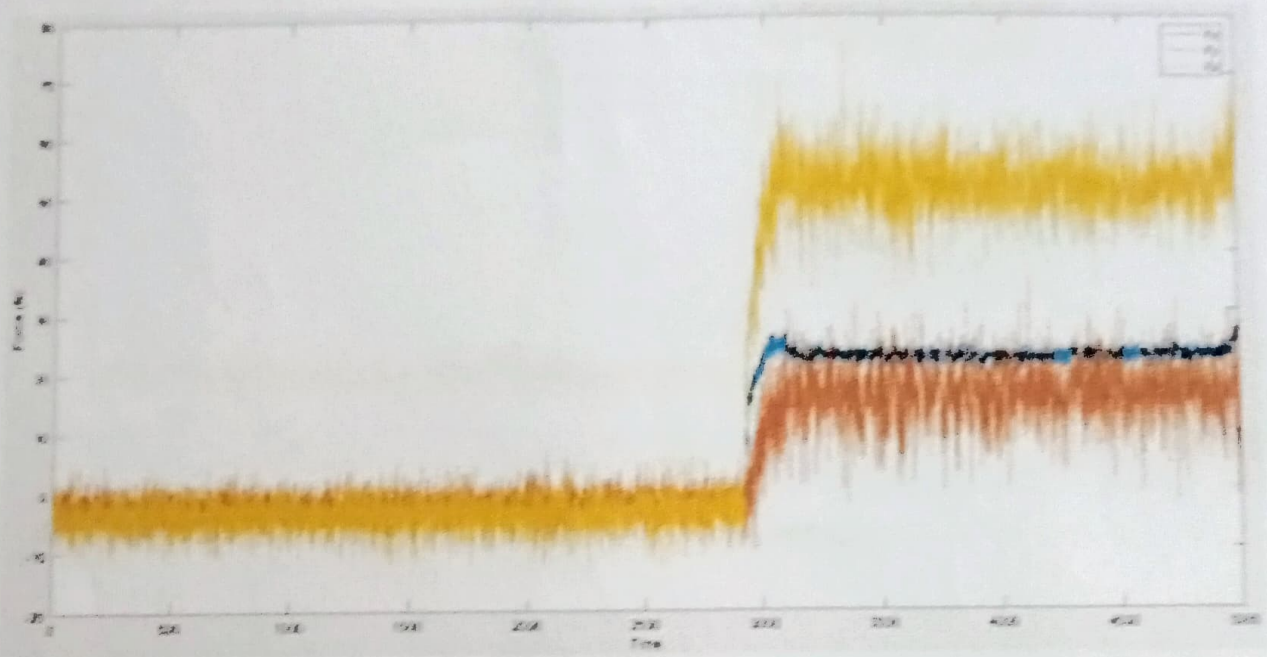
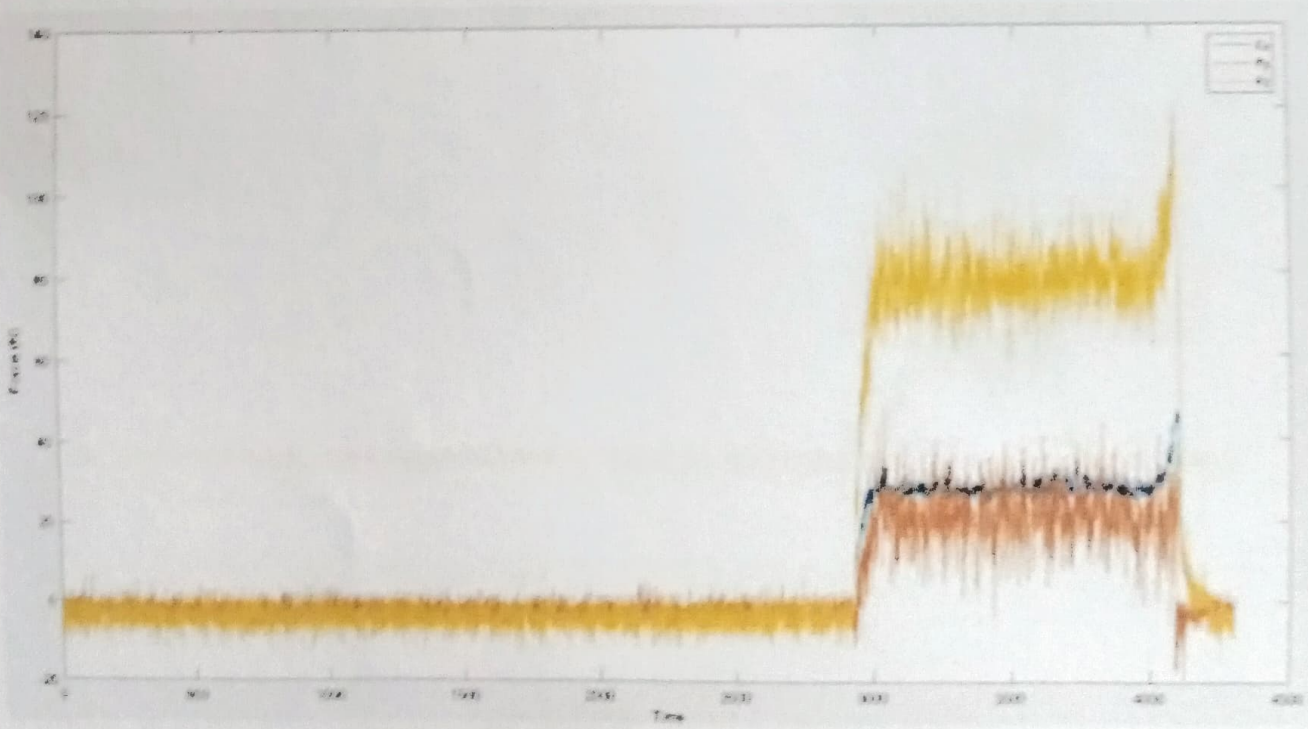
