Coverage Path Planning Algorithm - QGC Approach

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Algorithm

Algorithm 1 Generate Transects: `generateTransects`($\mathcal{P}$, θ, s)

Input: Polygon points $\mathcal{P}$ (Nx2 matrix), grid angle θ (degrees), grid spacing s (meters)
Output: Transects $\mathcal{T}$, rotated polygon $\mathcal{P}_{rot}$

$\theta \leftarrow \texttt{deg2rad}(\theta)$
$\mathbf{R} \leftarrow \begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}$
$\mathcal{P}_{rot} \leftarrow \mathbf{R} \cdot \mathcal{P}^T$

$\texttt{minX} \leftarrow \min(\mathcal{P}_{rot}(:, 1))$
$\texttt{maxX} \leftarrow \max(\mathcal{P}_{rot}(:, 1))$
$\texttt{minY} \leftarrow \min(\mathcal{P}_{rot}(:, 2))$
$\texttt{maxY} \leftarrow \max(\mathcal{P}_{rot}(:, 2))$

$\mathcal{T} \leftarrow \emptyset$
$\texttt{lines\_x} \leftarrow (\texttt{minX} - 2s) : s : (\texttt{maxX} + 2s)$
for $x \in \texttt{lines\_x}$ **do**
    $\mathbf{l} \leftarrow \begin{bmatrix} x & \texttt{minY} - 2s \\ x & \texttt{maxY} + 2s \end{bmatrix}$
    $\mathcal{T} \leftarrow \mathcal{T} \cup \{\mathbf{R}^{-1} \cdot \mathbf{l}^T\}$
end for

return $\mathcal{T}, \mathcal{P}_{rot}$