

Introduction

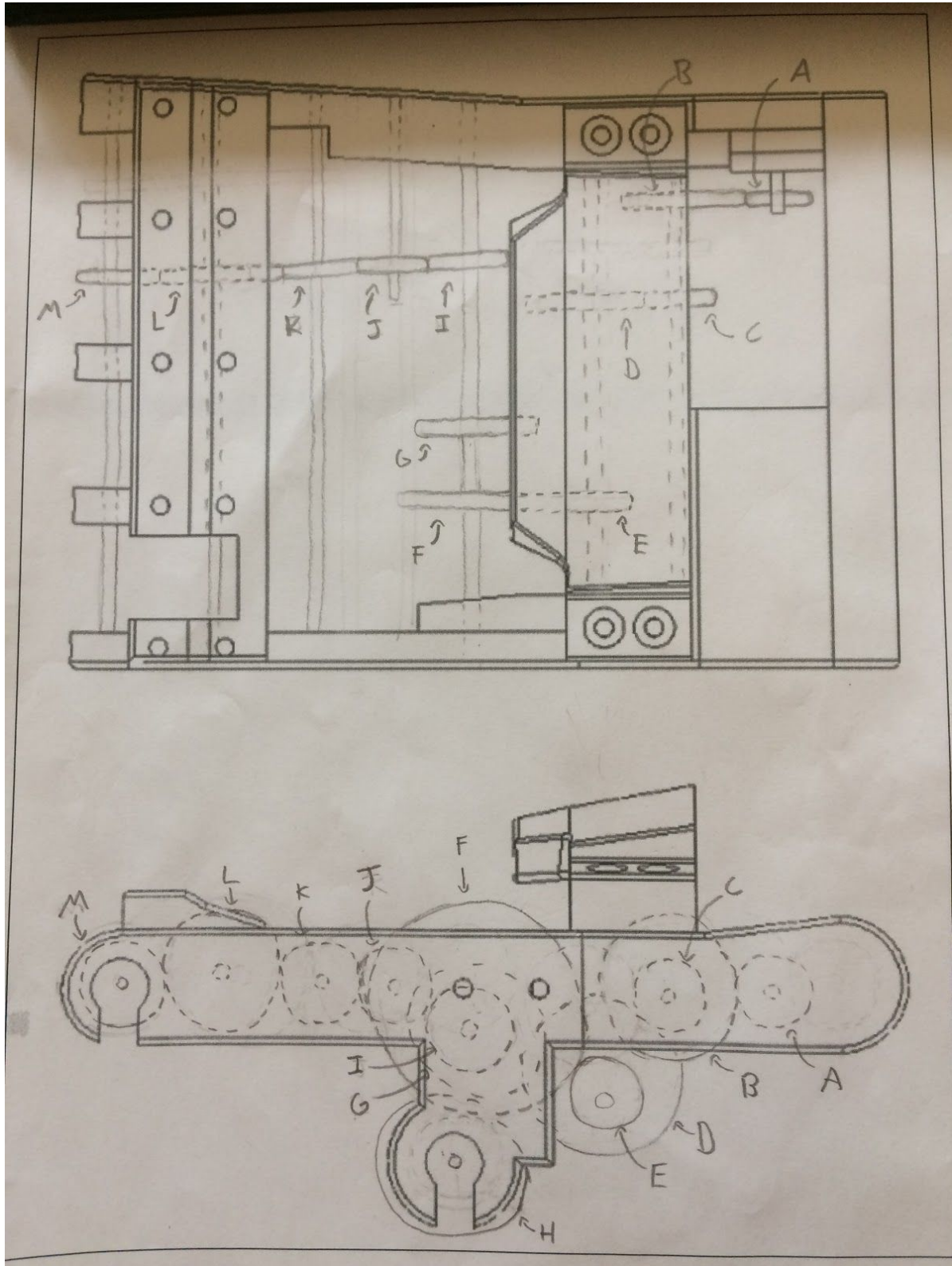
This design project began as the instructions from a biomedical company, BME Devices, to develop a gripping mechanism of a right-hand prosthesis. The apparatus was meant to function by the opening and closing of the forefinger and thumb, driven by a train of gears, all connected to a single motor. Our task was to develop a unique gear train, which would have to be designed to fit inside a prosthetic hand frame, while the motor, located in the wrist-portion of the frame, acts as the starting input that drives the entire mechanism. Our gearing mechanism was to be designed in such a way that the prosthetic forefinger thumb rotated in opposite directions in order to make contact with each other, simulating a gripping motion.