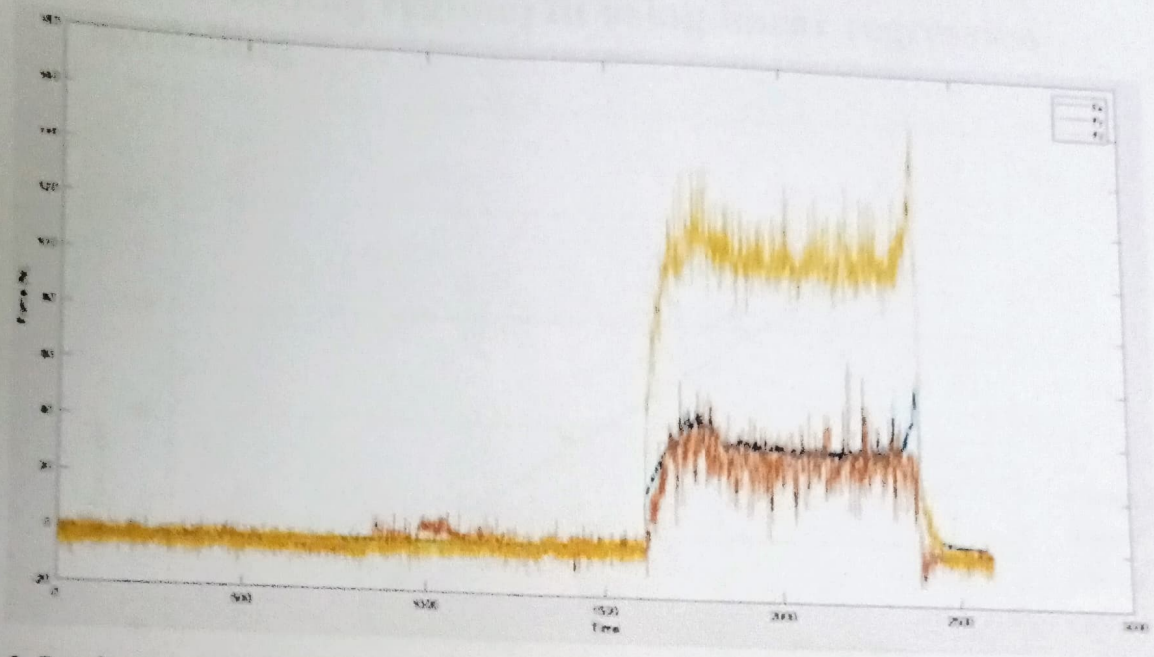
1. Feed rate = 0.065 mm/rev; cutting speed = 125 m/min



