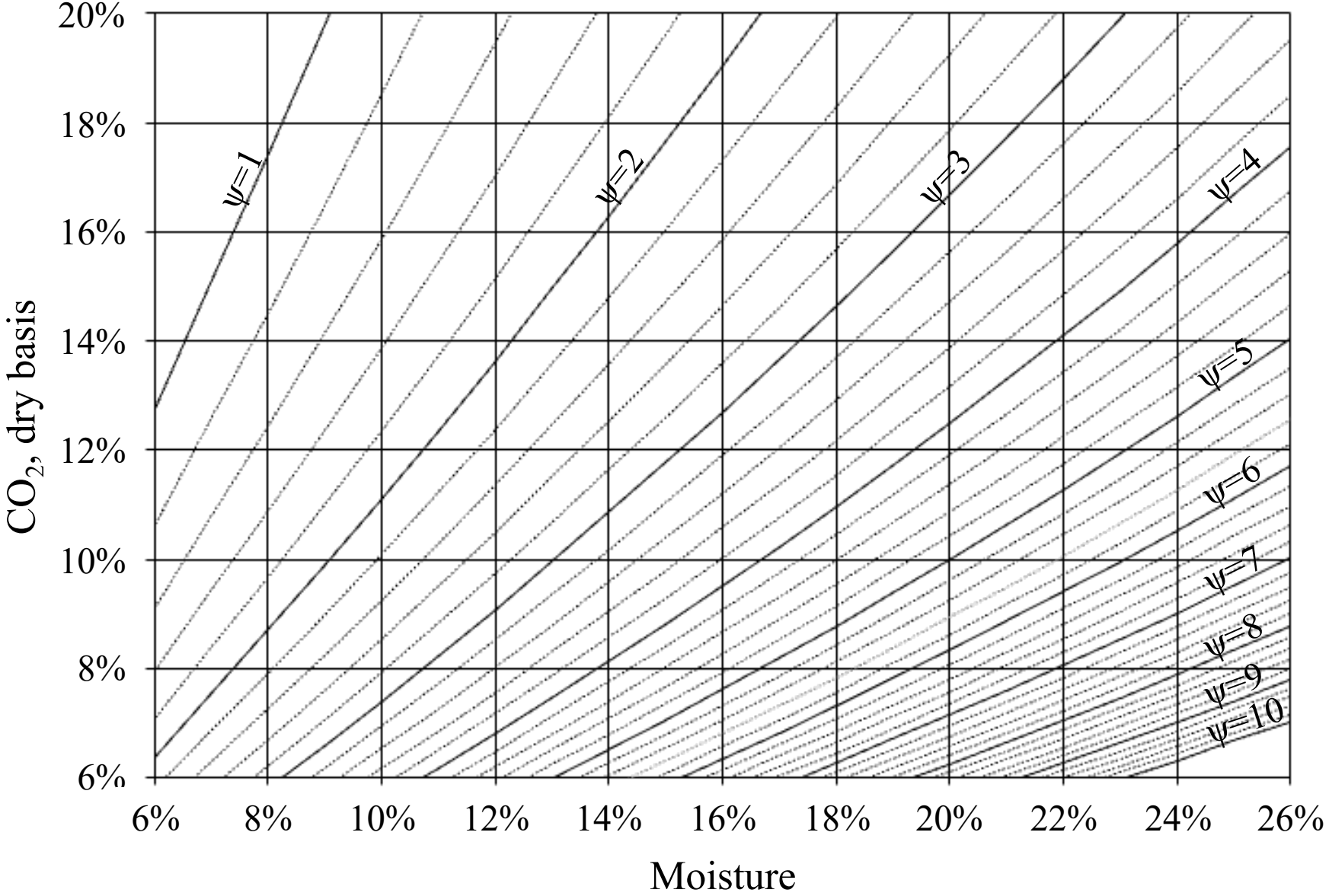
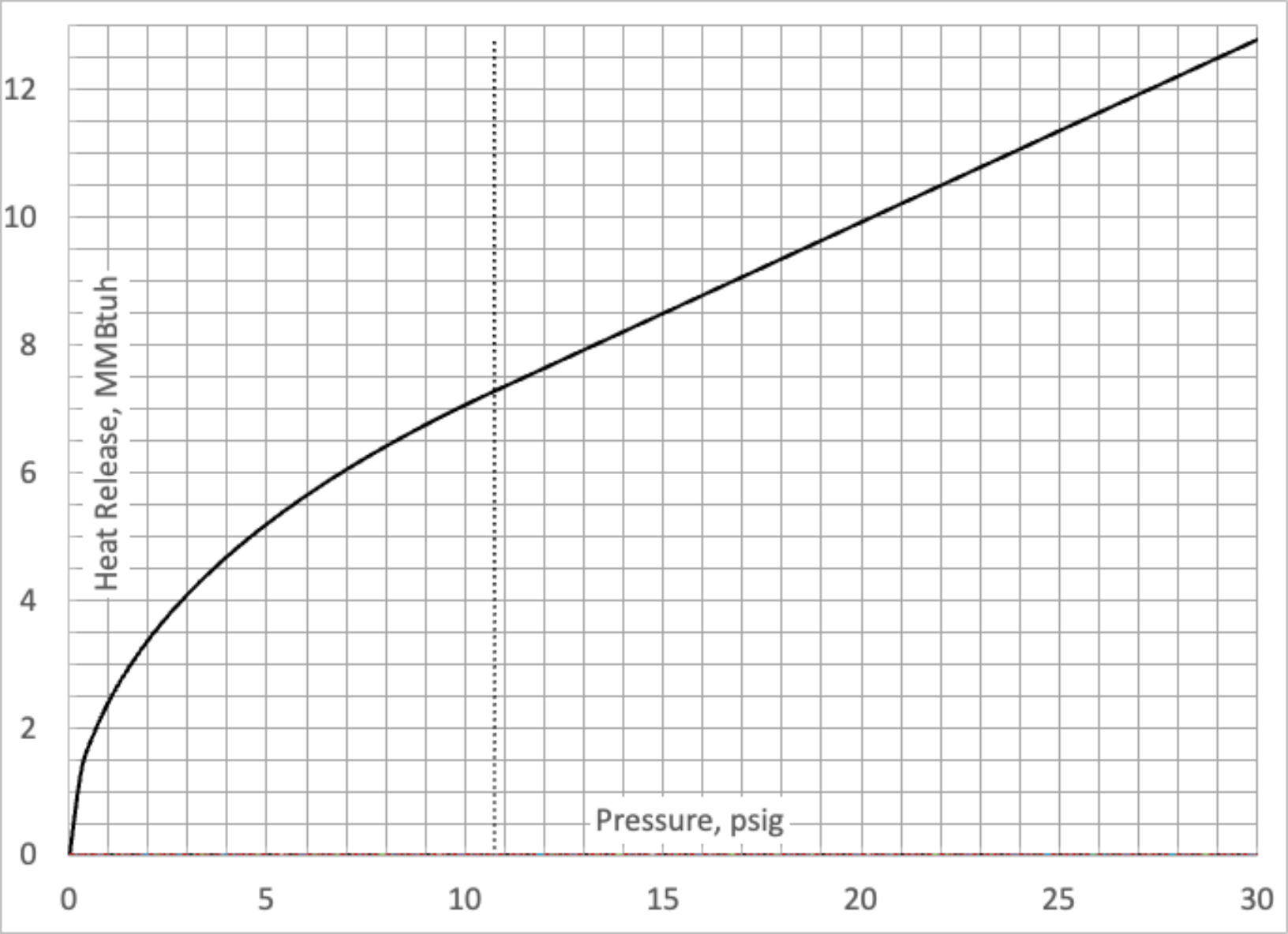
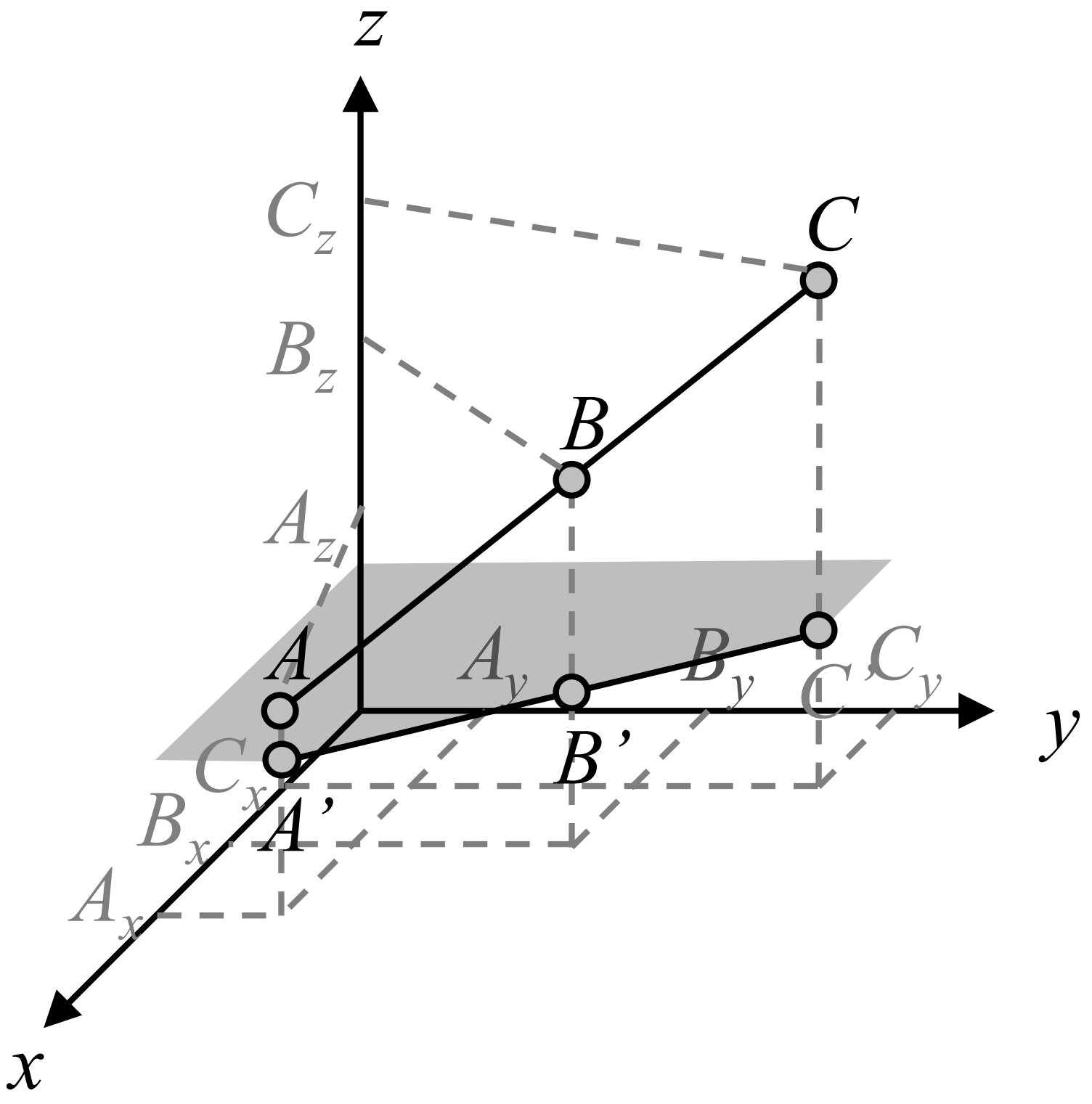
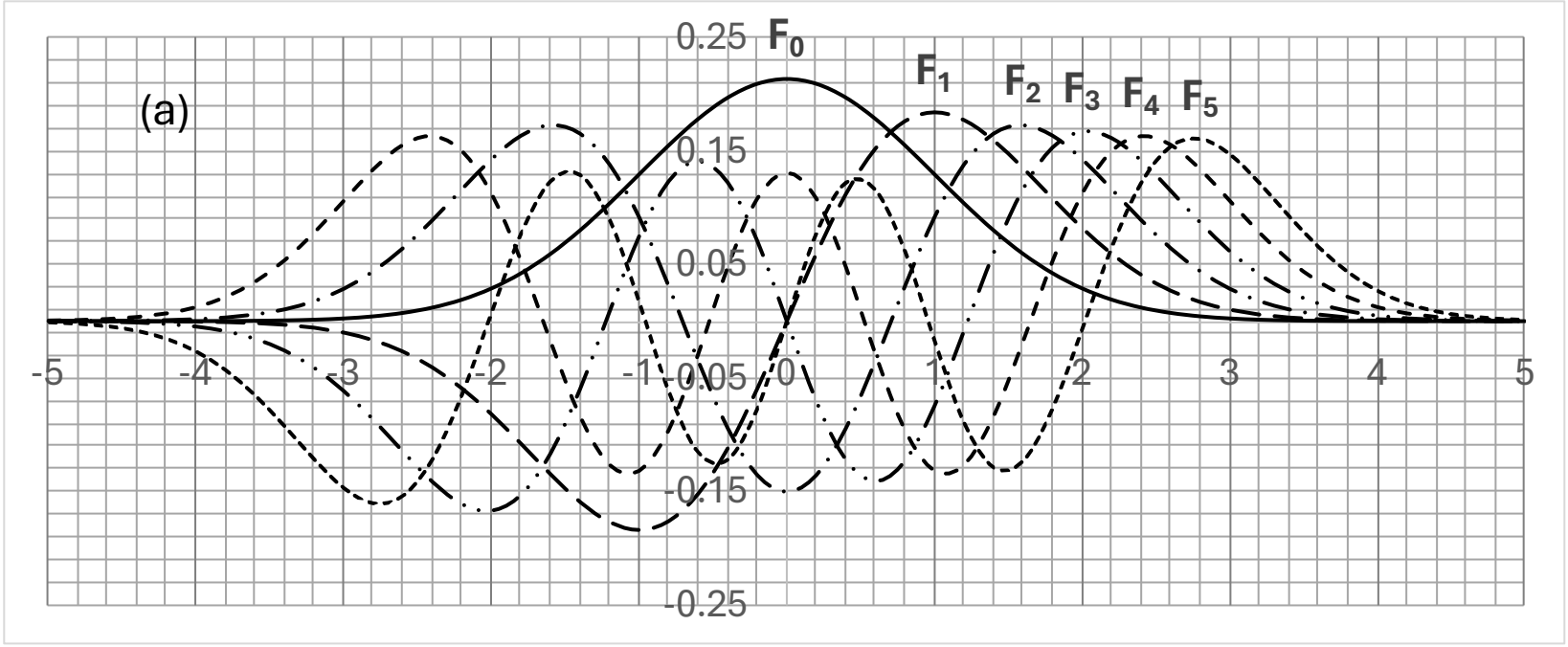
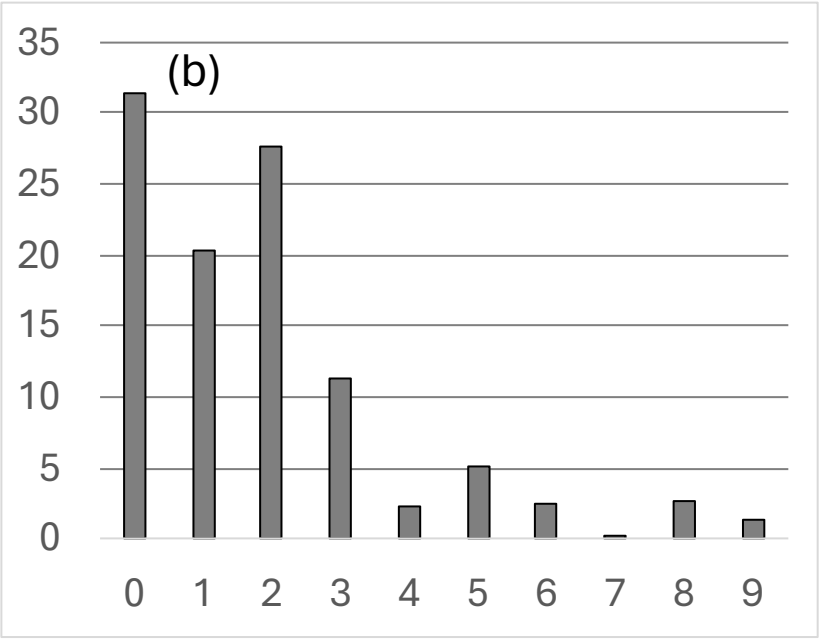
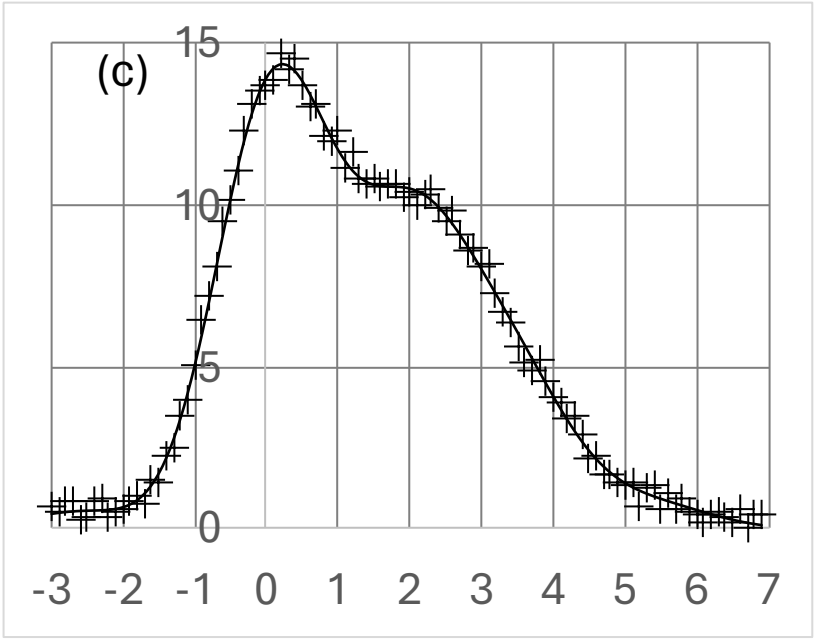