We were constrained to an Input Speed of 225 RPM and an Output Speed of 15 RPM, thus we had a gear ratio of 15. These specifications came into play and were pivotal for our gear train design. Ultimately, our final design consisted of a gear train consisting of 13 spur gears, linked with each other through meshed and axial connections. These gears were all held together with the use of hex nuts and threaded rods, and contained within a 3D printed mount. Finally, this mount was inserted into a prosthetic frame which would simulate a prosthetic hand.

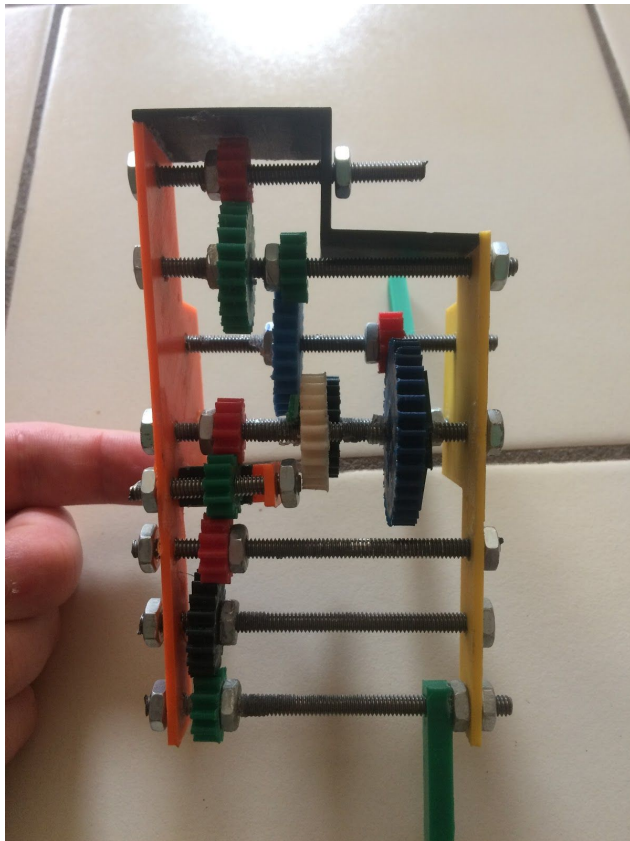
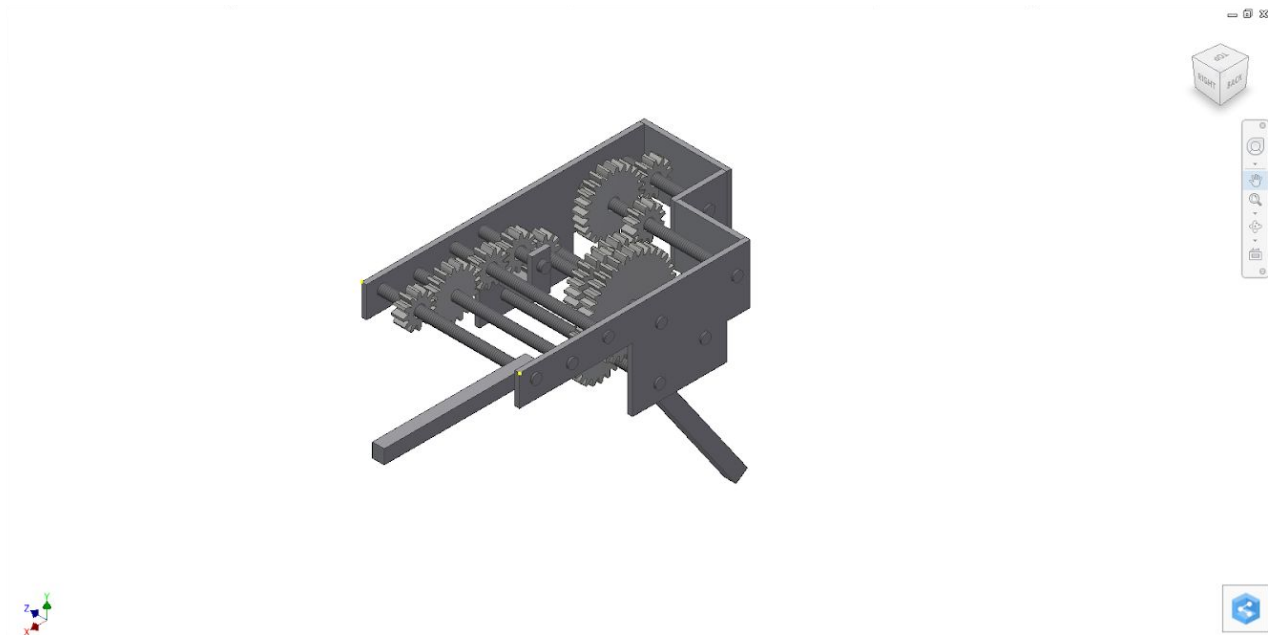
Parameter Table