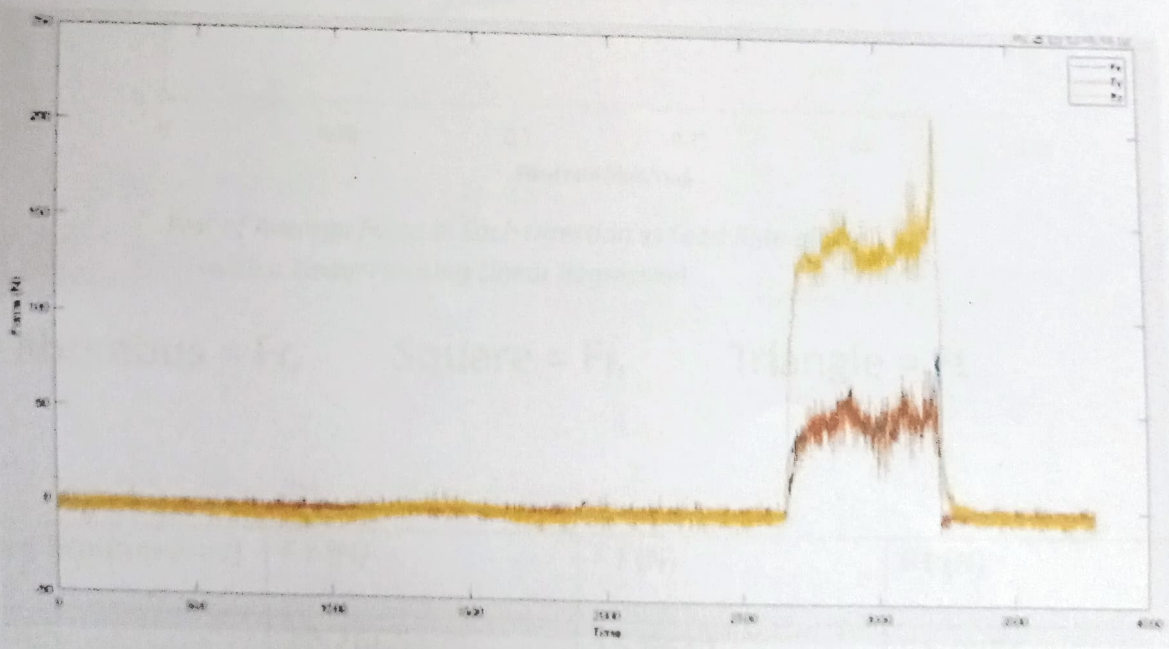
2. Feed rate = 0.115 mm/rev; cutting speed = 125 m/min

