

# Angle Recording CORDIC

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to reduce the number of CORDIC iterations

by encoding the angle of rotation  
as a linear combination of  
selected elementary angle of micro-rotations

Signal / Image Processing      DFT & DCT  
- the rotation angle known a priori

# Elementary Angle Set

$$S = \{ (\sigma \cdot \tan^{-1}(2^{-r})) : \sigma \in \{+1, -1\}, r \in \{1, 2, \dots, n-1\} \}$$

n-bit angle as a linear combination

$$\theta = \sum_{i=0}^{n-1} \sigma_i \cdot \tan^{-1}(2^{-i})$$

$$AR : \sigma \in \{+1, 0, -1\}$$

EAS (Elementary Angle Set) for AR methods

$$S_{EAS} = \{ (\sigma \cdot \tan^{-1}(2^{-r})) : \sigma \in \{+1, 0, -1\}, r \in \{1, 2, \dots, n-1\} \}$$

Simple angle recording — Hu's greedy algorithm

tries to represent the remaining angle

using the closest elementary angle  $\pm \tan^{-1}$

{ rotation mode — Angle Recording  
vectoring mode — Backward Angle Recording (BAk)

initialize  $\theta_0 = \theta$

$$\sigma_i = 0 \quad i = 0, 1, \dots, n-1$$

$$k = 0$$

repeat until  $|\theta_k| < \tan^{-1}(2^{-n+1})$  do

1. choose  $i_k$ ,  $i_k = 0, 1, 2, \dots, n-1$

such that

$$\left| |\theta_k| - \tan^{-1}(2^{-i_k}) \right| = \min_{i \in [0:n-1]} \left| |\theta_k| - \tan^{-1}(2^{-i}) \right|$$

2.  $\theta_{k+1} = \theta_k - \sigma_{i_k} \tan^{-1}(2^{-i_k})$

$$\sigma_{i_k} = \text{sign}(\theta_k)$$