20%
18%
16%
14%
12%
10%
8%
6%
CO_2, dry basis
ψ=1
ψ=2
ψ=3
ψ=4
ψ=5
ψ=6
ψ=7
ψ=8
ψ=9
ψ=10
6%
8%
10%
12%
14%
16%
18%
20%
22%
24%
26%
Moisture

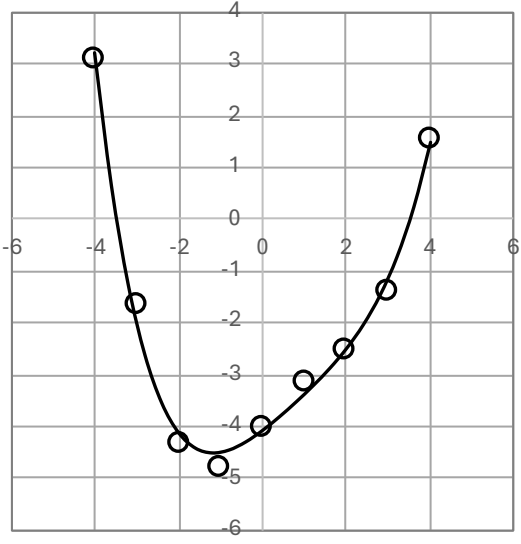

Heat Release, MMBtuh
Pressure, psig
0
2
4
6
8
10
12
0
5
10
15
20
25
30

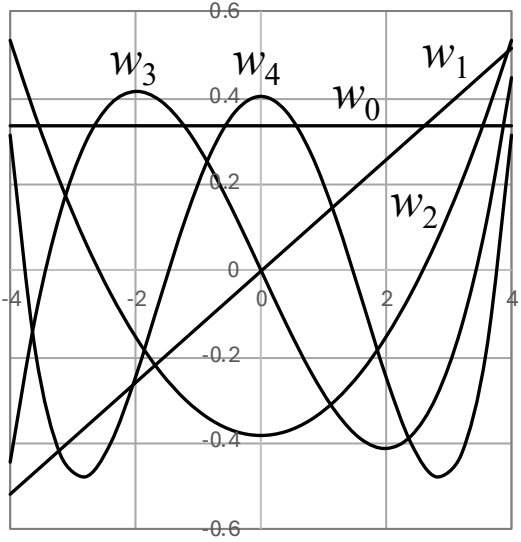

z
C_z
C
B_z
B
A_z
A
A_y
B_y
C_y
C
y
C_x
B'
B_x
A'
A_x
x

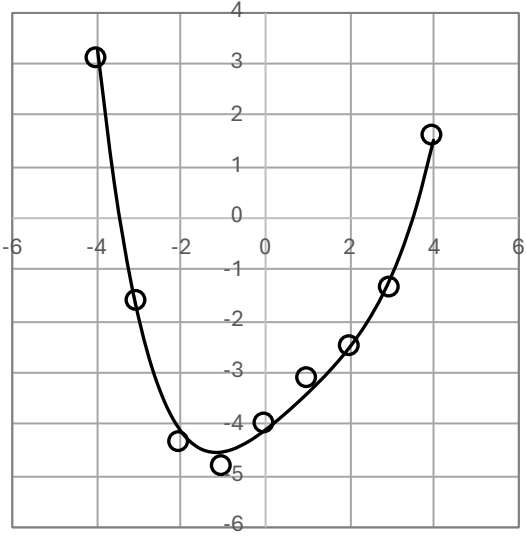

(a)
F0
F1
F2
F3
F4
F5
0.25
0.15
0.05
-0.05
-0.15
-0.25
-5
-4
-3
-2
-1
0
1
2
3
4
5

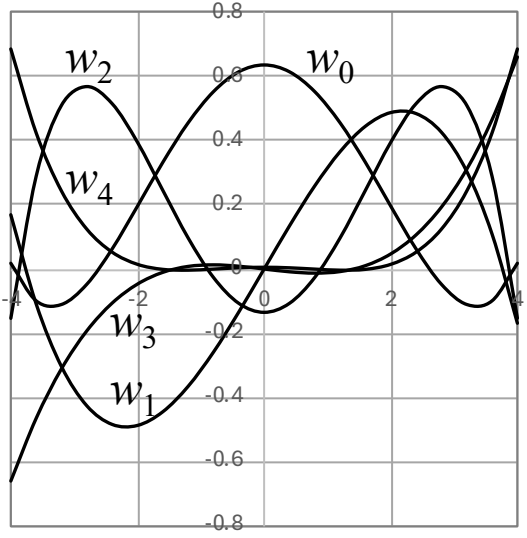

(b)
35
30
25
20
15
10
5
0
0 1 2 3 4 5 6 7 8 9

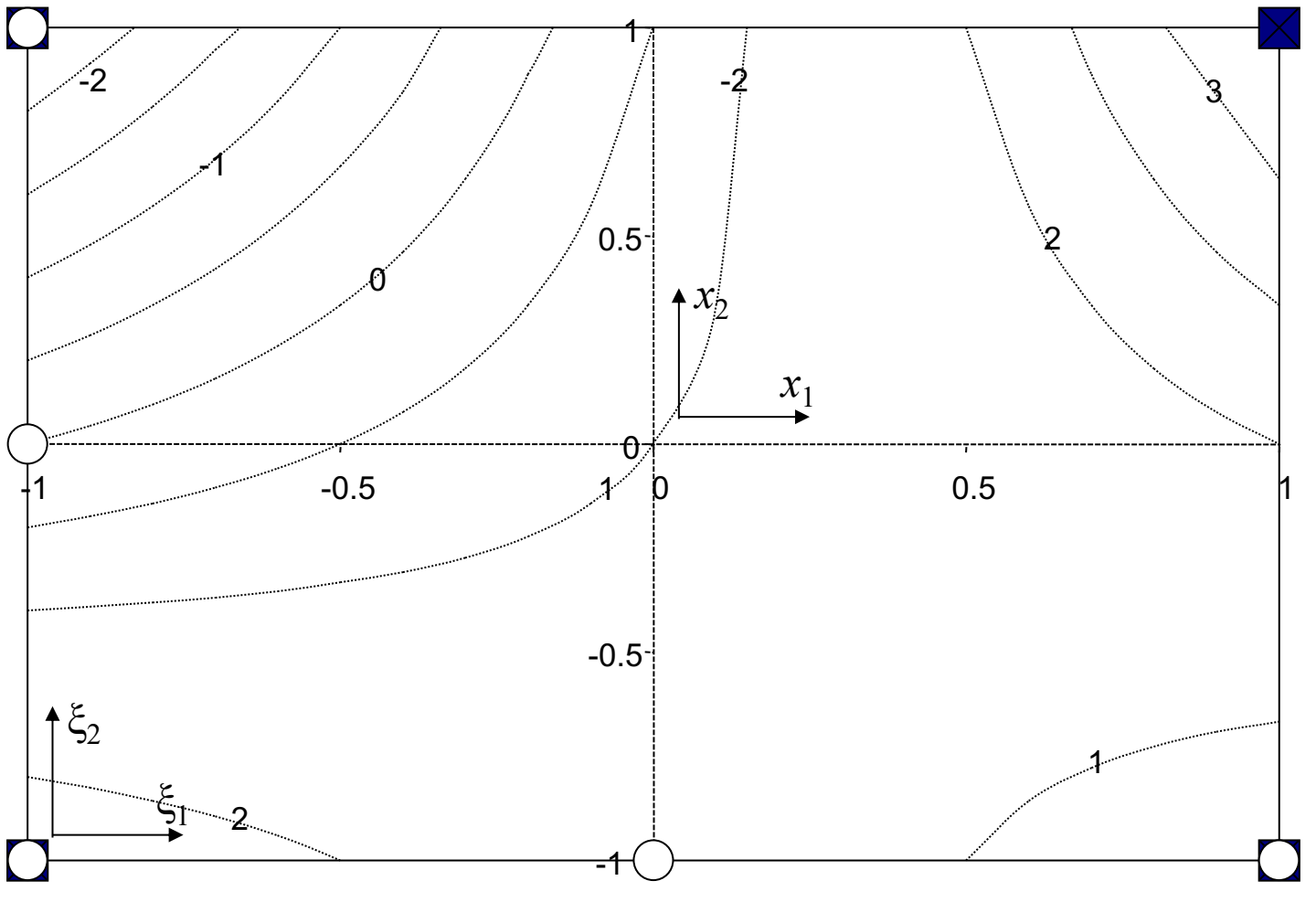

(c)
15
10
5
0
-3 -2 -1 0 1 2 3 4 5 6 7

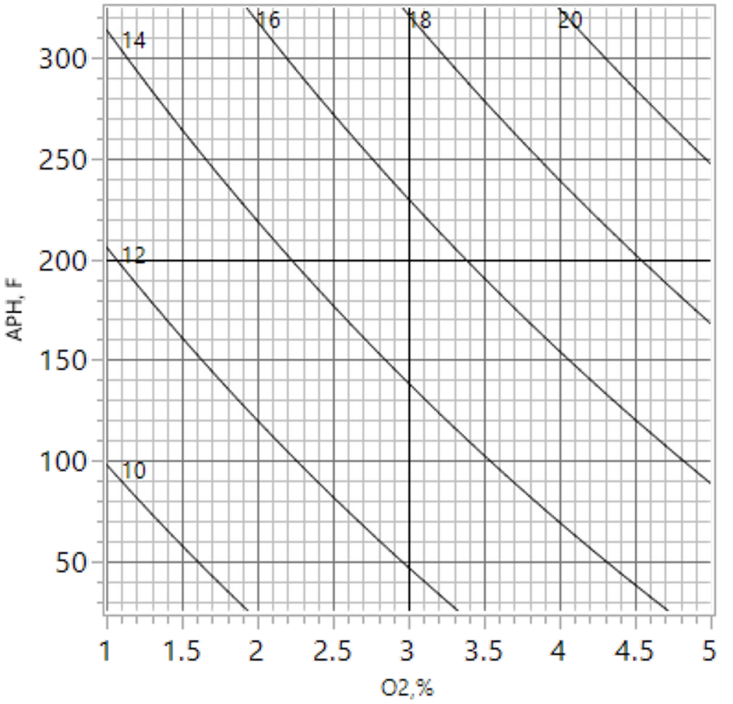

4
3
2
1
0
-1
-2
-3
-4
-5
-6
-6
-4
-2
0
2
4
6

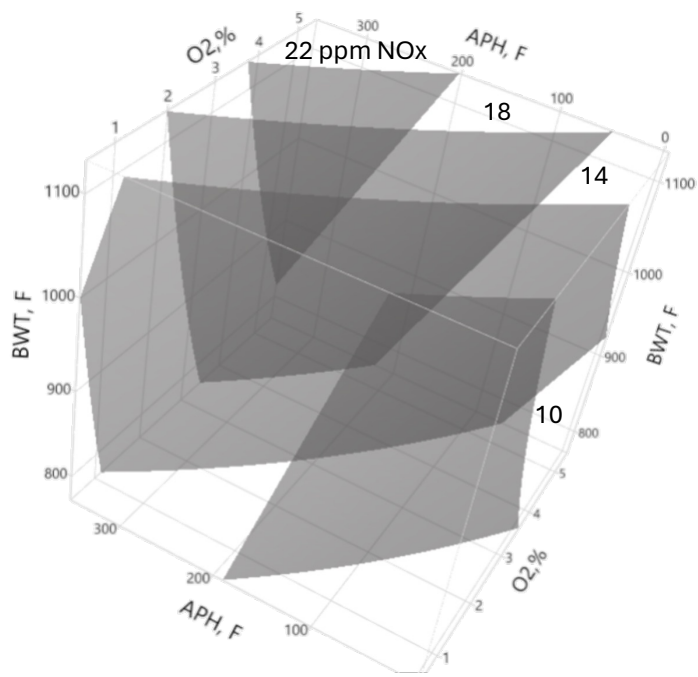

0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-4
-2
0
2
4
w_3
w_4
w_0
w_1
w_2

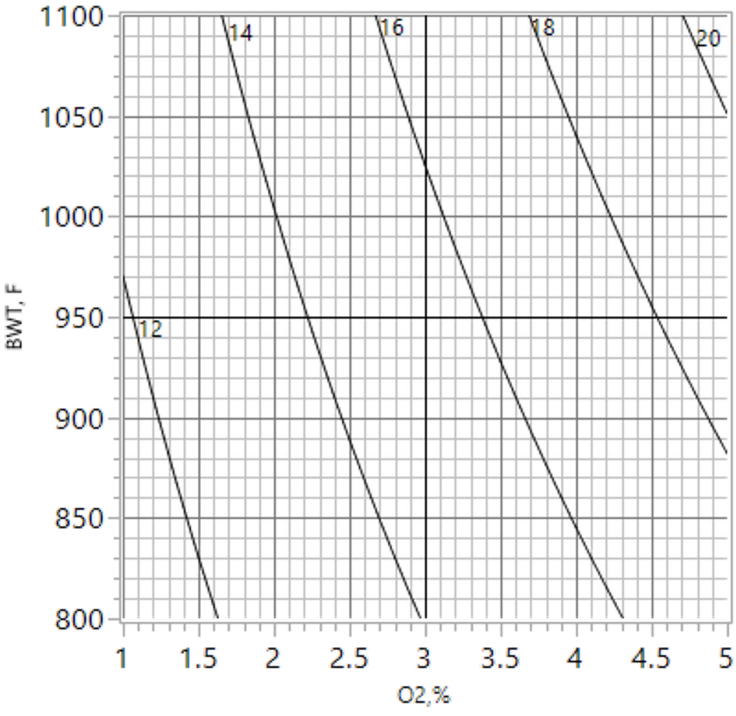

4
3
2
1
0
-1
-2
-3
-4
-5
-6
-6
-4
-2
0
2
4
6

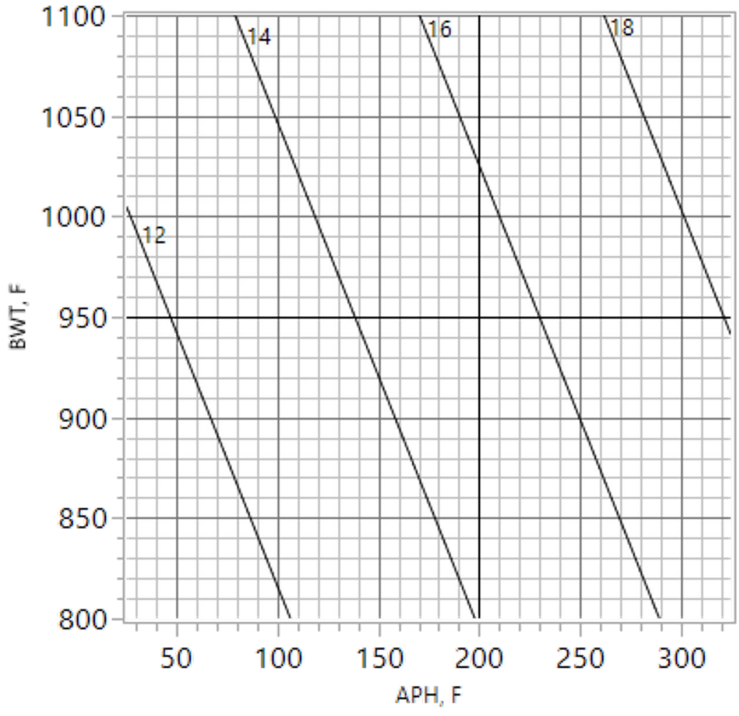

w_2
w_0
w_4
w_3
w_1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-4
-2
0
2
4

