Pulsing Command Table

Sub ID	Short Name	Access	Data Type	Unit	Note
0	zero_angle	get, set, save	float	1/s (rad)	This sets where the pulse starts around the motor
1	frequency	get, set, save	uint8_t	Hz	This sets how many pulses happen per rotation.
2	phase	get, set	float	1/s (rad)	This is added to the zero angle to set where the pulse happens. Zero angle is the default and then you can rotate the pulse using phase
3	amplitude	get, set	float	V	This sets how strong the pulse is. At lower speeds strong pulses can overcome the inertia of the motor spinning and cause it to stop.
4	voltage	get	float	V	This returns the current voltage being applied by the pulsing client.
5	limit	get	float	V	The current limit on pulsing amplitude based on settings and velocity
6	cutoff	get, set, save	float	rad/s	The velocity at which pulsing is allowed. Any velocity between cutoff and -cutoff will not pulse
7	zeroth	get, set, save	float	rad/s	Zeroth coefficient of the cutoff polynomial
8	first	get, set, save	float	rad/s/Unk	First coefficient of the cutoff polynomial
9	second	get, set, save	float	rad/s/Unk^2	Second coefficient of the cutoff polynomial
10	third	get, set, save	float	rad/s/Unk^3	Third coefficient of the cutoff polynomial
11	phase_lead_time	get, set, save	float	rad/Unk	The phase lead time setting for tuning pulsing propellers

12	phase_lead_angle	get	float	rad	The instantaneous phase lead angle determined by the phase lead time
13	phase_act	get	float	rad	The instantaneous phase being using by the pulsing client
14	amplitude_act	get	float	V	The instantaneous amplitude being using by the pulsing client

Command Explanation

Zero Angle

Zero angle sets where pulse starts compared to the motor's zero angle. If an appropriate propeller is attached, this will rotate the direction that torque is made as a baseline

Frequency

This is an integer number of pulses that happen per rotation of the motor. This can be useful if the motor is not directly driving the propeller

Phase

This is added to the zero angle to change the phase at which the pulse starts. If using this firmware to control a pulsing propeller, this is what you should use to vary the torque direction.

Amplitude

This sets the amplitude of the pulse in volts. If the motor is running at a DC voltage of 10V and a pulsing amplitude of 2V is applied then the max voltage required by the motor will be 12V. Ensure that your motor has enough voltage overhead supplied.

Voltage

This returns the current instantaneous voltage being applied by the pulsing client. If your angle and phase are set to 0 radians and the motor is at 0 radians then this will return 0. If your motor is at pi/2 radians it will return what the amplitude is set to (unless an amplitude limiter is being used).

Limit

This returns the instantaneous limiter on pulsing amplitude based on settings and the current motor velocity.

Cutoff

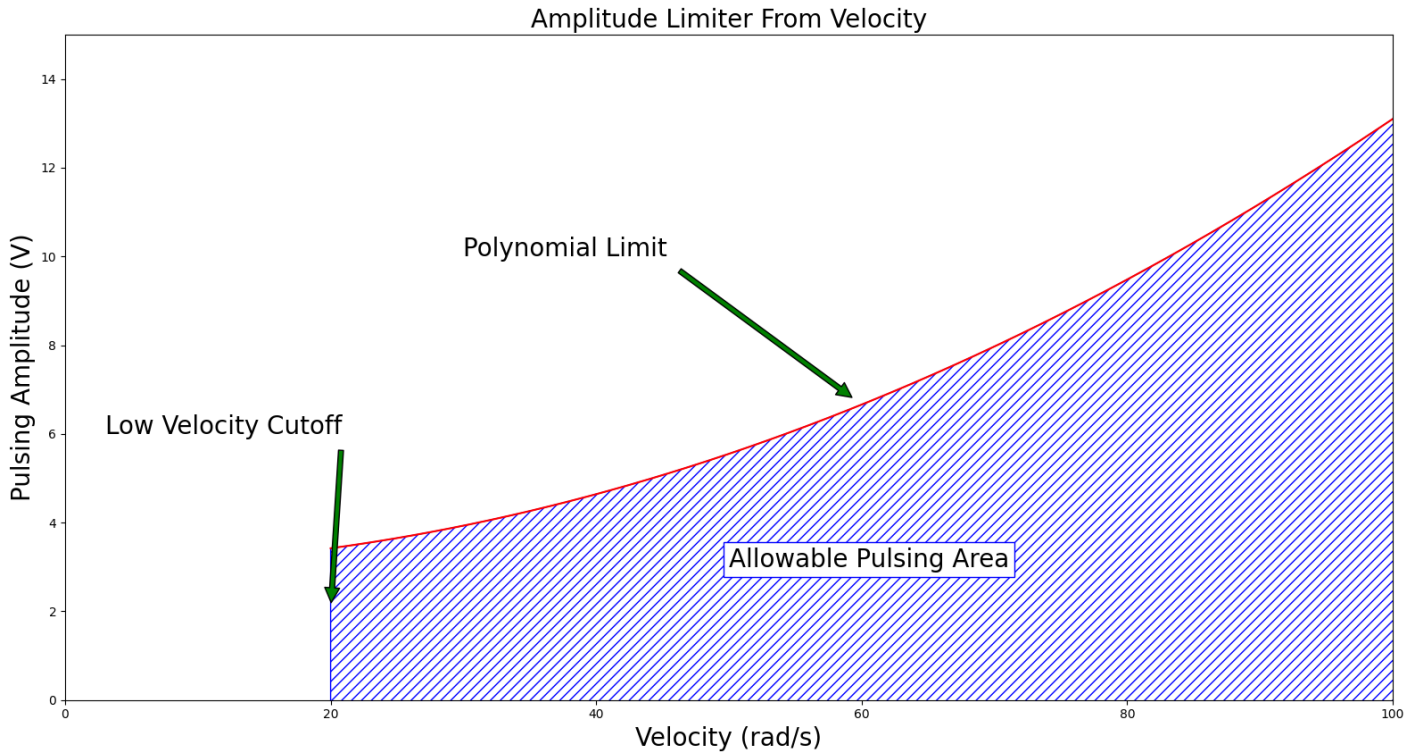
The cutoff setting allows you to prevent the motor from pulsing when it is below a certain speed in rad/s. This is always positive. If it is set to 200rad/s then the motor cannot pulse between -200 and 200 rad/s.

