

Corresponding to the paper entitled “In-Stream Hydrokinetic Turbine Fault Detection and Fault Tolerant Control - A Benchmark Model” submitted to ACC 2019.

FAU MHK Simulation Setup Instruction

Setup

1. For initial download and compiling instructions please refer to <https://nwtc.nrel.gov/FAST8>
2. Replace the AeroDyn, ElastoDyn, InflowWind, and ServoDyn input files with the ones provided to represent FAU's MHK (Marine Hydrokinetic Turbine) operating conditions

Setup

3. Go to MHK folder -> InflowWind -> SEED Files
4. Copy one of the seed files to InflowWind -> Wind

« MHK » InflowWind » SEED Files			
Search SEED Files			
Name	Date modified	Type	Size
FAU_TurbSim_Hydro_19283440.bts	10/4/2018 12:49 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_44112233.bts	10/4/2018 12:44 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_56123489.bts	10/4/2018 12:37 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_56781234.bts	10/4/2018 12:30 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_112233445.bts	10/4/2018 12:40 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_123456789.bts	10/4/2018 12:25 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_201820182.bts	10/4/2018 12:45 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_221133445.bts	10/4/2018 12:41 PM	BTS File	8,508 KB
FAU_TurbSim_Hydro_234777891.bts	10/4/2018 12:46 PM	BTS File	8,508 KB

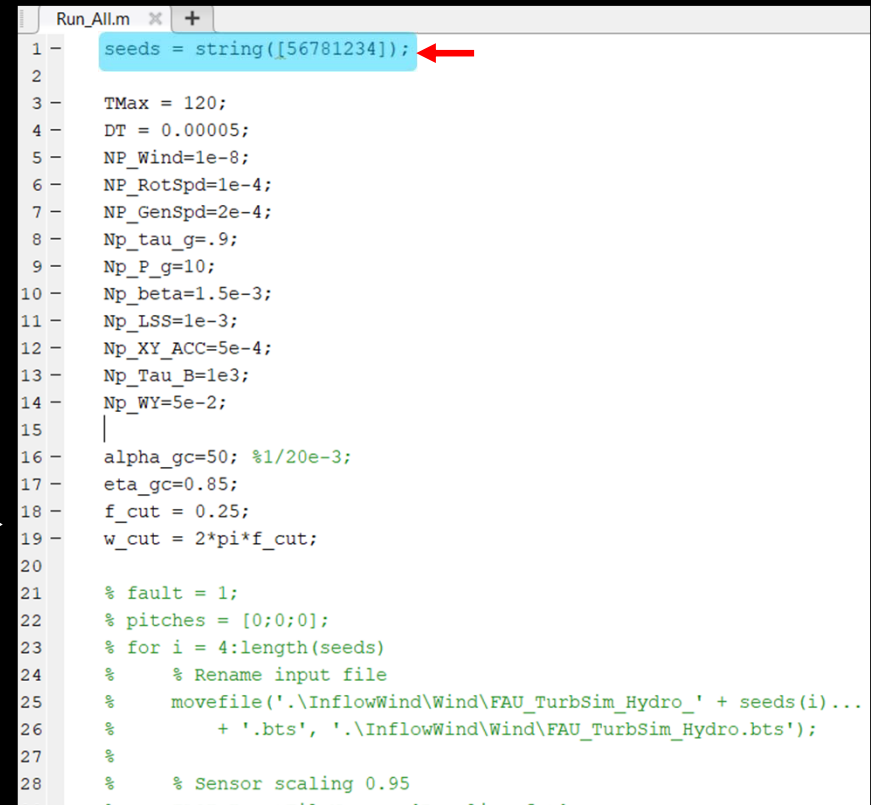
« MHK » InflowWind » Wind			
Search Wind			
Name	Date modified	Type	Size
FAU_TurbSim_Hydro_56781234.bts	10/4/2018 12:30 PM	BTS File	8,508 KB

