New approach to visualize Parallel Path boundaries in PragPal algorithm

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1 Introduction

Visualizing new robust method to generate boundaries around the dynamic path made using PragPal algorithm

2 Methods

2.1 Method-1

Using this method we can generate distortion-less parallel path boundaries but with non-constant width.

Procedure and math involved

Let us assume a 2-turn path using 4 points P_1, P_2, P_3 and P_4. Let P_1 is the start point and P_4 is the end point. Let the starting path width be p_w, $P_2 - P_1 = \overrightarrow{a}$, $P_3 - P_2 = \overrightarrow{b}$ and turn angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ be β. Now we try to find the direction of average of the 2 vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ to find the path boundary points at the turn.

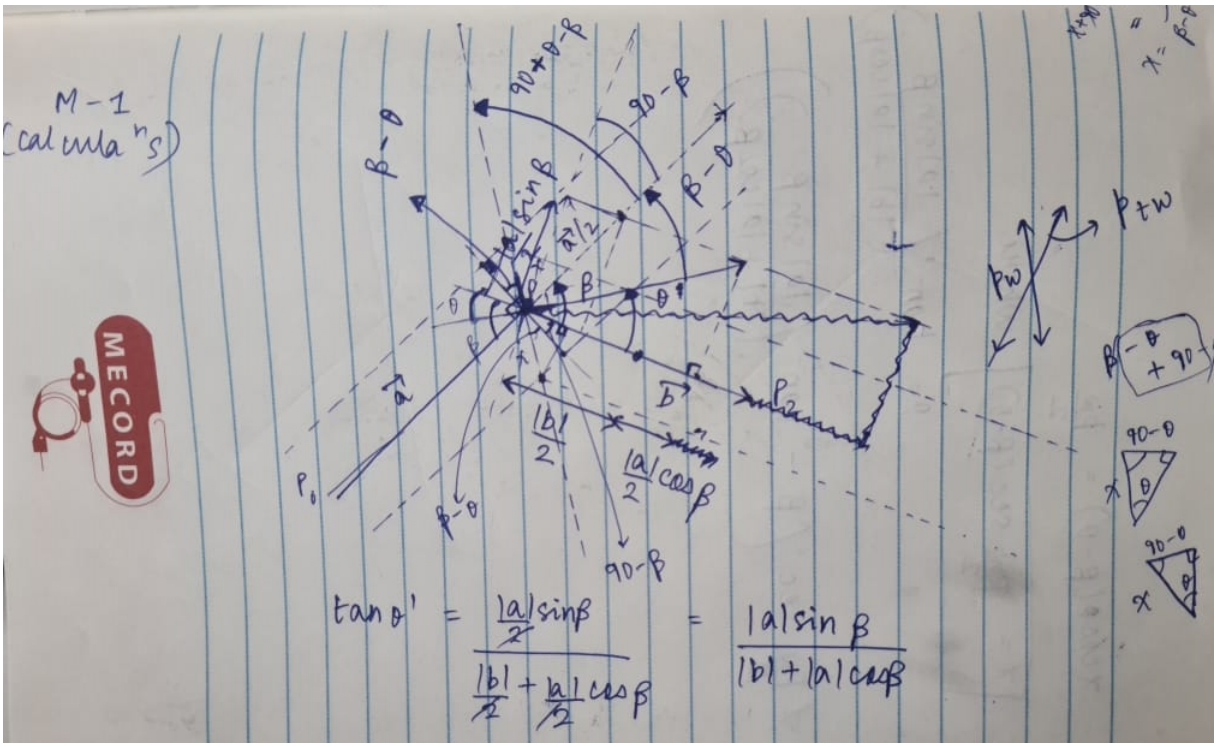

Figure 1: Finding boundary points and path width at a turn

By taking components of vector $\overrightarrow{a}$ perpendicular and parallel to $\overrightarrow{b}$ we get the average direction of the vectors. The average direction vector has a angle θ with the $\overrightarrow{b}$. Once we get the average vector direction we draw a line perpendicular to this vector at the turn point.