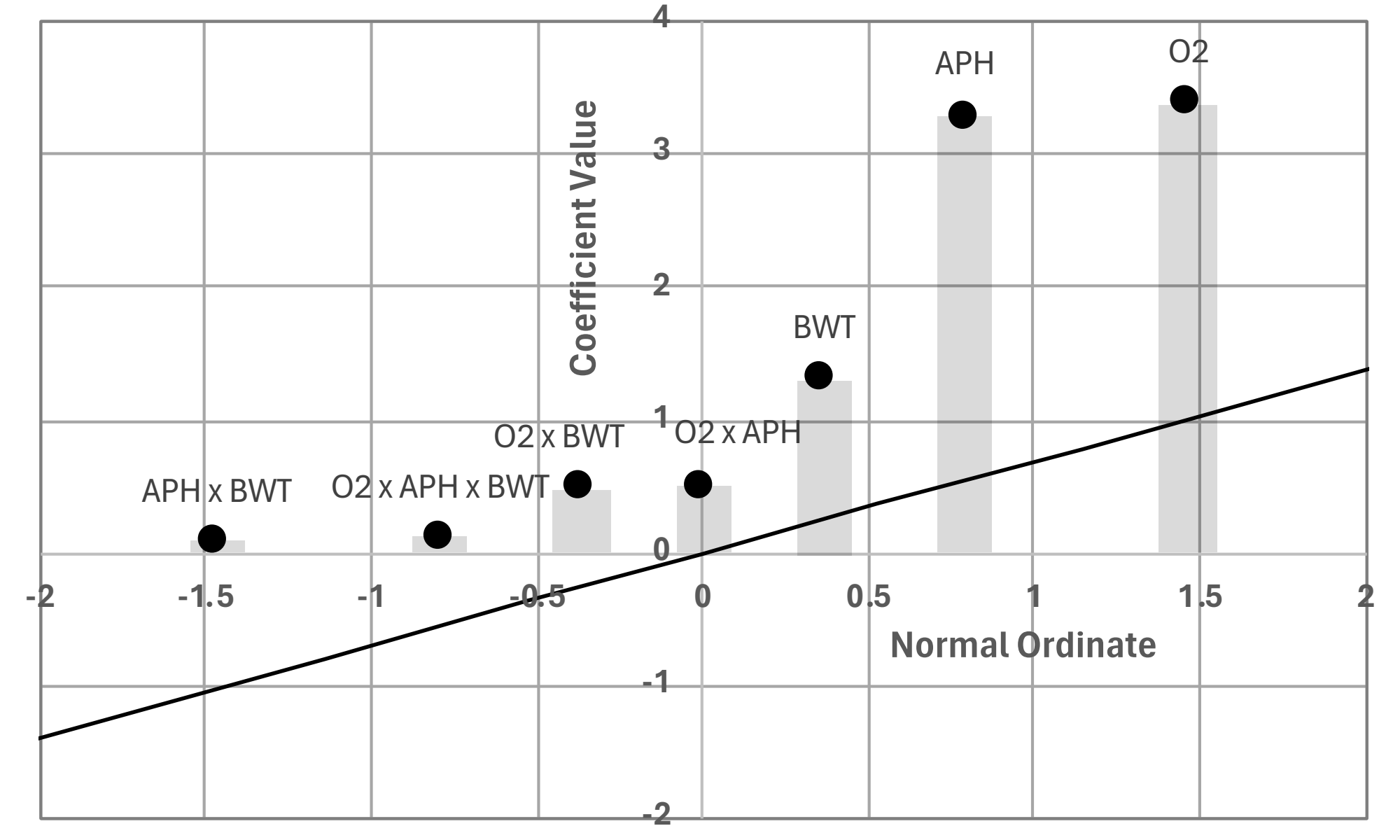

-2
-1
0
1
-2
3
2
0.5
x_2
x_1
0
-1
-0.5
1
0
0.5
1
-0.5
ξ_2
ξ_1
2
1
-1

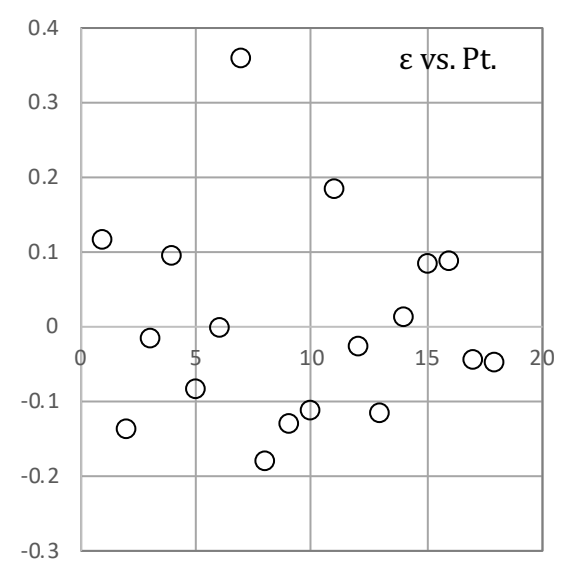

APH, F
O2,%
14
16
18
20
12
10

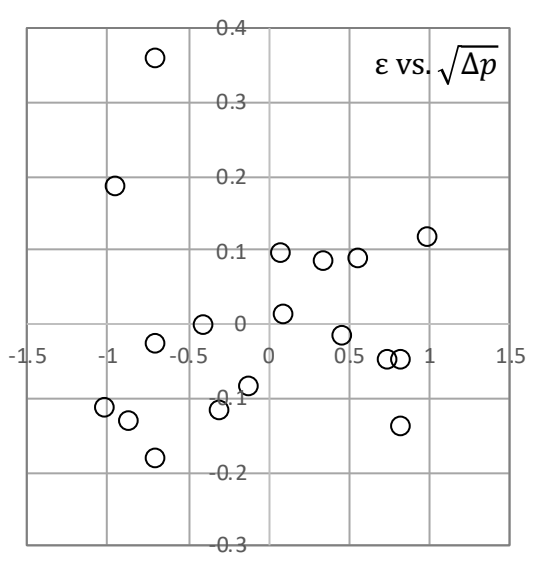

22 ppm NOx
O2,%
APH, F
BWT, F
18
14
10

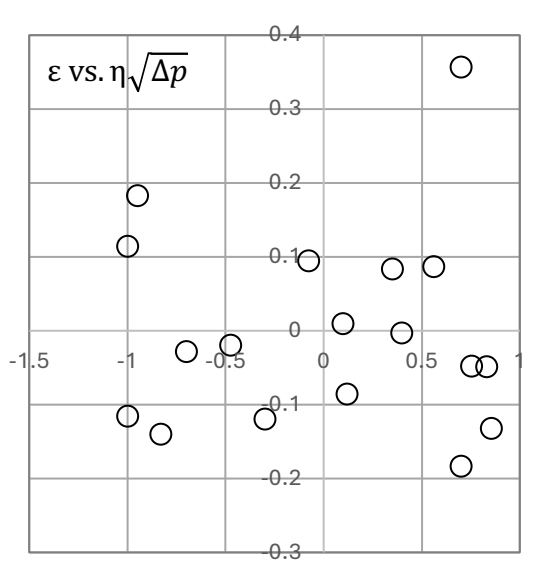

BWT, F
O2,%
14
16
18
20
12

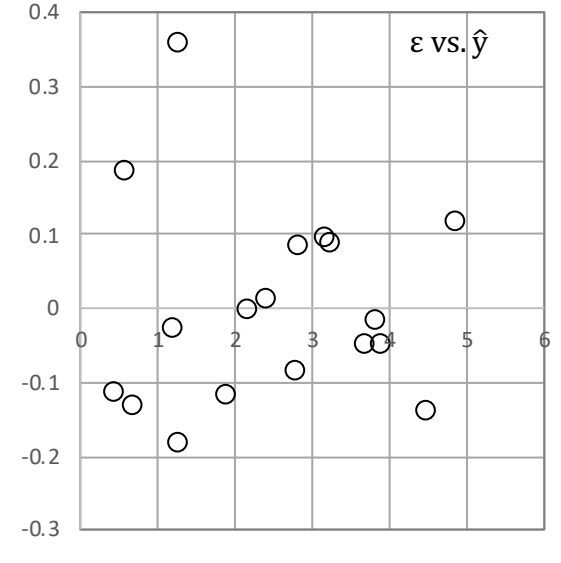

BWT, F
APH, F
14
16
18
12

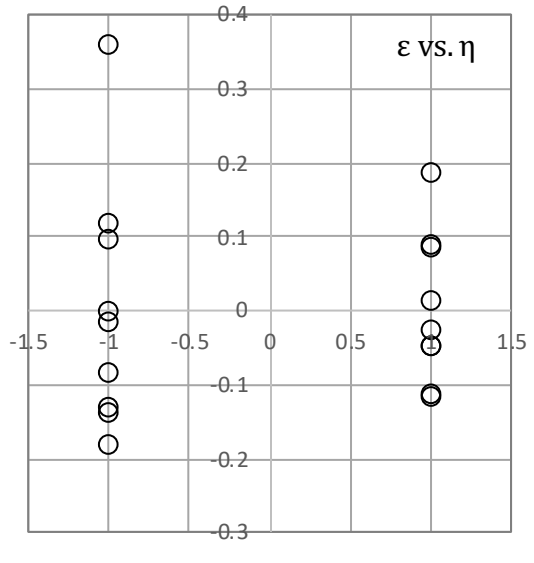

Coefficient Value
Normal Ordinate
APH
O2
BWT
O2 x BWT
O2 x APH
APH x BWT
O2 x APH x BWT
4
3
2
1
0
-1
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2

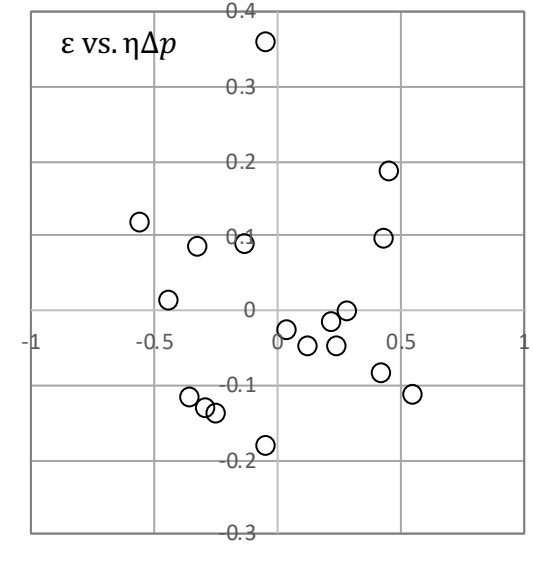

ε vs. Pt.

