domain
```

```
Flutter.Freq      = Freq;  
Flutter.Spec      = Spec;
```




力外乱

```
[Force] = SetForceDist (PlantData, DistParam) ;
```

```
% Output parameters in time domain
```

```
Force.Dist = Dist;
```

```
Force.DistT = DistT;
```

```
Force.DistTs = Tu;
```

```
Force.DistAtPes = DistAtPes;
```

```
Force.DistAtPesT = DistAtPesT;
```

```
Force.DistAtPesTs = Ts;
```

```
% Output parameters in frequency domain
```

```
Force.Freq = Freq;
```

```
Force.Spec = Spec;
```

```
Force.SpecAtPes = SpecAtPes;
```



センサーノイズ

```
[Sensor] = SetSensorNoise(PlantData, DistParam);
```

```
% Output parameters in time domain
```

```
Sensor.Noise = Noise;
```

```
Sensor.NoiseT = NoiseT;
```

```
Sensor.NoiseTs = Ts;
```

```
% Output parameters in frequency domain
```

```
Sensor.Freq = Freq;
```

```
Sensor.Spec = Spec;
```



Repeatable RunOut (RRO) 外乱

```
[RRO] = SetRRO (PlantData, DistParam) ;
```

```
% Output parameters in time domain
```

```
RRO.Dist      = RRODist;
```

```
RRO.DistT     = RRODistT;
```

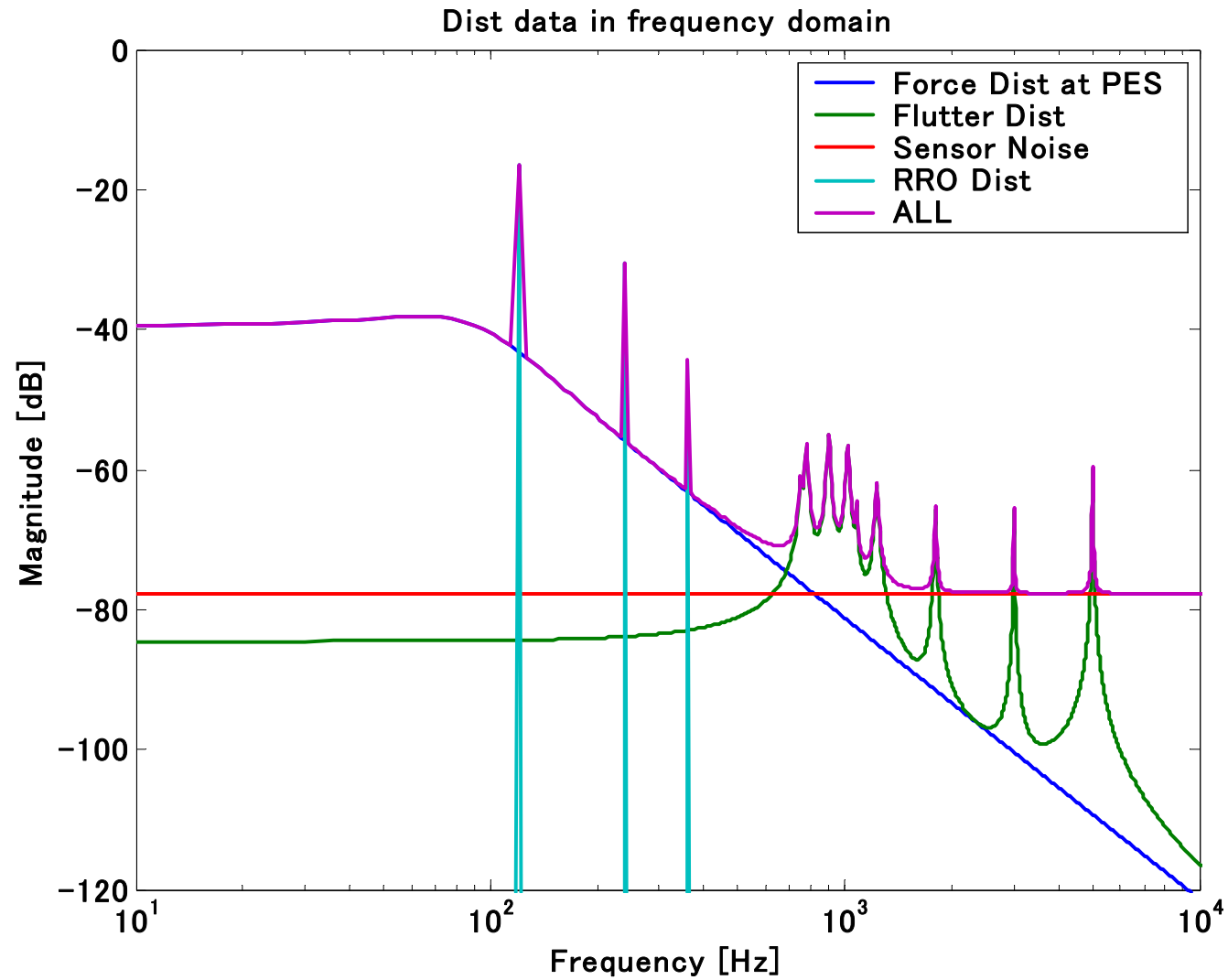
```
RRO.DistTs    = Ts;
```