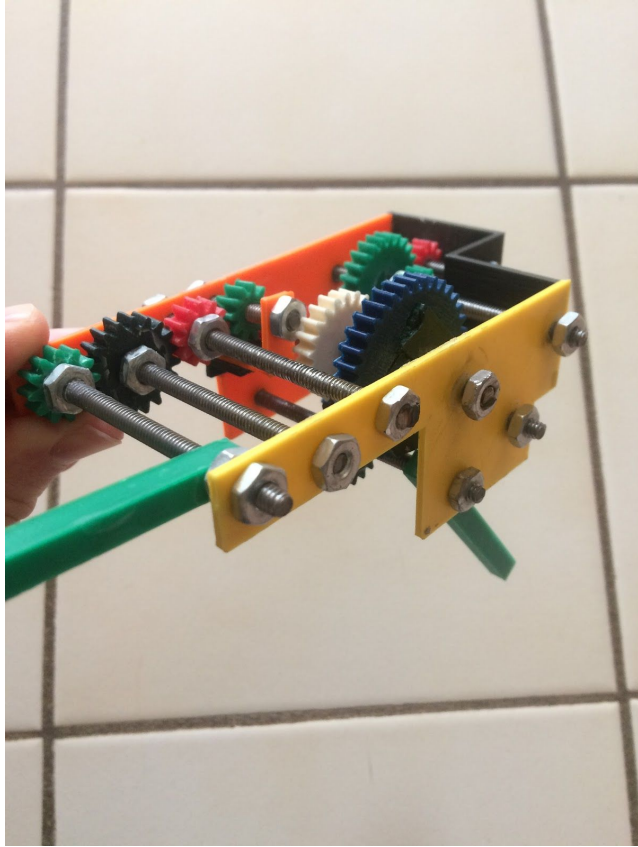
Gear Name	Type of Gear	Connection to Preceding Gear		Pitch Diameter (mm)	Module (mm/tooth)	Number of Teeth
		Type	Name			
A	Spur	N/A	N/A	12	1	12
B	Spur	Mesh	A	24	1	24
C	Spur	Axial	B	12	1	12
D	Spur	Mesh	C	3	1	30
E	Spur	Axial	D	12	1	12
F	Spur	Mesh	E	36	1	36
G	Spur	Axial	F	22	1	22
H	Spur	Mesh	G	22	1	22
I	Spur	Axial	F	12	1	12
J	Spur	Mesh	I	12	1	12
K	Spur	Mesh	J	12	1	12
L	Spur	Mesh	K	19	1	19
M	Spur	Mesh	K	12	1	12