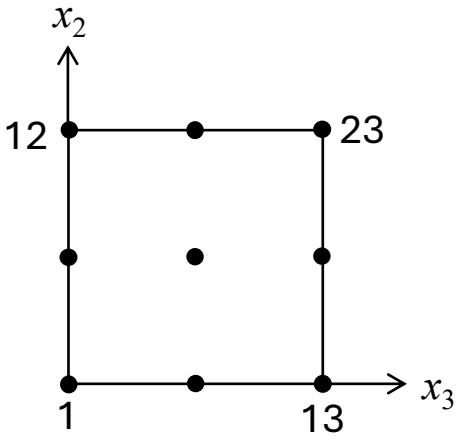

ε vs. $\sqrt{\Delta p}$

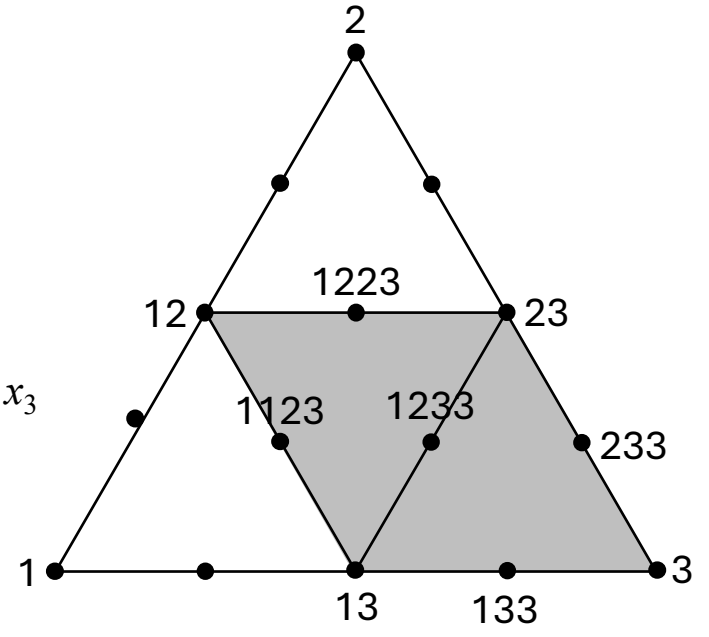

ε vs. η$\sqrt{\Delta p}$

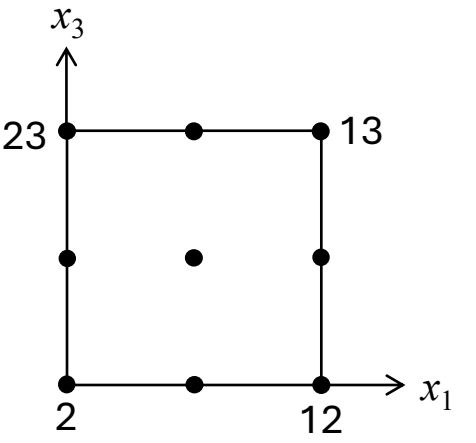

ε vs. ŷ


ε vs. η


ε vs. ηΔp

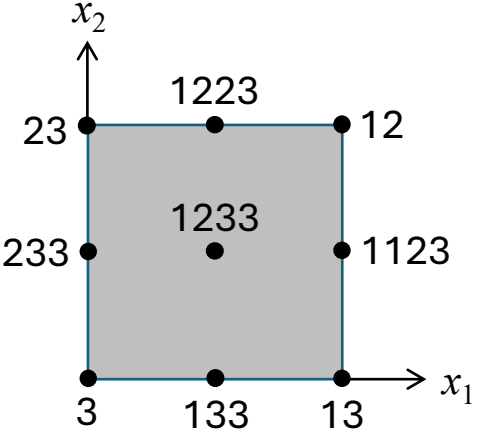




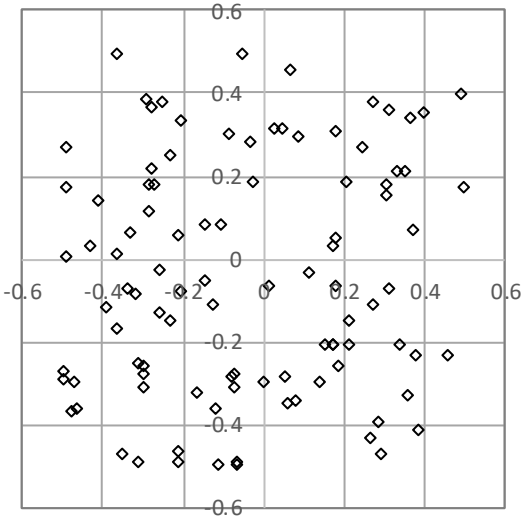


Correspondence Between 3^2 Factorial and Portion of Simplex Lattice

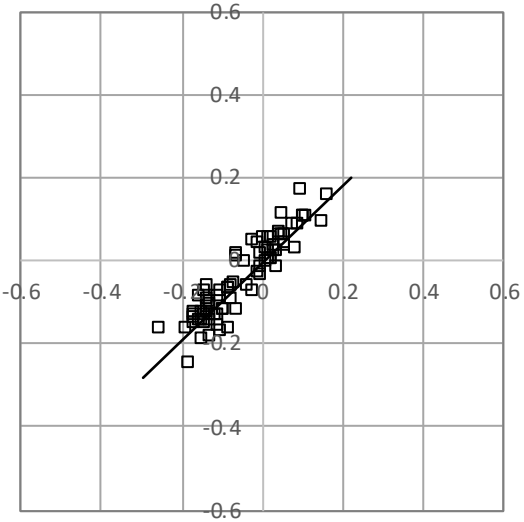
(Pt x)	x_1	x_2	Pt z	z_1	z_2	z_3
0	-1	-1	**3**	0	0	1
1	0	-1	**133**	1/4	0	3/4
11	1	-1	**13**	1/2	0	1/2
2	-1	0	**233**	0	1/4	3/4
22	0	0	**1233**	1/4	1/4	1/2
122	1	0	**1123**	1/2	1/4	1/4
22	-1	1	**23**	0	1/2	1/2
12	0	1	**1223**	1/4	1/2	1/4
1122	1	1	**12**	1/2	1/2	0