```
% Output parameters in frequency domain
```

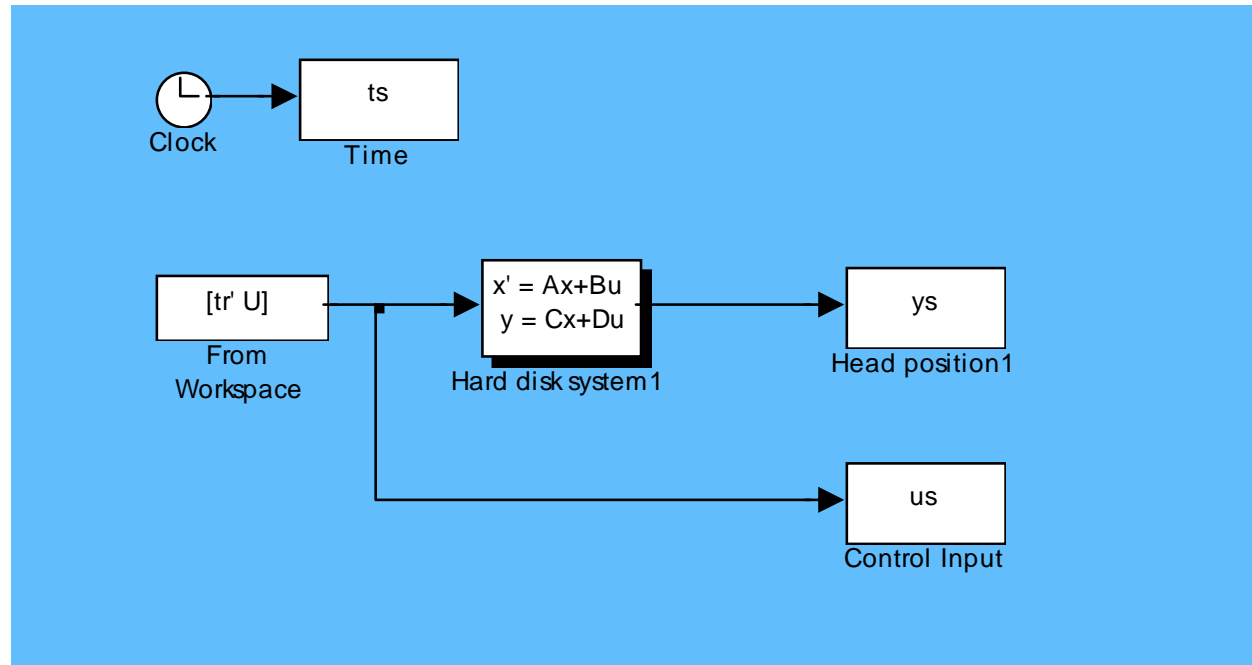
```
RRO.Freq      = Freq;
```