Simplified Gearing Mechanism



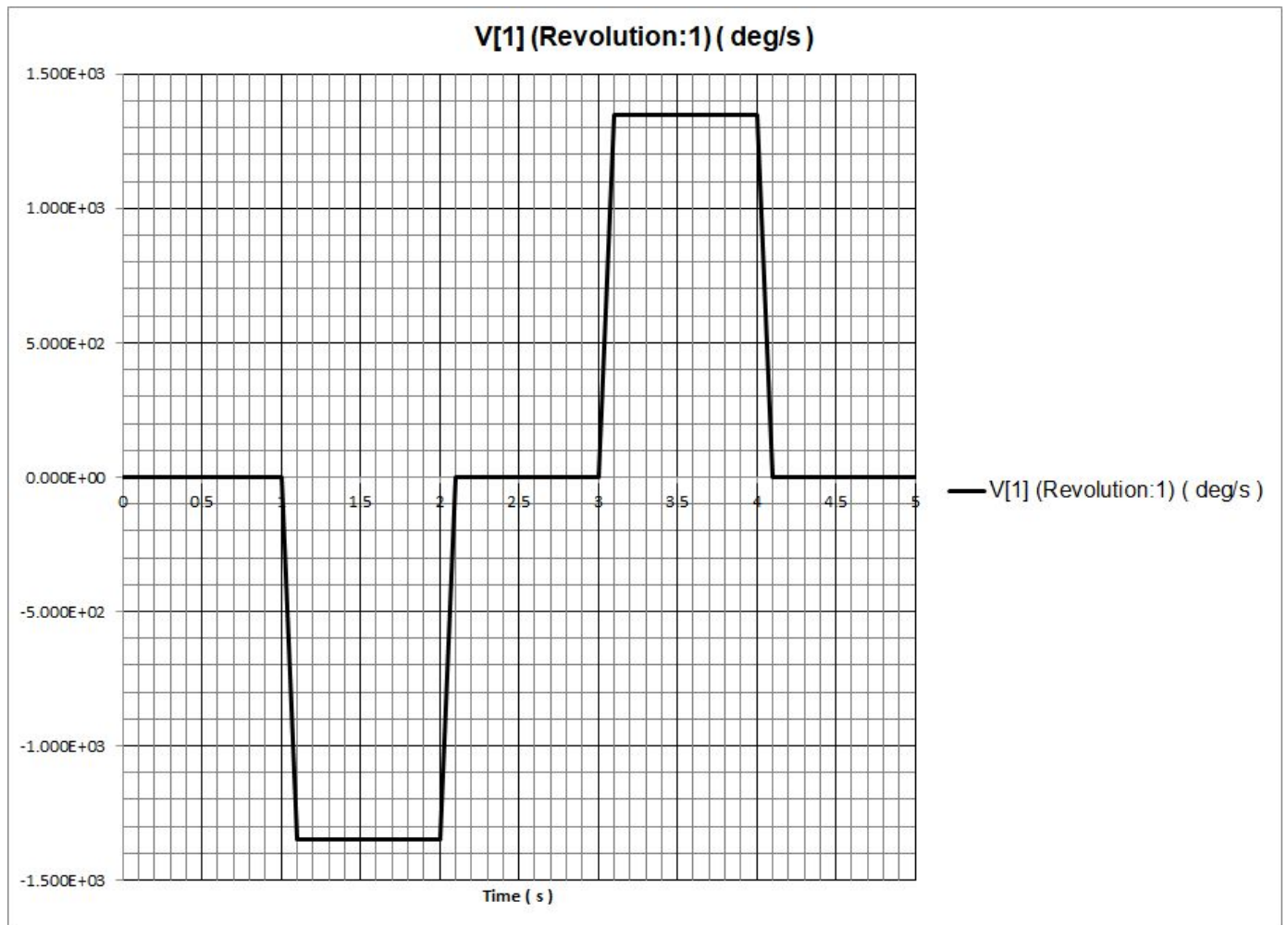
Screenshots



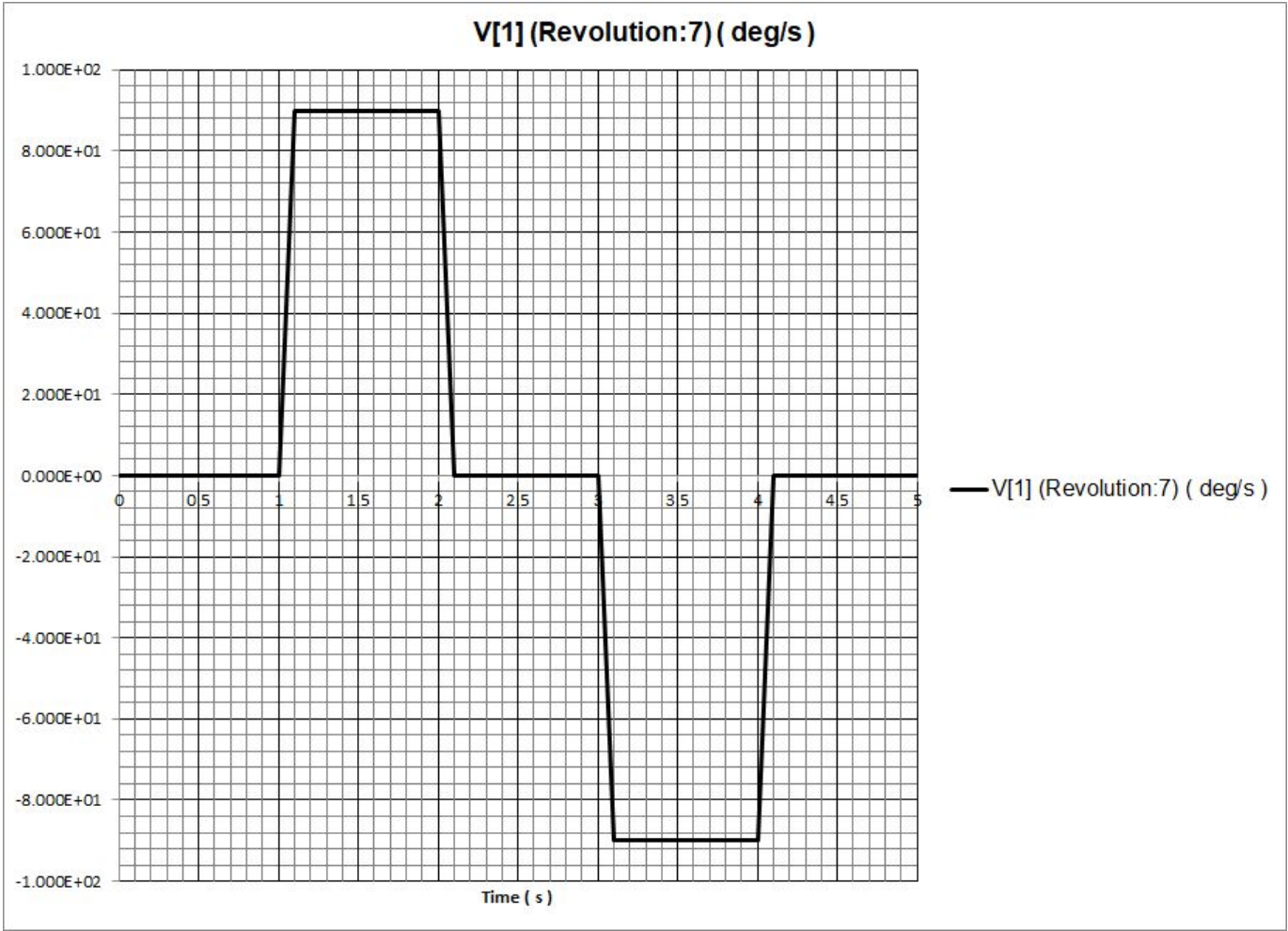


Output Graphs

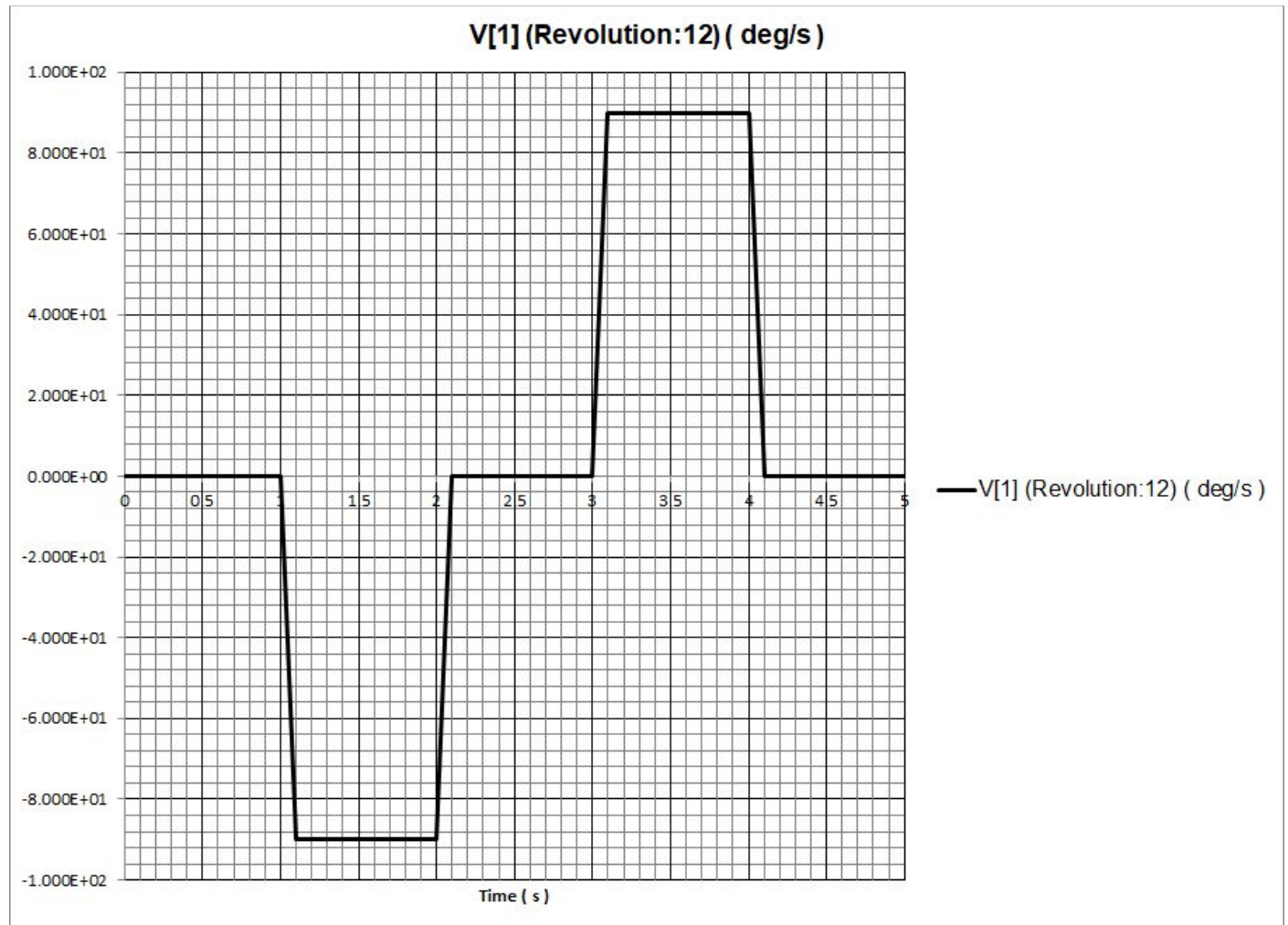
Input Graph



Thumb



Finger



Data

Export to FEA	Time (s)	V[1] (Revolution:1) (deg/s)	V[1] (Revolution:7) (deg/s)	V[1] (Revolution:12) (deg/s)
	0.00000	0.00000	0.00000	0.00000
	0.10000	0.00000	0.00000	0.00000
	0.20000	0.00000	0.00000	0.00000
	0.30000	0.00000	0.00000	0.00000
	0.40000	0.00000	0.00000	0.00000
	0.50000	0.00000	0.00000	0.00000
	0.60000	0.00000	0.00000	0.00000
	0.70000	0.00000	0.00000	0.00000
	0.80000	0.00000	0.00000	0.00000
	0.90000	0.00000	0.00000	0.00000
	1.00000	0.00000	0.00000	0.00000
