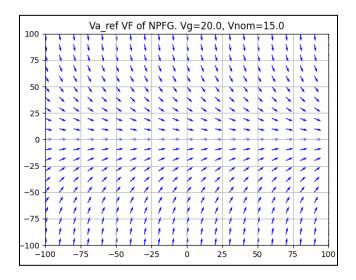
## Week 7 Report - Jan 2, 2023 ~ Jan 8, 2023

## **Vector Field Drawing**

To get an intuitive sense on the NPFG's Air-velocity reference vector around a path, a small script was made to visualize the VF. With this, the coupling between track error boundary (grows linearly with ground speed of the vehicle), look-ahead angle (course of Vectors), and a reference speed (magnitude of the vector).



More info can be found in 7 NPFG VectorField Visualization document.

## **Timeline Setting**

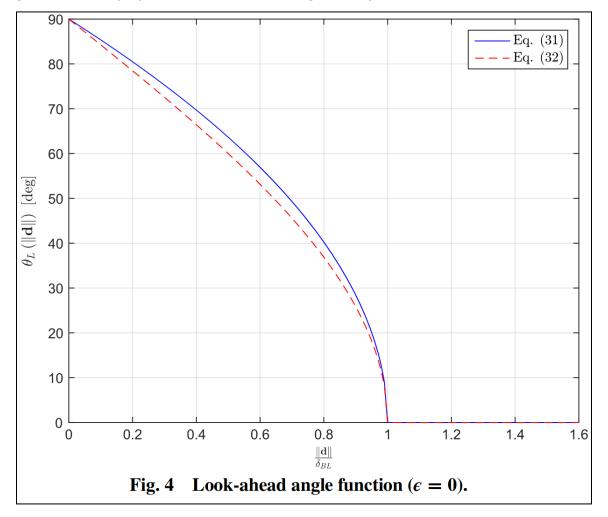
As part of the preparation for the <u>8\_Intermediate\_Presentation</u> which was held on Jan 9, 2023, the timeline for the project & goals were updated.

	Noven	nber	December			£	January					February				March
	21	28	5		<del>19</del>	<del>26</del>	2		16	23	30	6	13	20	27	4
Background																
<u>Literature review</u>																
Thesis Problem definition																
Simulation Environment																
Evaluate NPFG for MC/FW in Windy Wings																
Evaluate Jerk induced by NPFG (MC)																
Benchmark against NPFG																
Include Wind dynamics in Simulation																
Benchmark new formulation in Wind																
Theoretical Formulation																
Formulate new ref vector for multicopter																
Apply new formulation for VTOL																
Consider wind into guidance																
Testing																
Implement new guidance in PX4																
Evaluate new formulation on real MC																
Evaluate new formulation on real FW																
Evaluate new formulation on real VTOL																
Documentation																
Weekly report (due Sunday, 3pm CET)	~	<b>~</b>	~	~	<b>~</b>	<b>~</b>										
Latex lemplate familiarity																
Intermediate presentation								9.01								
Prepare final presentation																
Final report writing																8.03

In summary, the new jerk-limited air-velocity reference vector formulation & considering wind into guidance were incorporated.

The document can be accessed <u>here</u> as well.

## Revisiting 3D-NPFG paper & look-ahead angle ramp-in curve



In the <u>3D NPFG Paper</u>, I have revisited this diagram, which gives a good sense on how the vehicle's inertial velocity will \*turn relative to the error vector between the closest point on path, in the direction of the unit path tangent vector (should approach PI/2, as vehicle approaches (X-value in the above diagram reaching 0.0).

And the 'jerk', when assuming a constant vehicle speed & no-wind (airspeed == groundspeed), the jerk is simply a in a form of:

$$\left[\frac{\frac{V_g}{\delta_{BL}} \cdot \frac{|d|}{\delta_{BL}} \cdot sin(\theta_L(|d|))\right]^2 \cdot V_g.$$

As it is simply a centrifugal acceleration / jerk, which is a multiplication of vehicle's speed and functions of the look-ahead angle & normalized track error variables. Therefore, this will be used to plot the jerk experienced by the vehicle under different guidance laws each with their unique look-ahead angle function curves. Which will first provide an intuitive sense on jerk experienced by vehicle with constant speed & no-wind.