```
RRO.Spec      = Spec;
```

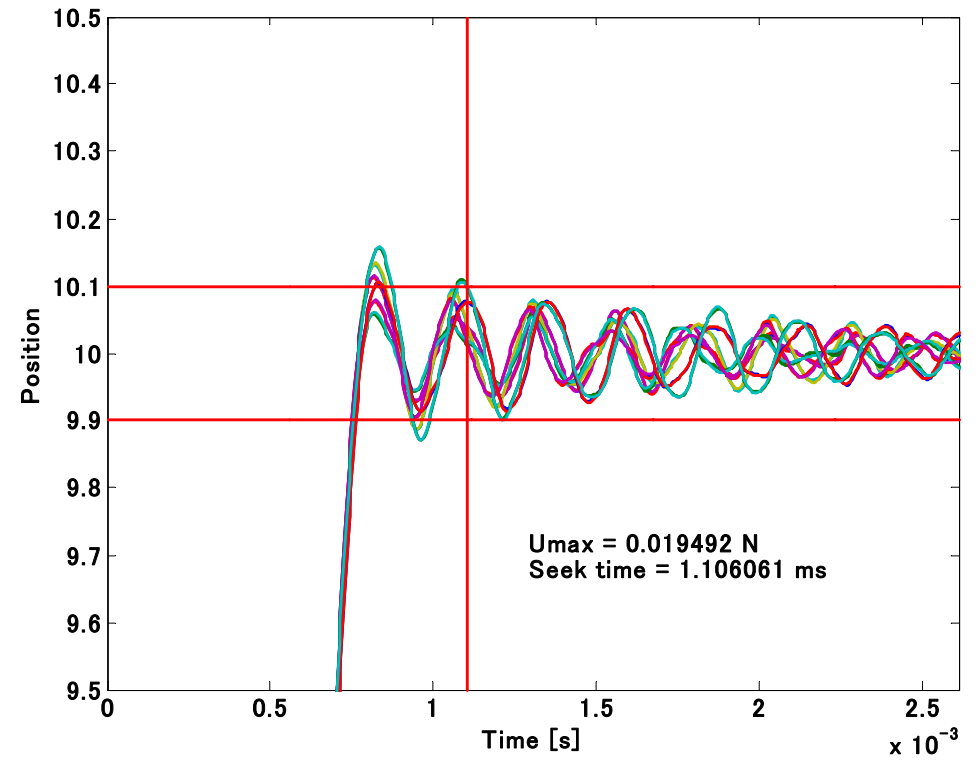
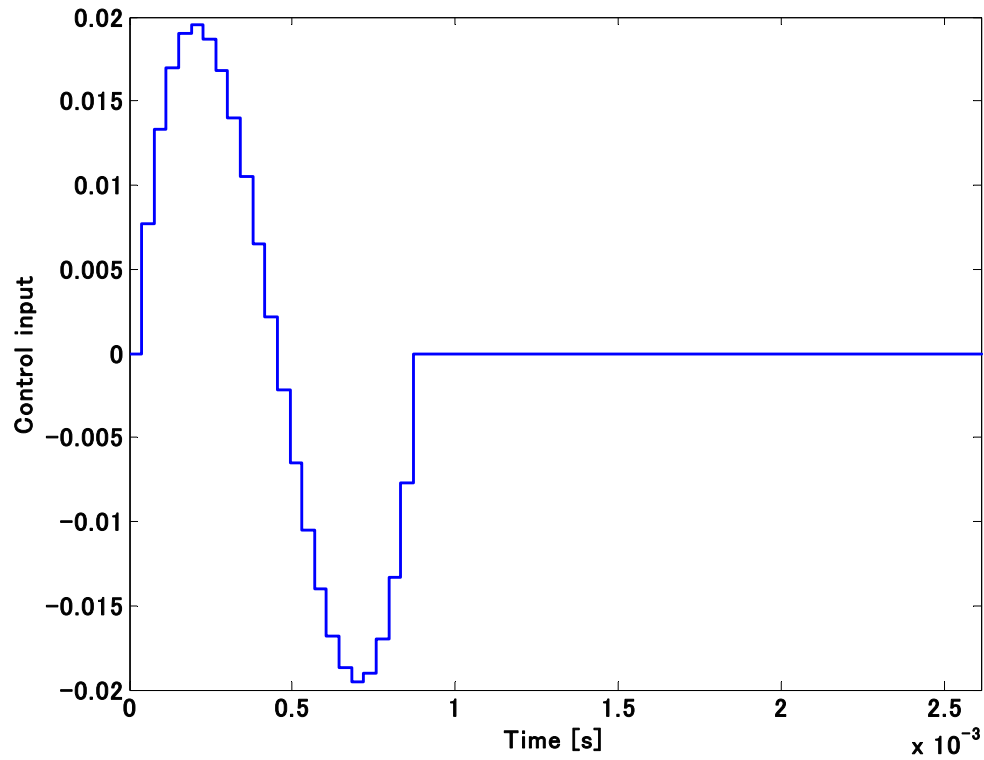
外乱のスペクトラム