Our boundary points will lie on this line.

We do the same as above for all the turn points and find the line on which boundary points will lie. Then from the starting point P_1 we draw 2 parallel lines to the $\overrightarrow{a}$ and let it intersect the boundary line made previously, these intersection points will give us the left and right boundary points. In the below figure 2 p_{tw} is the path width at a turn.

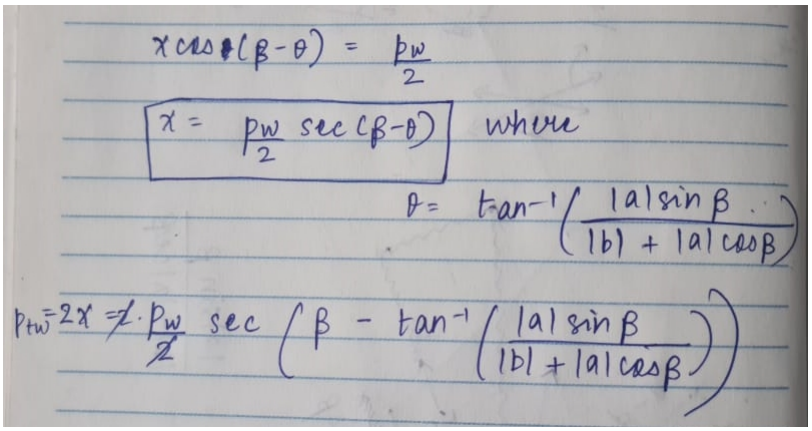

Figure 2: Calculation of the path width at a turn

We repeat the above by extrapolating a parallel path again from the above newly found boundary points along the $\overrightarrow{b}$ and let it intersect the next boundary line. Using this we can generate a parallel path with non-constant width.

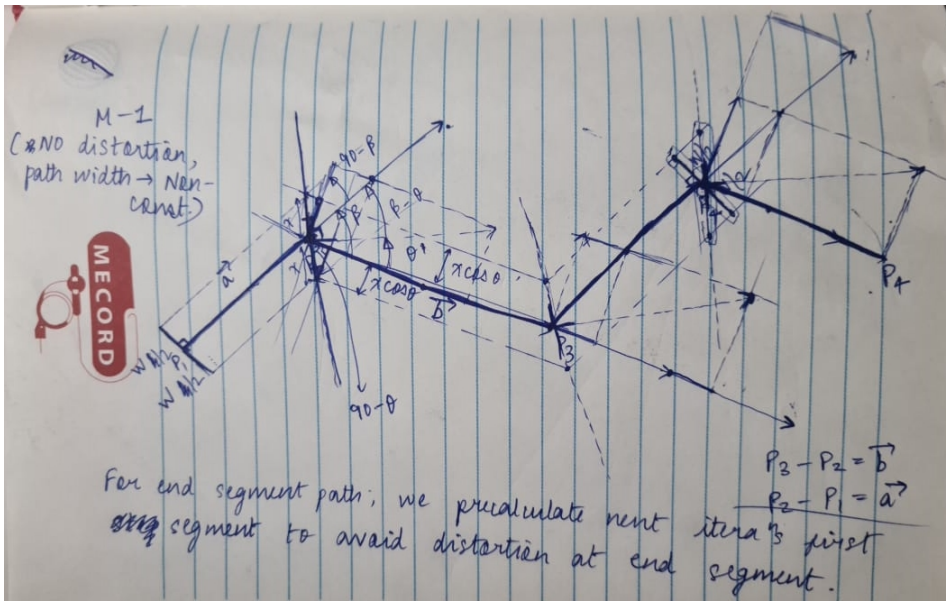

Figure 3: Generation of parallel path with non-constant path width

However, some distortion may occur at the endpoint if we are not calculating the next iterations path vector(This can be seen in figure 3 , where initially the end point width was some $p_w^{'}$ but after a new path is added in front of it the path boundary points change making the turn path width a little longer and skewed from the original path width). This problem can be avoided if we calculate the path vector of the next segment before rendering it in VR.

2.2 Method-2