	1.10000	-1350.00000	90.01880	-90.00515
	1.20000	-1350.00000	90.01880	-90.00515
	1.30000	-1350.00000	90.01880	-90.00515
	1.40000	-1350.00000	90.01880	-90.00515
	1.50000	-1350.00000	90.01880	-90.00515
	1.60000	-1350.00000	90.01880	-90.00515
	1.70000	-1350.00000	90.01880	-90.00515
	1.80000	-1350.00000	90.01880	-90.00515
	1.90000	-1350.00000	90.01880	-90.00515
	2.00000	-1350.00000	90.01880	-90.00515
	2.10000	0.00000	0.00000	0.00000
	2.20000	0.00000	0.00000	0.00000
	2.30000	0.00000	0.00000	0.00000
	2.40000	0.00000	0.00000	0.00000
	2.50000	0.00000	0.00000	0.00000
	2.60000	0.00000	0.00000	0.00000
	2.70000	0.00000	0.00000	0.00000
	2.80000	0.00000	0.00000	0.00000
	2.90000	0.00000	0.00000	0.00000
	3.00000	0.00000	0.00000	0.00000
	3.10000	1350.00000	-90.01880	90.00515
	3.20000	1350.00000	-90.01880	90.00515
	3.30000	1350.00000	-90.01880	90.00515
	3.40000	1350.00000	-90.01880	90.00515
	3.50000	1350.00000	-90.01880	90.00515
	3.60000	1350.00000	-90.01880	90.00515
	3.70000	1350.00000	-90.01880	90.00515
	3.80000	1350.00000	-90.01880	90.00515
	3.90000	1350.00000	-90.01880	90.00515
	4.00000	1350.00000	-90.01880	90.00515
	4.10000	0.00000	0.00000	0.00000
	4.20000	0.00000	0.00000	0.00000
	4.30000	0.00000	0.00000	0.00000
	4.40000	0.00000	0.00000	0.00000
	4.50000	0.00000	0.00000	0.00000

	4.60000	0.00000	0.00000	0.00000
	4.70000	0.00000	0.00000	0.00000
	4.80000	0.00000	0.00000	0.00000
	4.90000	0.00000	0.00000	0.00000
	5.00000	0.00000	0.00000	0.00000