Setup

5. Use MATLAB to open Run_All.m

bin	10/8/2018 10:45 A	File folder	
MHK	10/8/2018 10:45 A	File folder	
notes.txt	10/8/2018 10:45 A	Text Document	1 KB
<input checked="" type="checkbox"/> Run_All.m	10/8/2018 10:45 A	MATLAB Code	2 KB
run-all.bat	10/8/2018 10:45 A	Windows Batch File	1 KB

6. Change the seed value to match the file in the "Wind" folder

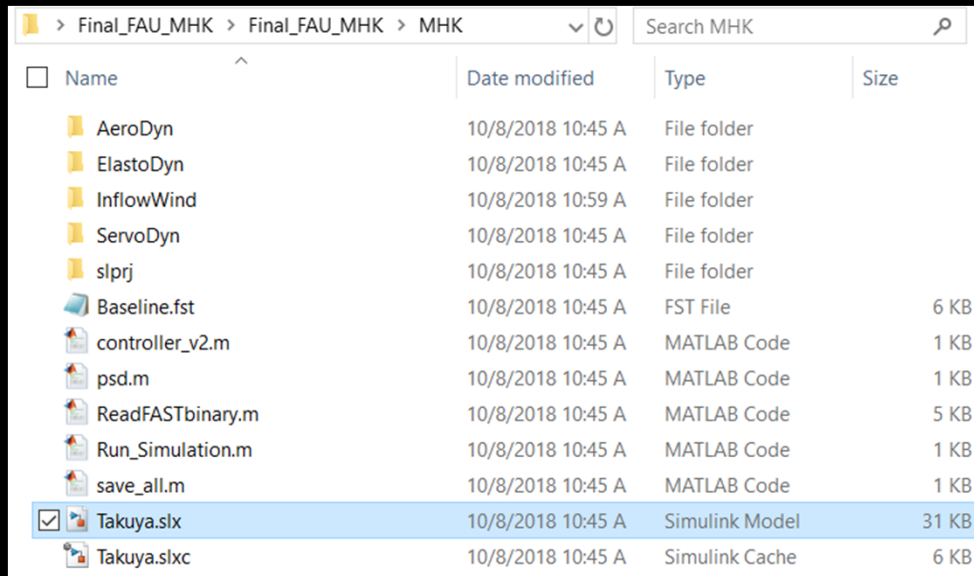


The image shows a MATLAB script named Run_All.m. The first line of the script is `seeds = string([56781234]);`, which is highlighted in blue. A red arrow points to this line. The script continues with various parameter assignments and a loop that processes the seeds. The parameters include TMax, DT, NP_Wind, NP_RotSpd, NP_GenSpd, Np_tau_g, Np_P_g, Np_beta, Np_LSS, Np_XY_ACC, Np_Tau_B, Np_WY, alpha_gc, eta_gc, f_cut, w_cut, % fault, % pitches, % for i = 4:length(seeds), % Rename input file, % movefile, % Sensor scaling, and % Sensor scaling.