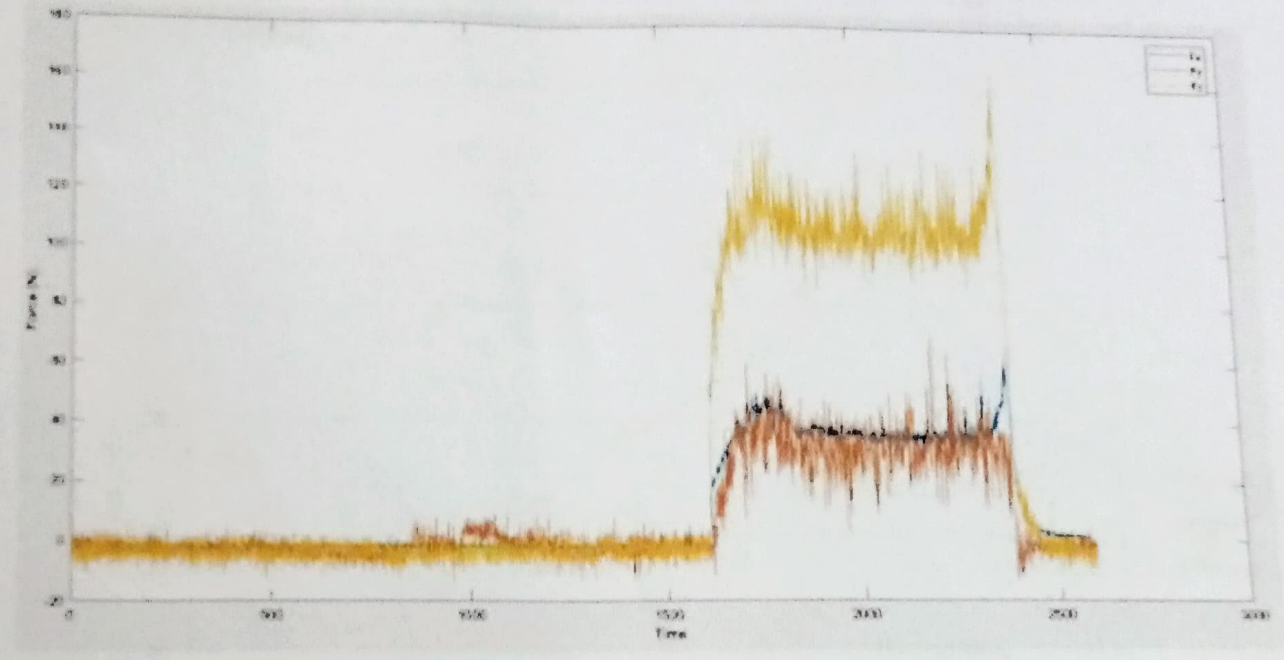


3. Feed rate = 0.165 mm/rev; cutting speed = 125 m/min

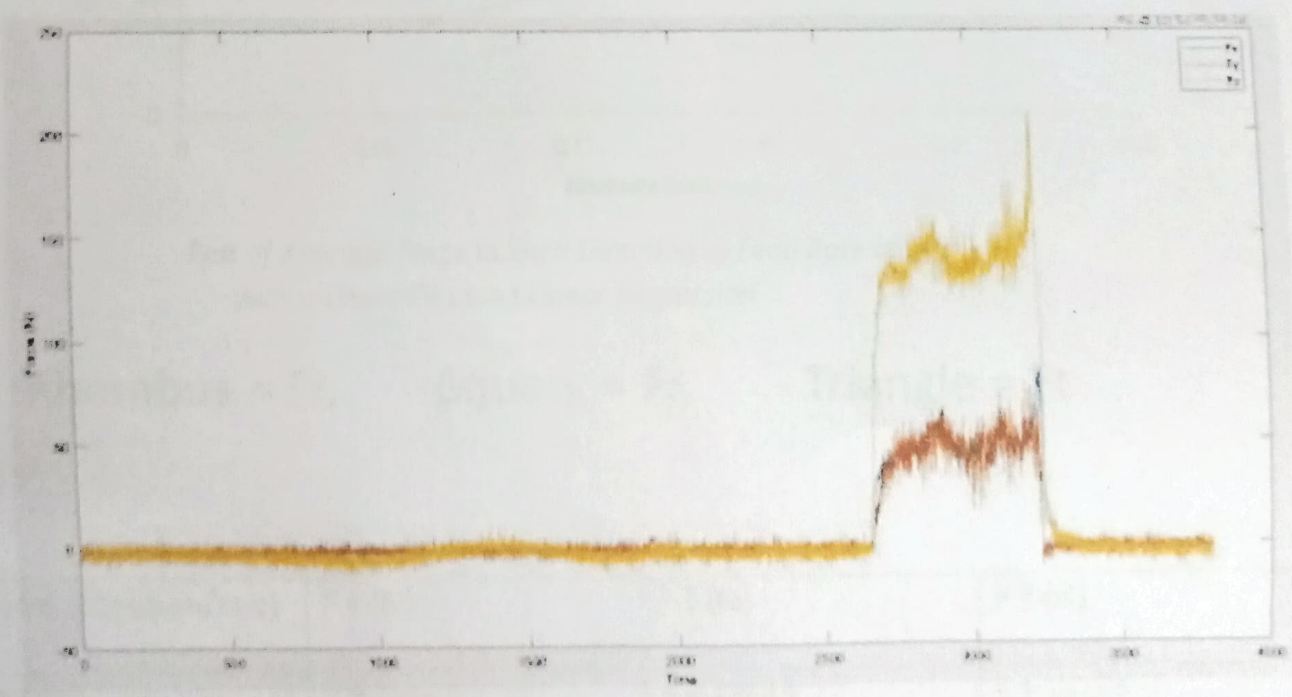