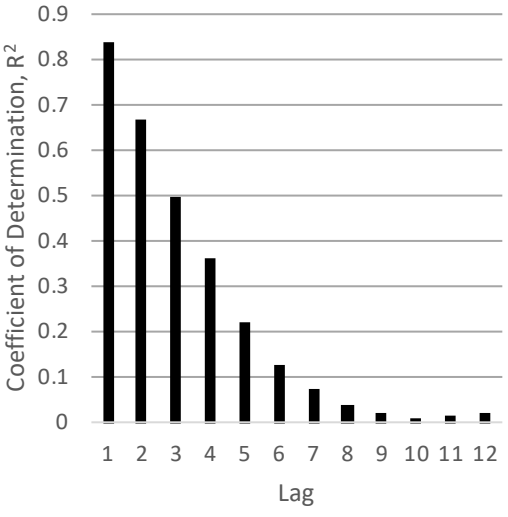
Lag 1 Plot, ±0.5 Uniform Distribution



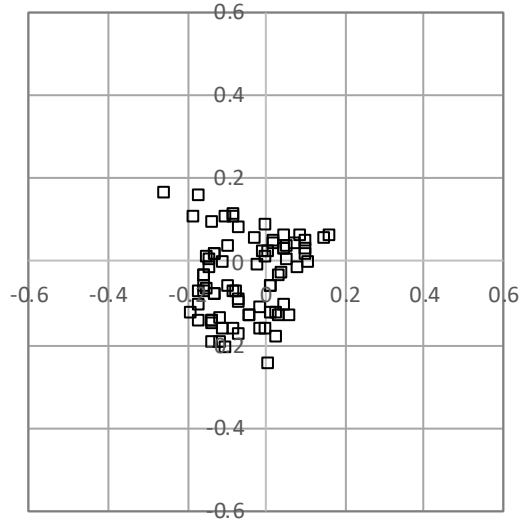
Lag 1 Plot, 10-pt Moving Average

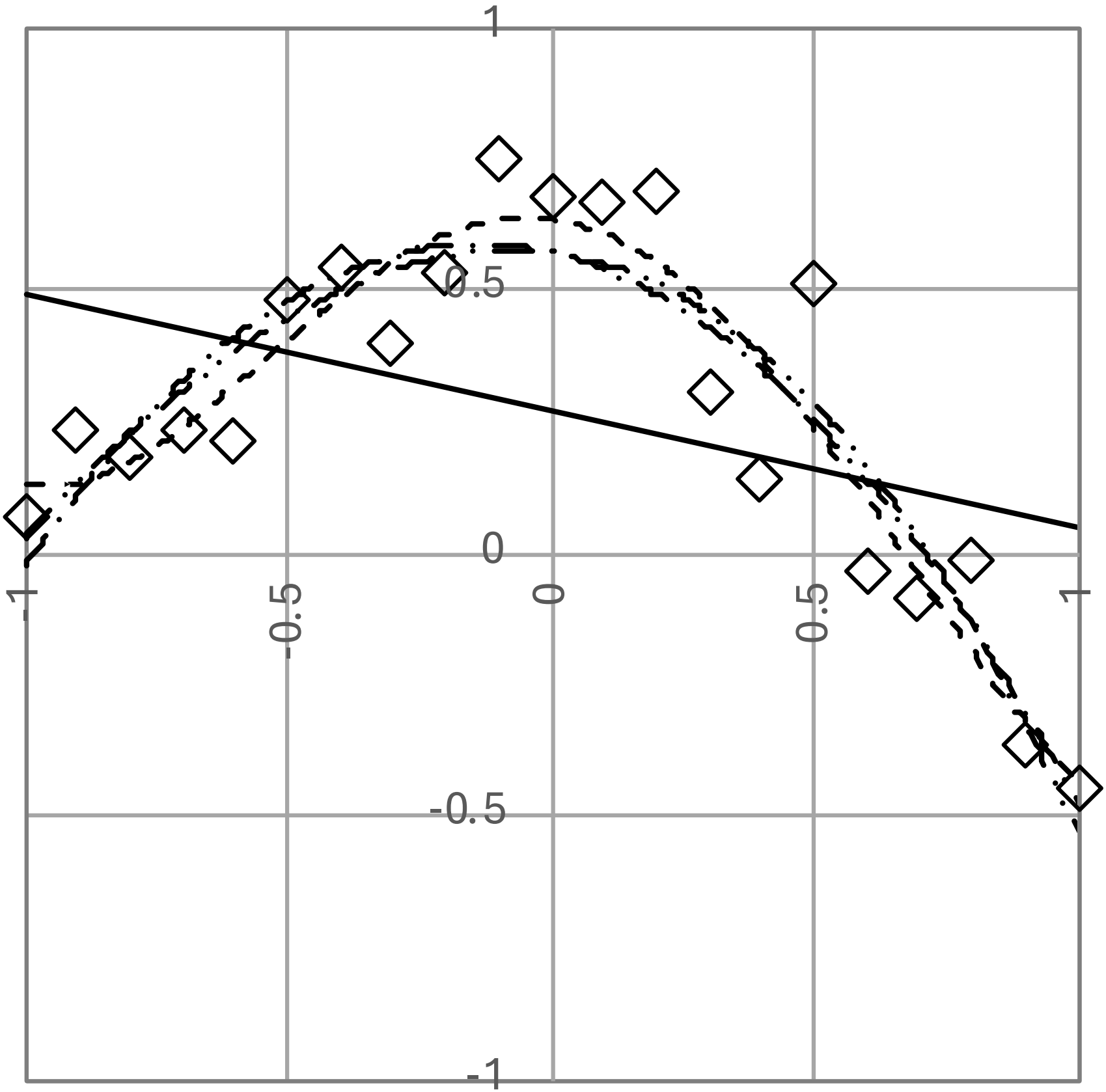


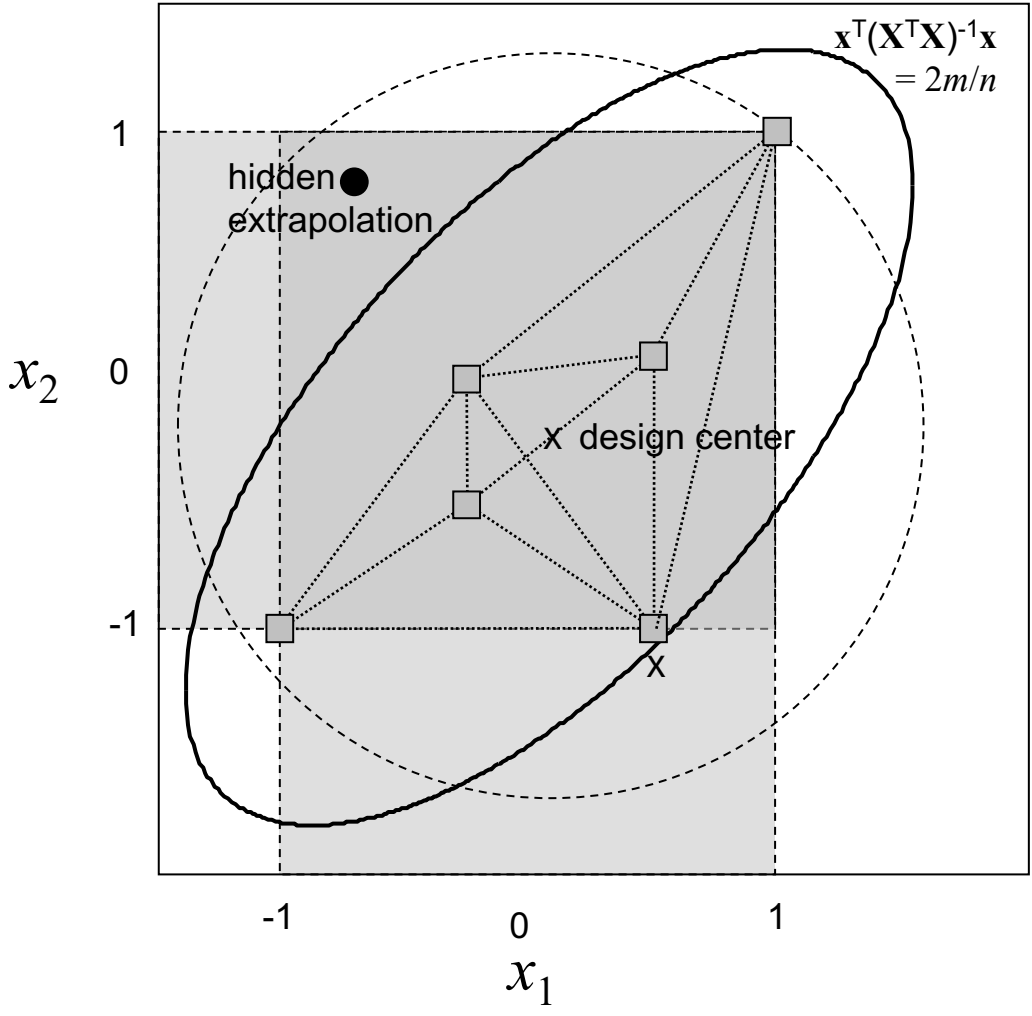
Correlations of 10-pt Moving Averages by Lag