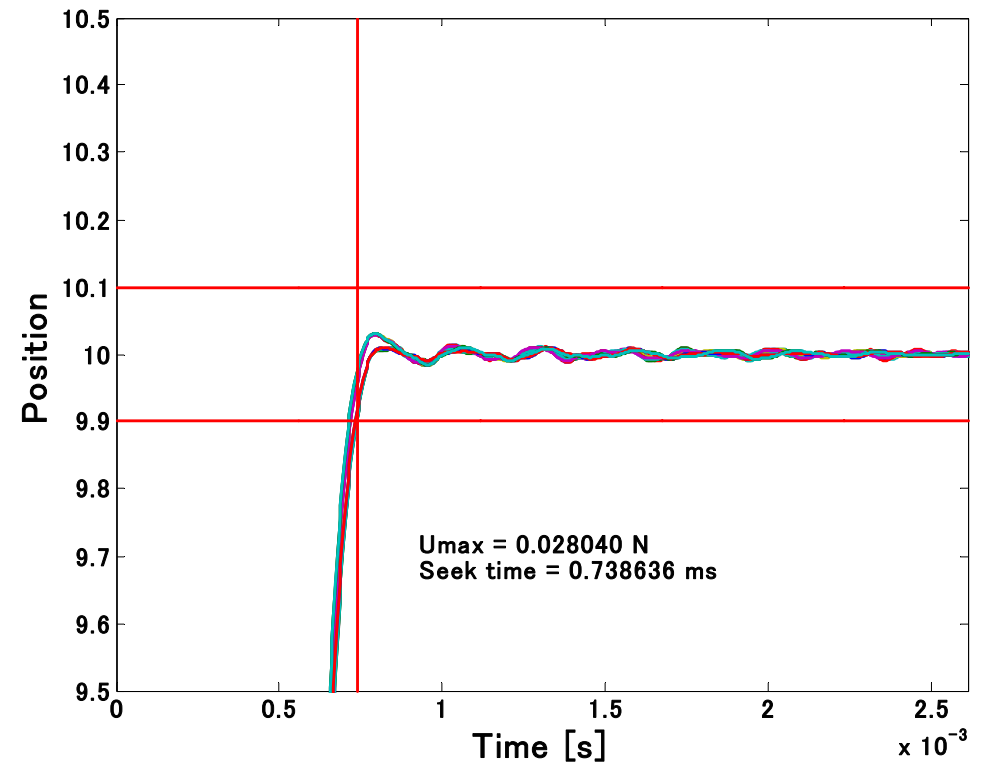
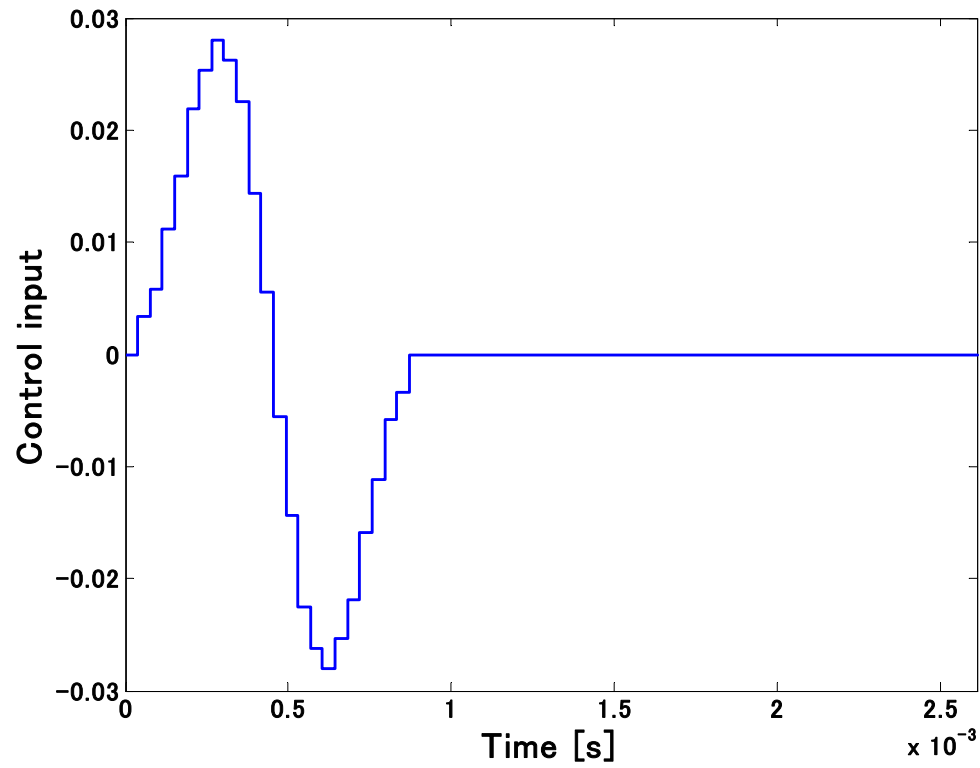
シーク制御デモ



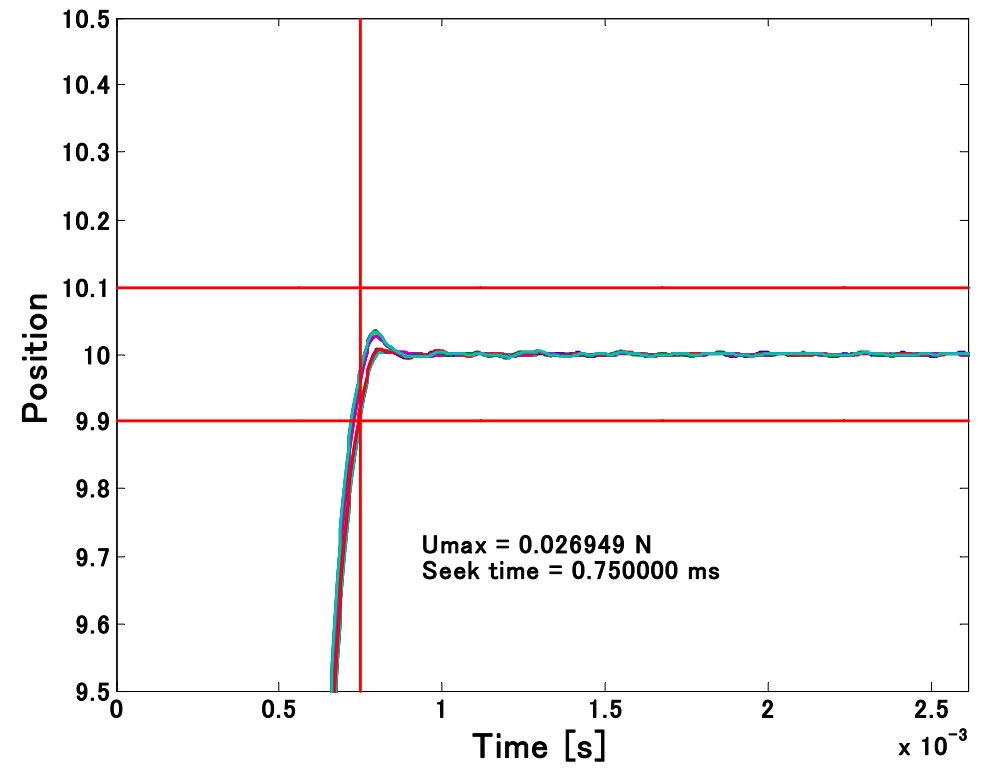