Zeroth, first, second, third

These variables define a polynomial for limiting the pulsing amplitude based on the current velocity of the motor. These can be useful to prevent your motor from stopping completely if the pulsing voltage is too high above the drive voltage. The polynomial is defined by:

$$limit = zeroth + first * vel + second * vel^2 + third * vel^3$$

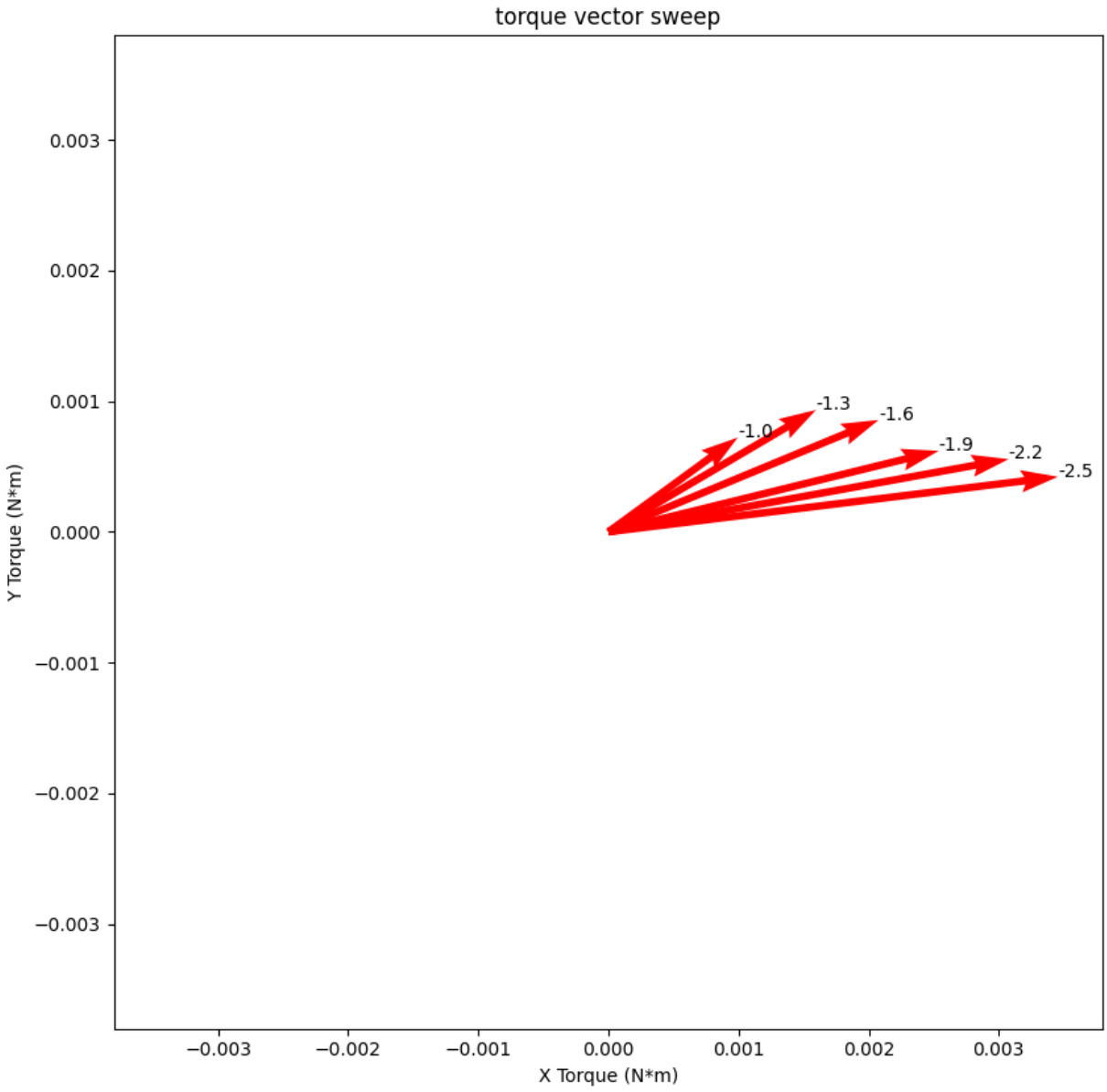
The plot below shows how the cutoff and polynomial interact to create a region of allowable amplitudes:



Phase Lead Time

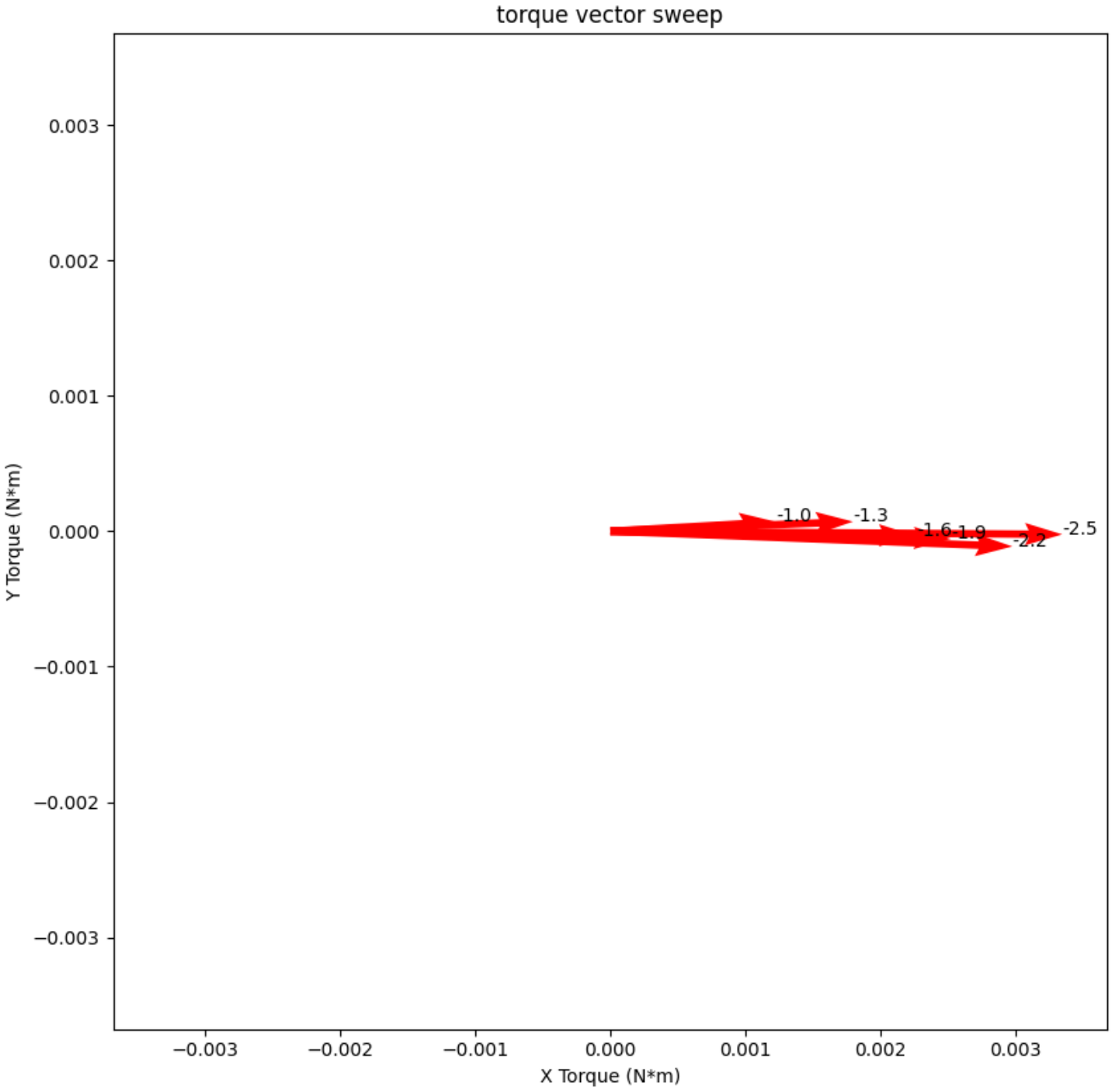
This variable can be used to vary how the phase is adjusted based on the velocity of the motor. Some propeller's torque can change angle based on their velocity. An example of before a phase lead time is applied

is shown below:



As more voltage is applied to the motor, it spins faster and the torque changes angles while the phase setting remains constant. This undesirable behavior can be corrected using the phase lead time variable. Once it is

applied the torque can be corrected to have the same angle regardless of motor velocity:



Phase Lead Angle

This reports the current correction factor to phase based on phase lead time and motor velocity.

Phase Act

This is the actual phase based on the commanded phase and the correction from the phase lead time parameter.

Amplitude Act

This is the current amplitude of pulse that the motor is applying based on the commanded amplitude and the limit functions.