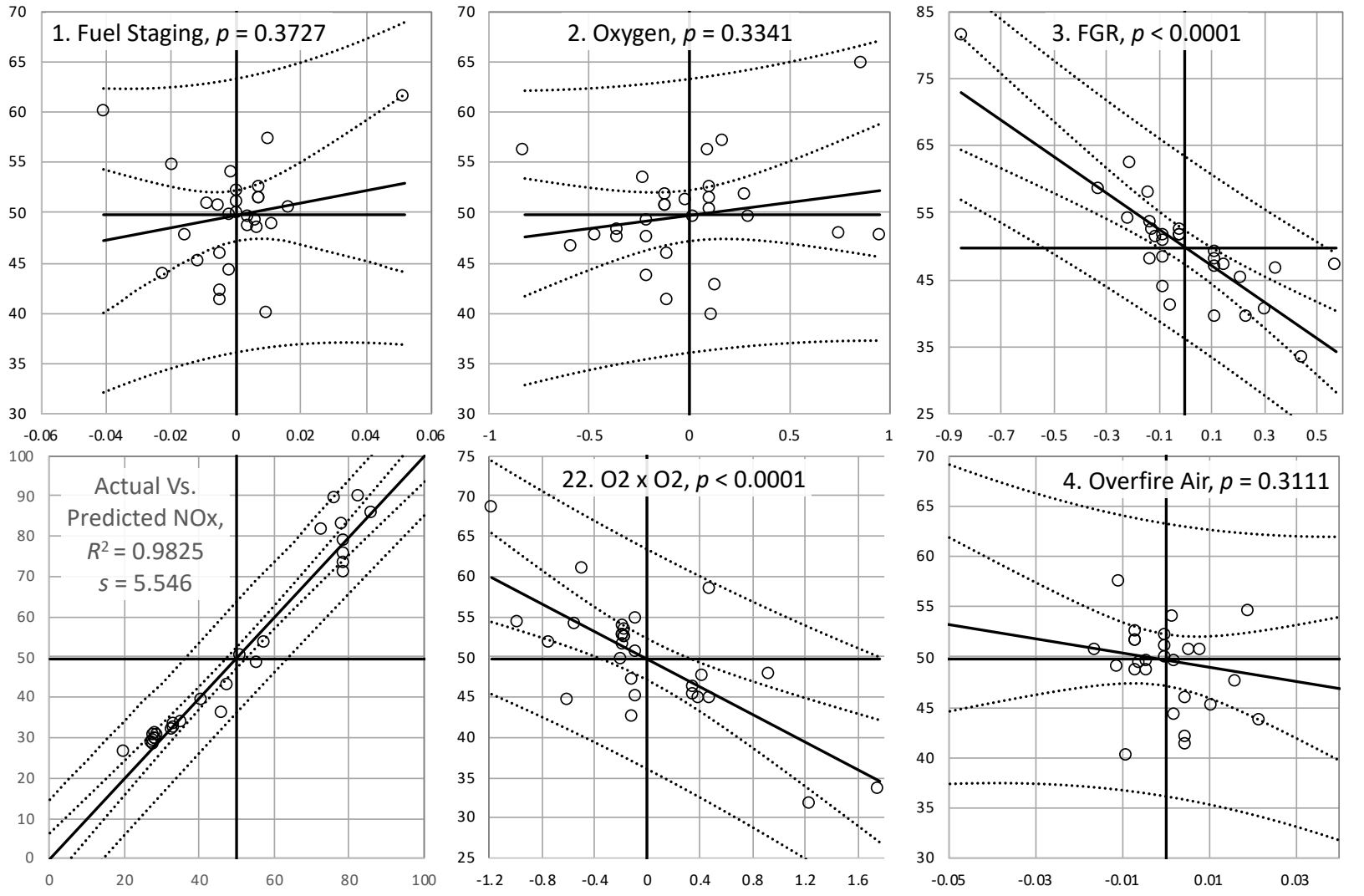


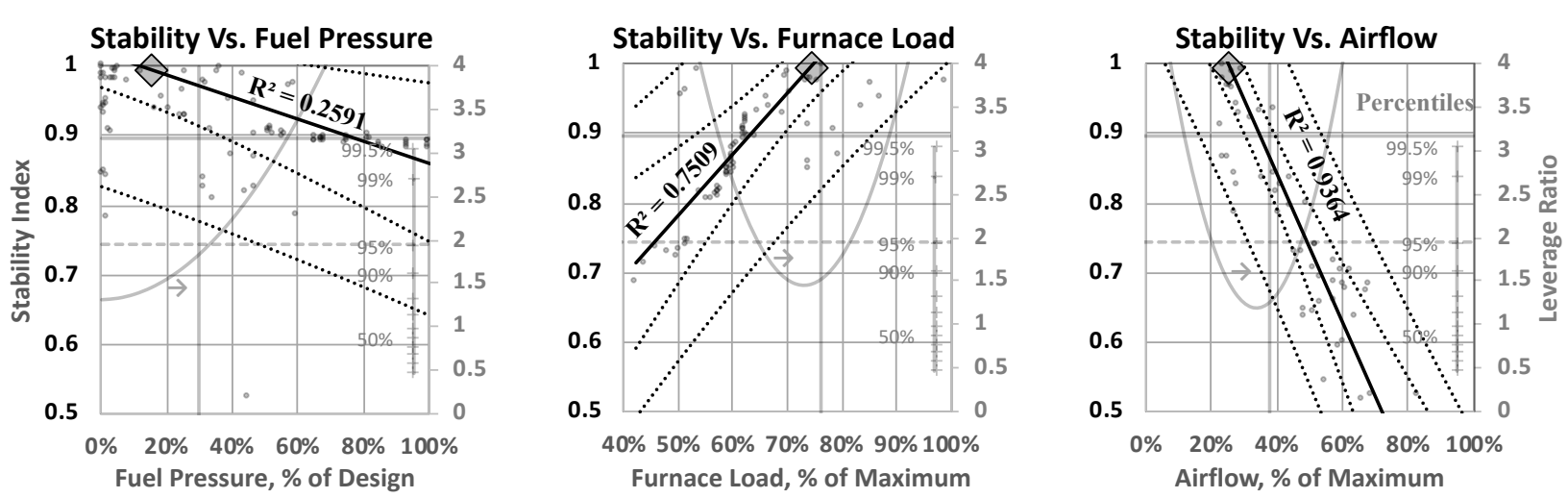
Lag 10 Plot, 10-pt Moving Average

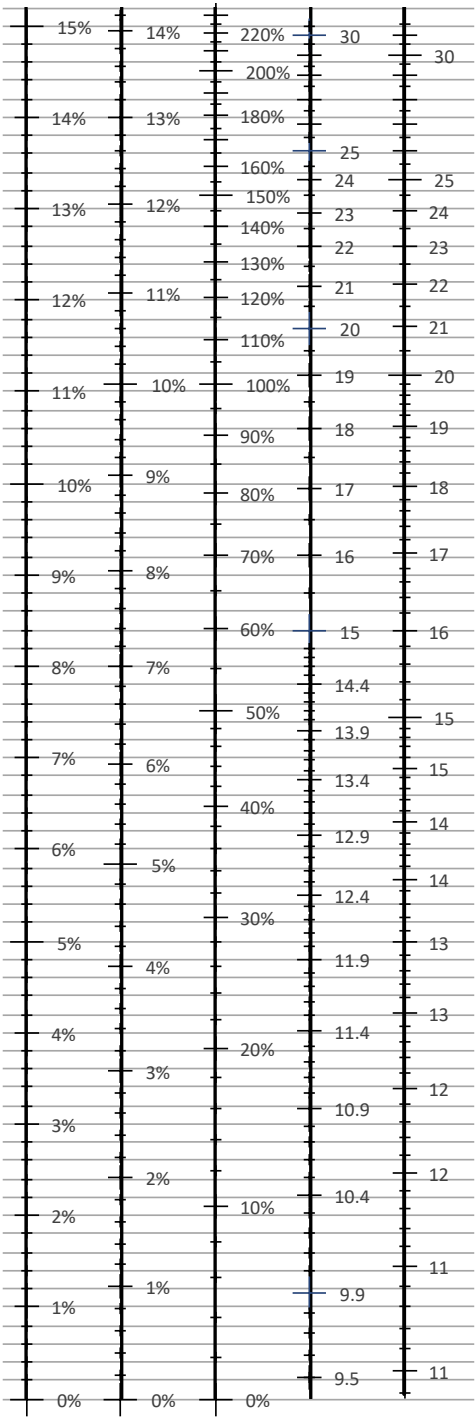


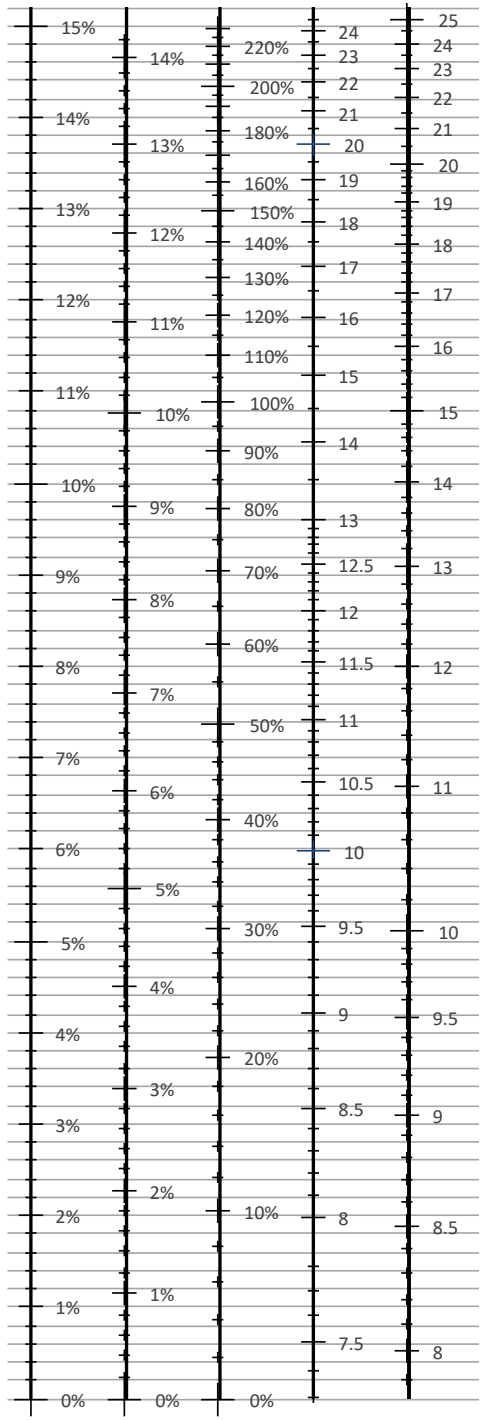

1
0.5
0
-0.5
-1
-1
-0.5
0
0.5
1

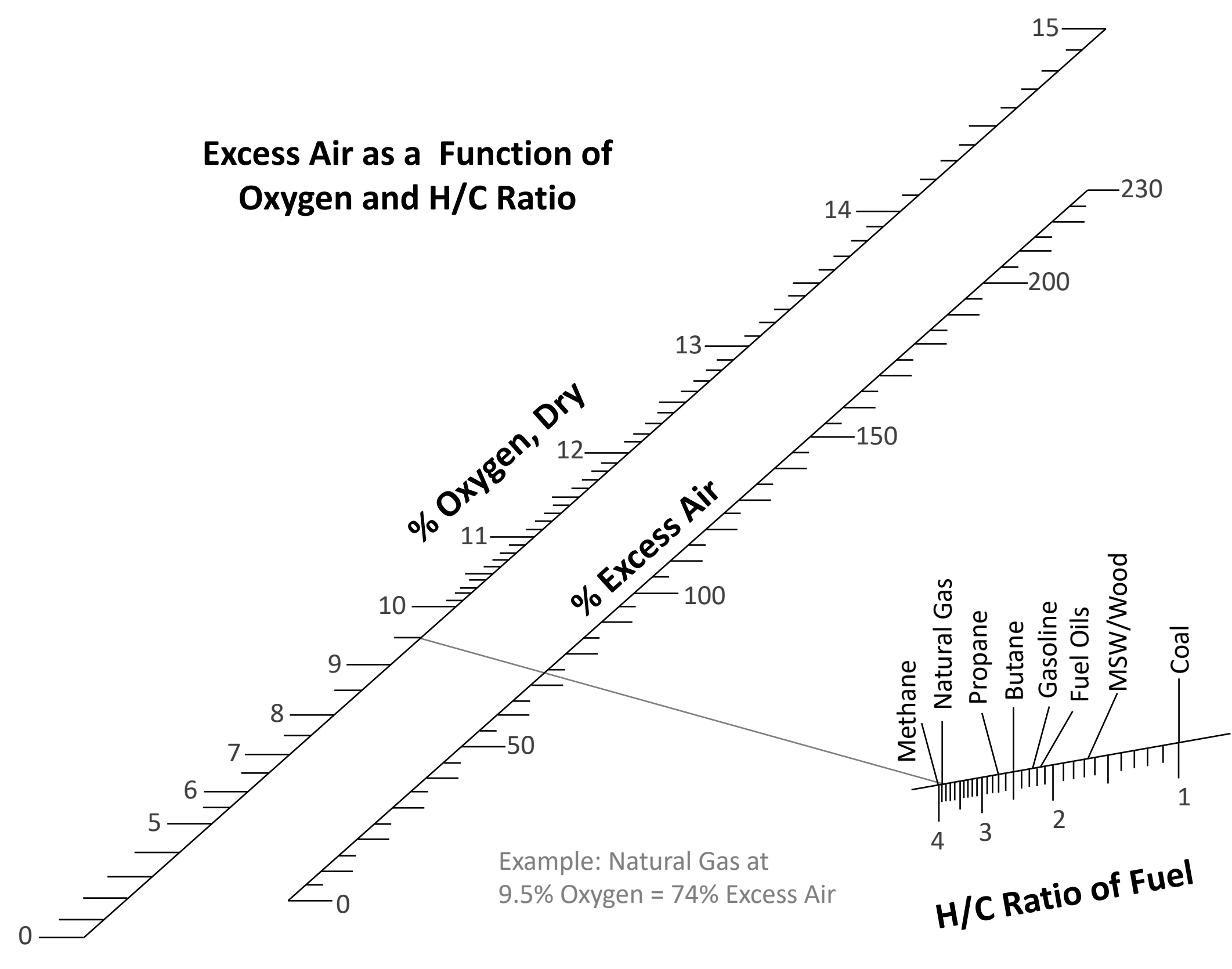

$\mathbf{x}^T(\mathbf{X}^T\mathbf{X})^{-1}\mathbf{x}$
$= 2m/n$
hidden
extrapolation
x design center
x
1
0
-1
x_2
-1
0
1
x_1


1. Fuel Staging, p = 0.3727
2. Oxygen, p = 0.3341
3. FGR, p < 0.0001
Actual Vs. Predicted NOx, R^2 = 0.9825 s = 5.546
22. O2 x O2, p < 0.0001
4. Overfire Air, p = 0.3111

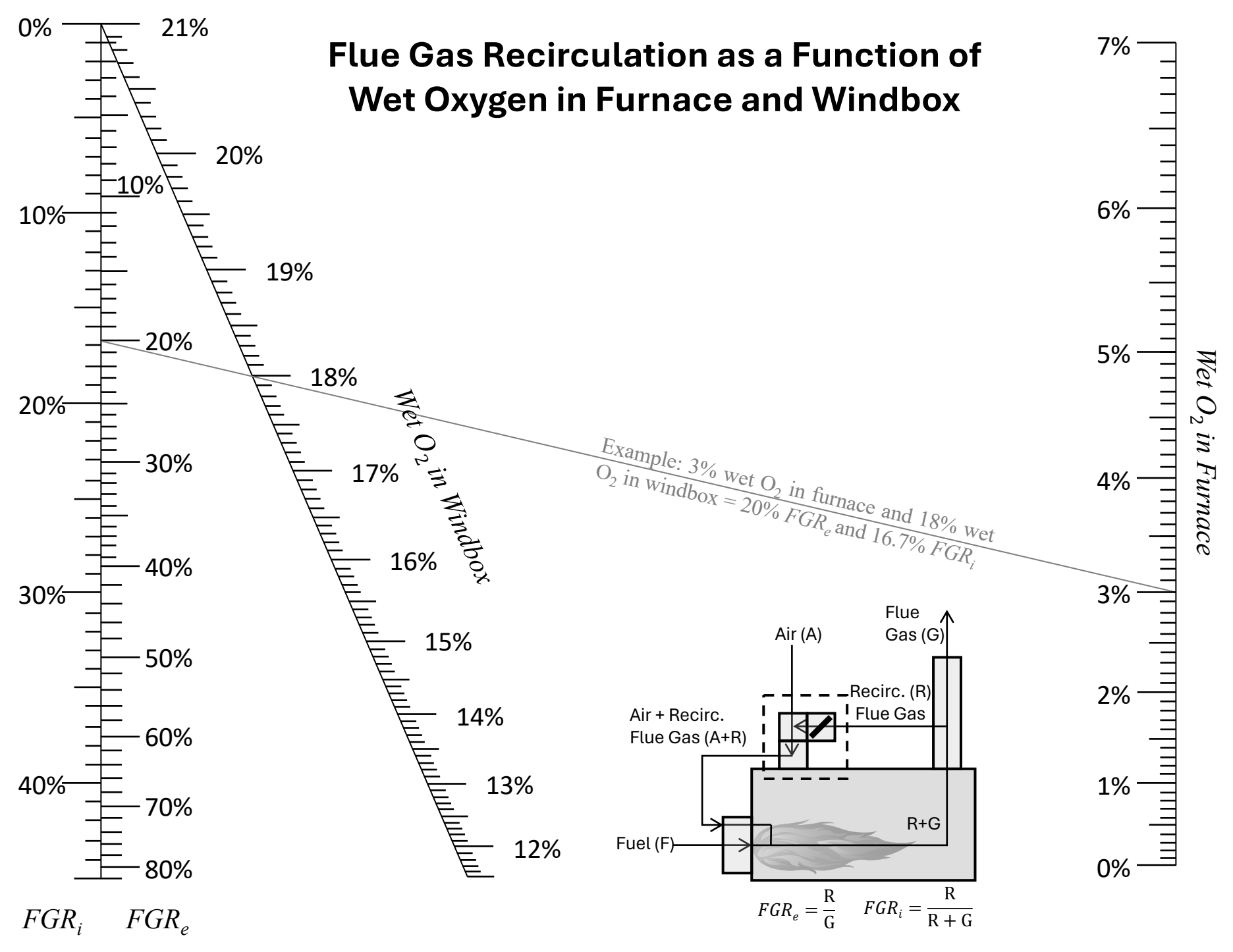

Stability Vs. Fuel Pressure
R² = 0.2591
99.5%
99%
95%
90%
50%
Stability Index
Fuel Pressure, % of Design
0% 20% 40% 60% 80% 100%
1 0.9 0.8 0.7 0.6 0.5
4 3.5 3 2.5 2 1.5 1 0.5 0
Stability Vs. Furnace Load
R² = 0.7509
Furnace Load, % of Maximum
40% 50% 60% 70% 80% 90% 100%
Stability Vs. Airflow
R² = 0.9364
Percentiles
Airflow, % of Maximum
Leverage Ratio


15%
14%
13%
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
14%
13%
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
220%
200%
180%
160%
150%
140%
130%
120%
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
30
25
24
23
22
21
20
19
18
17
16
15
14.4
13.9
13.4
12.9
12.4
11.9
11.4
10.9
10.4
9.9
9.5
30
25
24
23
22
21
20
19
18
17
16
15
15
14
14
13
13
12
12
11
11