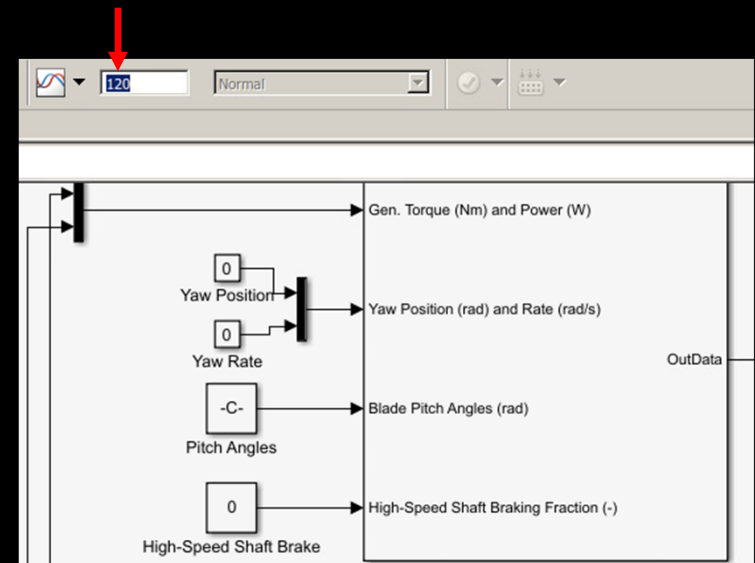
```
1 seeds = string([56781234]);
2
3 TMax = 120;
4 DT = 0.00005;
5 NP_Wind=1e-8;
6 NP_RotSpd=1e-4;
7 NP_GenSpd=2e-4;
8 Np_tau_g=.9;
9 Np_P_g=10;
10 Np_beta=1.5e-3;
11 Np_LSS=1e-3;
12 Np_XY_ACC=5e-4;
13 Np_Tau_B=1e3;
14 Np_WY=5e-2;
15
16 alpha_gc=50; %1/20e-3;
17 eta_gc=0.85;
18 f_cut = 0.25;
19 w_cut = 2*pi*f_cut;
20
21 % fault = 1;
22 % pitches = [0;0;0];
23 % for i = 4:length(seeds)
24 %     % Rename input file
25 %     movefile('.\InflowWind\Wind\FAU_TurbSim_Hydro_' + seeds(i)...
26 %         + '.bts', '.\InflowWind\Wind\FAU_TurbSim_Hydro.bts');
27 %
28 %     % Sensor scaling 0.95
```

Setup

7. Open the Takuya.slx file in Simulink
8. Change the simulation time from 30 sec to 120 sec (n/a if already at 120 sec)

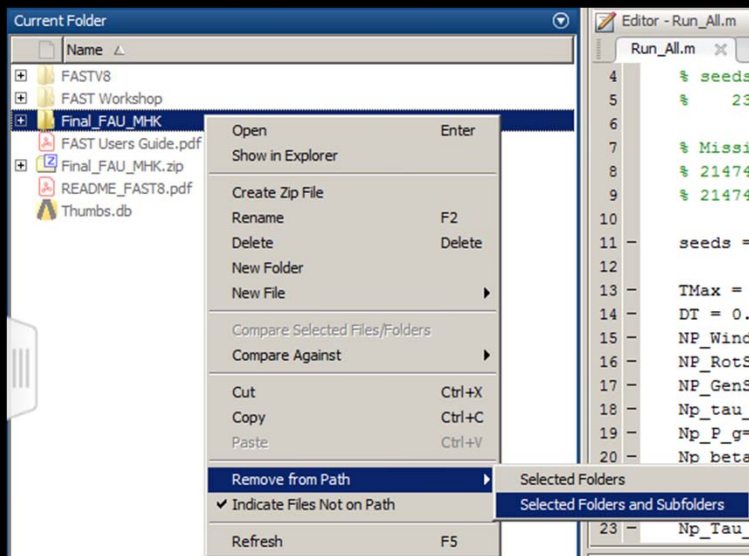


Final_FAU_MHK > Final_FAU_MHK > MHK				Search MHK
<input type="checkbox"/> Name	Date modified	Type	Size	
AeroDyn	10/8/2018 10:45 A	File folder		
ElastoDyn	10/8/2018 10:45 A	File folder		
InflowWind	10/8/2018 10:59 A	File folder		
ServoDyn	10/8/2018 10:45 A	File folder		
slprj	10/8/2018 10:45 A	File folder		
Baseline.fst	10/8/2018 10:45 A	FST File	6 KB	
controller_v2.m	10/8/2018 10:45 A	MATLAB Code	1 KB	
psd.m	10/8/2018 10:45 A	MATLAB Code	1 KB	
ReadFASTbinary.m	10/8/2018 10:45 A	MATLAB Code	5 KB	
Run_Simulation.m	10/8/2018 10:45 A	MATLAB Code	1 KB	
save_all.m	10/8/2018 10:45 A	MATLAB Code	1 KB	
<input checked="" type="checkbox"/> Takuya.slx	10/8/2018 10:45 A	Simulink Model	31 KB	
Takuya.slxc	10/8/2018 10:45 A	Simulink Cache	6 KB	