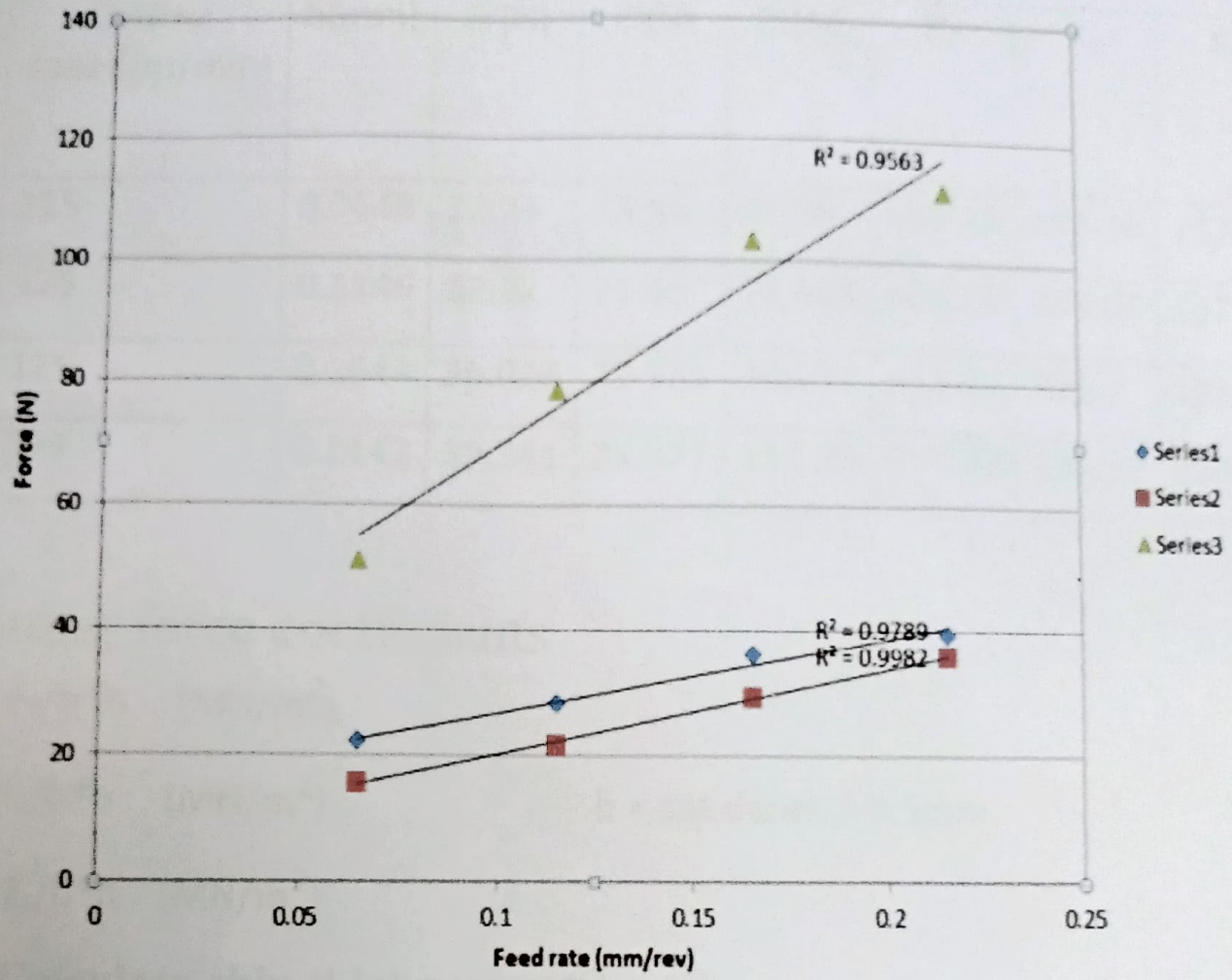
4. Feed rate = 0.215 mm/rev; cutting speed = 125 m/min