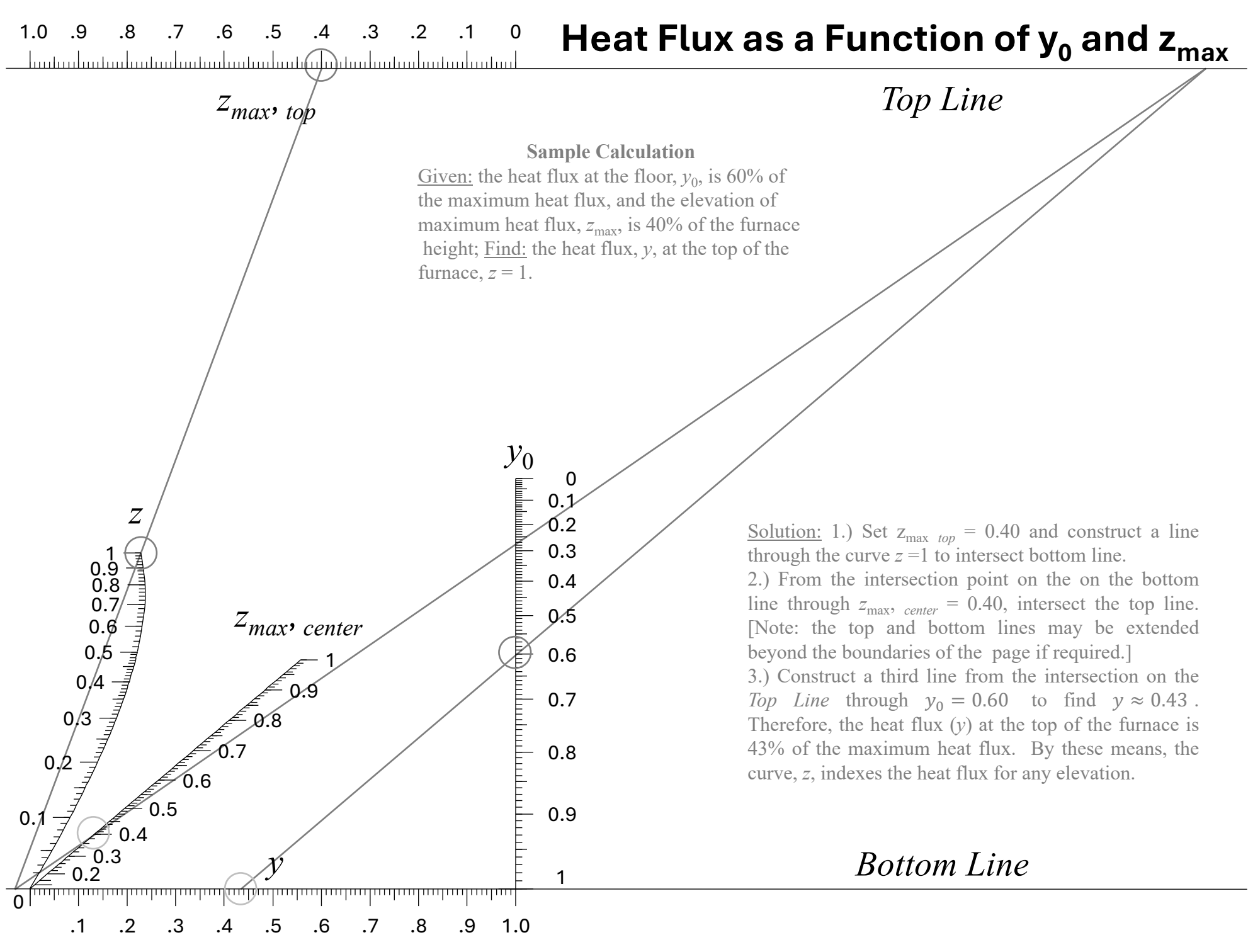

15%
14%
13%
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
220%
200%
180%
160%
150%
140%
130%
120%
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
24
23
22
21
20
19
18
17
16
15
14
13
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9.5
9
8.5
8


Excess Air as a Function of Oxygen and H/C Ratio
% Oxygen, Dry
% Excess Air
H/C Ratio of Fuel
0
5
6
7
8
9
10
11
12
13
14
15
0
50
100
150
200
230
Methane
Natural Gas
Propane
Butane
Gasoline
Fuel Oils
MSW/Wood
Coal
4
3
2
1
Example: Natural Gas at
9.5% Oxygen = 74% Excess Air

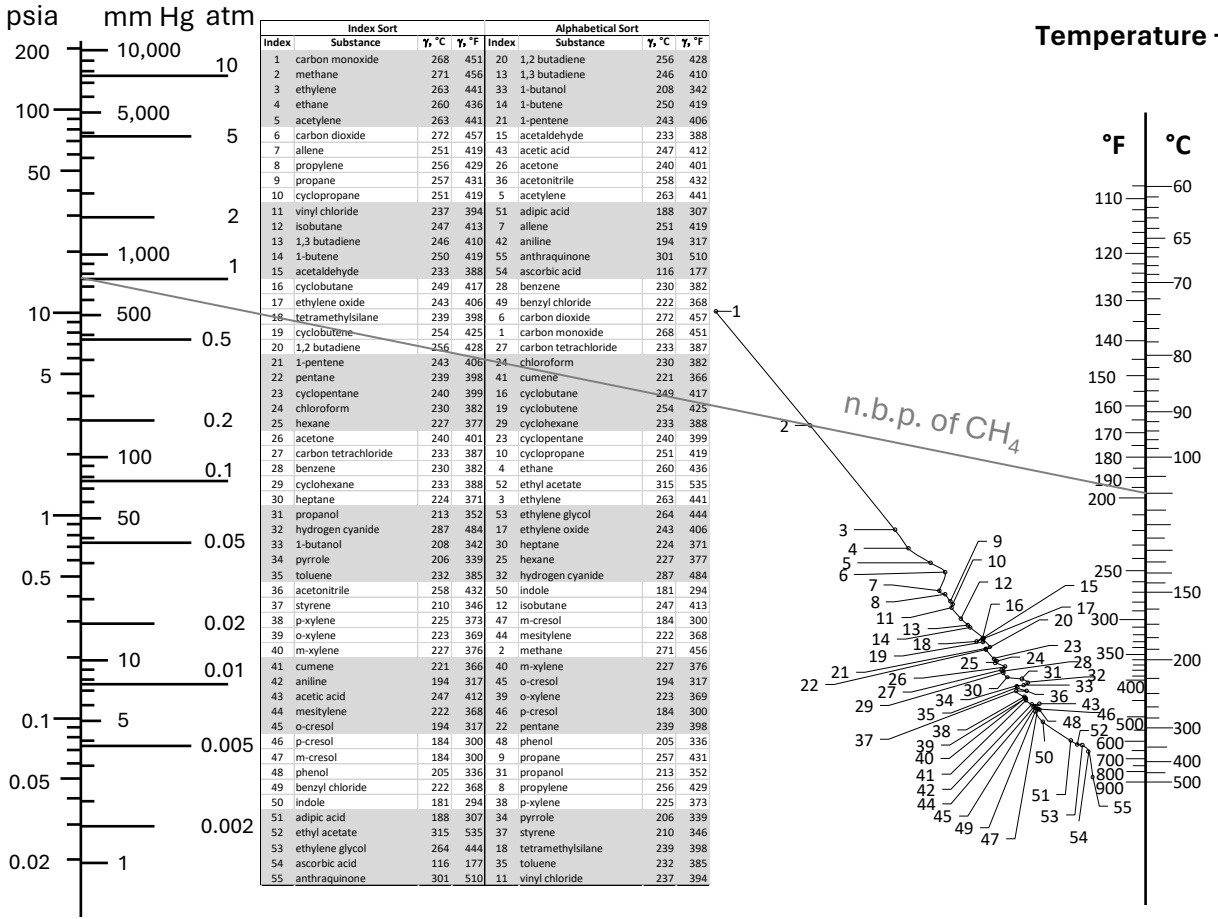
Flue Gas Recirculation as a Function of Wet Oxygen in Furnace and Windbox



Heat Flux as a Function of y_0 and z_{max}



Vapor Pressure – Temperature Nomograph for 55 Chemicals



Index Sort			
Index	Substance	γ, °C	γ, °F
1	carbon monoxide	268	451
2	methane	271	456
3	ethylene	263	441
4	ethane	260	436
5	acetylene	263	441
6	carbon dioxide	272	457
7	allene	251	419
8	propylene	256	429
9	propane	257	431
10	cyclopropane	251	419
11	vinyl chloride	237	394
12	isobutane	247	413
13	1,3 butadiene	246	410
14	1-butene	250	419
15	acetaldehyde	233	388
16	cyclobutane	249	417
17	ethylene oxide	243	406
18	tetramethylsilane	239	398
19	cyclobutene	254	425
20	1,2 butadiene	256	428
21	1-pentene	243	406
22	pentane	239	398
23	cyclopentane	240	399
24	chloroform	230	382
25	hexane	227	377
26	acetone	240	401
27	carbon tetrachloride	233	387
28	benzene	230	382
29	cyclohexane	233	388
30	heptane	224	371
31	propanol	213	352
32	hydrogen cyanide	287	484
33	1-butanol	208	342
34	pyrrole	206	339
35	toluene	232	385
36	acetonitrile	258	432
37	styrene	210	346
38	p-xylene	225	373
39	o-xylene	223	369
40	m-xylene	227	376
41	cumene	221	366
42	aniline	194	317
43	acetic acid	247	412
44	mesitylene	222	368
45	o-cresol	194	317
46	p-cresol	184	300
47	m-cresol	184	300
48	phenol	205	336
49	benzyl chloride	222	368
50	indole	181	294
51	adipic acid	188	307
52	ethyl acetate	315	535
53	ethylene glycol	264	444
54	ascorbic acid	116	177
55	anthraquinone	301	510

Alphabetical Sort			
Index	Substance	γ, °C	γ, °F
20	1,2 butadiene	256	428
13	1,3 butadiene	246	410
33	1-butanol	208	342
14	1-butene	250	419
21	1-pentene	243	406
15	acetaldehyde	233	388
43	acetic acid	247	412
26	acetone	240	401
36	acetonitrile	258	432
5	acetylene	263	441
51	adipic acid	188	307
7	allene	251	419
42	aniline	194	317
54	ascorbic acid	116	177
28	benzene	230	382
49	benzyl chloride	222	368
6	carbon dioxide	272	457
1	carbon monoxide	268	451
27	carbon tetrachloride	233	387
24	chloroform	230	382
41	cumene	221	366
16	cyclobutane	249	417
19	cyclobutene	254	425
29	cyclohexane	233	388
23	cyclopentane	240	399
10	cyclopropane	251	419
4	ethane	260	436
52	ethyl acetate	315	535
53	ethylene glycol	264	444
17	ethylene oxide	243	406
30	heptane	224	371
25	hexane	227	377
32	hydrogen cyanide	287	484
50	indole	181	294
12	isobutane	247	413
47	m-cresol	184	300
44	mesitylene	222	368
2	methane	271	456
40	m-xylene	227	376
45	o-cresol	194	317
39	o-xylene	223	369
46	p-cresol	184	300
22	pentane	239	398
48	phenol	205	336
31	propanol	213	352
8	propylene	256	429
9	propane	257	431
34	pyrrole	206	339
18	tetramethylsilane	239	398
35	toluene	232	385
11	vinyl chloride	237	394