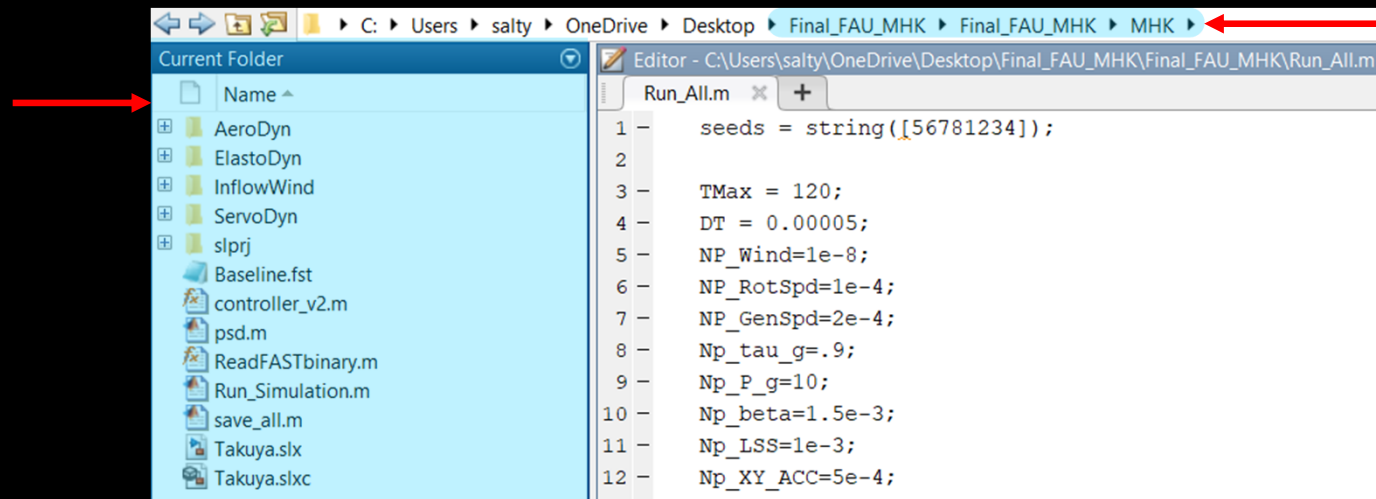
Setup

9. In MATLAB, add the Final_FAU_MHK folder to path as seen in picture
(Note: “Add to Path” will be shown)









Run

10. In MATLAB, navigate the “Current Folder” window to the MHK folder and then press play to run the script



Post-process

11. The program will yield a set of output files to the MHK folder named: “TurbSim_56781234_p*.mat” where p* represents the pitch angle for each simulation in radians.

<input checked="" type="checkbox"/>		TurbSim_221133445_p0.2618.mat	10/7/2018 1:29 PM	MATLAB Data	128,527 KB
<input checked="" type="checkbox"/>		TurbSim_221133445_p0.05236.mat	10/7/2018 6:32 AM	MATLAB Data	125,037 KB
<input checked="" type="checkbox"/>		TurbSim_221133445_p0.10472.mat	10/7/2018 8:17 AM	MATLAB Data	127,594 KB
<input checked="" type="checkbox"/>		TurbSim_221133445_p0.15708.mat	10/7/2018 10:01 A	MATLAB Data	126,742 KB
<input checked="" type="checkbox"/>		TurbSim_221133445_p0.20944.mat	10/7/2018 11:45 A	MATLAB Data	127,607 KB
<input checked="" type="checkbox"/>		TurbSim_221133445_p0.mat	10/7/2018 4:48 AM	MATLAB Data	125,010 KB