4. Feed rate = 0.215 mm/rev; cutting speed = 125 m/min





Plot of Average Force in Each Direction vs Feed Rate along with a Linear Fit using Linear Regression

Rhombus = Fr, Square = F_f, Triangle = Ft

Feed rate(mm/rev)	F r (N)	F f (N)	F t (N)
0.065	22.2665	15.6641	51.0856
0.115	28.3204	21.6601	78.6086
0.165	36.038	29.2386	103.1566
0.215	39.3417	35.9771	111.7956

Feed rate (mm/rev)	Cutting speed(m/min)	h(mm)	Fr(N)	Ff(N)	Ft(N)	Kr	K_f	K_f
0.065	125	0.0648	22.26	15.66	51.08	687.23	483.46	1576.7
0.115	125	0.1146	28.32	21.66	78.608	494.25	378.01	1371.8
0.165	125	0.1644	36.038	29.238	103.15	438.42	355.7	1254.9
0.215	125	0.2142	39.341	35.977	111.79	367.32	335.92	1043.8

Cutting force coefficients

$K_t = F_t/b*h$ (MN/m^2)

$K_f = F_f/b*h$ (MN/m^2) b = cut depth = 0.5mm

$K_r = F_r/b*h$ (MN/m^2)

4. Calculate chip thickness ratio

chip thickness ratio = h (uncut chip thickness)/hc (deformed chip thickness)

Feed rate (mm/rev)	Cutting speed(m/min)	h	hc	rc	ϕ(rad)	β(rad)
0.065	125	0.0648	0.3110	0.2082	0.2097	0.6891
0.115	125	0.1146	0.2580	0.4440	0.4481	0.4508
0.165	125	0.1644	0.5910	0.2781	0.2814	0.6174
0.215	125	0.2142	0.5680	0.3771	0.3818	0.5171

$$K_t = \left[\frac{\tau_s}{\sin\phi_n} \frac{\cos(\beta_n - \alpha_n) + \tan i \tan\eta \sin\beta_n}{\sqrt{\cos^2(\phi_n + \beta_n - \alpha_n) + \tan^2\eta \sin^2\beta_n}}\right]$$

$$K_f = \left[\frac{\tau_s}{\sin\phi_n \cos i} \frac{\sin(\beta_n - \alpha_n)}{\sqrt{\cos^2(\phi_n + \beta_n - \alpha_n) + \tan^2\eta \sin^2\beta_n}}\right]$$

$$K_r = \left[\frac{\tau_s}{\sin\phi_n} \frac{\cos(\beta_n - \alpha_n)\tan i - \tan\eta \sin\beta_n}{\sqrt{\cos^2(\phi_n + \beta_n - \alpha_n) + \tan^2\eta \sin^2\beta_n}}\right]$$

Feed rate (mm/rev)	Kr (N/mm^2)	Kf (N/mm^2)	Kt (N/mm^2)
0.065	1452.7	830.5	1660.4
0.115	761.5	198.9	870.4
0.165	1125.5	531.6	1286.5
0.215	869.8	298	994.2

Work piece: Aluminium (shear strength = 3.03e8 N/m^2)

5. Compare the experimentally identified and estimated cutting force coefficients

ΔK_r = Kr(theoretical) - K_r (experimental)

ΔK_f = Kf(theoretical) - K_f (experimental)

ΔK_t = Kt (theoretical) - K_t (experimental)

	Experimental	Theoretical	Difference
Kr	687.23	1452.7	765.47
	494.25	761.5	267.25
	438.42	1125.5	687.08
	367.32	869.8	502.48
Kf	483.46	830.5	347.04
	378.01	198.9	-179.11
	355.7	531.6	175.9
	335.92	298.0	-57.92
Kt	1576.72	1660.4	83.68
	1371.88	870.4	-501.48
	1254.94	1286.5	31.56
	1043.85	994.2	-49.65

The numbers might be different because we made some guesses when figuring them out. Also, the numbers we measured during the experiment could be a bit off because of mistakes we made while doing the experiment