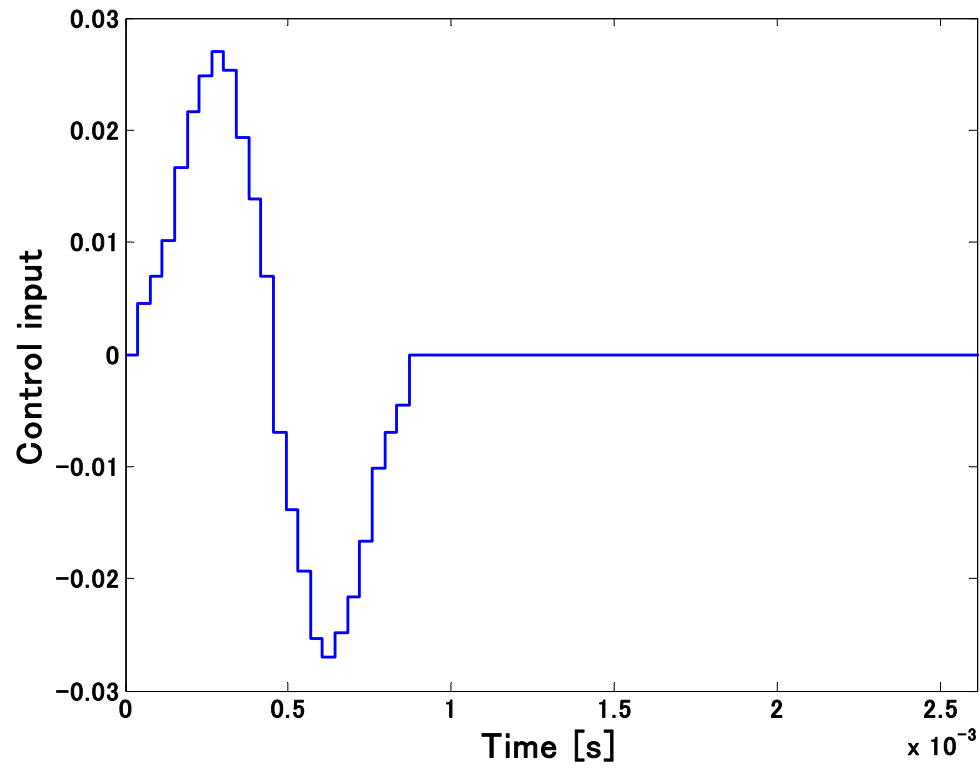
Minimum jerk input



Frequency shaped FSC 1



Frequency shaped FSC 2





ベンチマーク問題～シーク制御編～

- シーク時間は目標トラックの ± 0.1 track以内に収まった時間とする
- ロバスト性については、すべての変動モデル & ループゲイン変動 $\pm 5\%$ のすべての組み合わせで評価する
- 制御入力にLimitは設けない
- シーク距離は1track及び10trackとする