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COMPLEX ARITHMETIC THROUGH CORDIC

(Dedicated to Prof. Y. Komatu for his 60th birthday)

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Abstract

A unified algorithm for elementary functions due to coordinate transformations, named CORDIC has been first introduced by Volder [1] and later extensively investigated by Walther [2]. Here the author mentions several practical remarks for the application of the algorithm to complex arithmetic including square root.

§1. The principle of CORDIC.

In order that the present paper may be self-contained, we first briefly summarize the principle of the algorithm.

1.1. Generalized polar coordinates.

Let (x, y) be the planar orthogonal coordinates for a point P and introduce a *generalized polar coordinate system* (R, A) by

$$(1) \qquad \begin{cases} R=(x^2+my^2)^{1/2} \\ A=m^{-1/2}\arctan(m^{1/2}y/x), \end{cases} \qquad \begin{cases} x=R\cos(m^{1/2}A) \\ y=Rm^{-1/2}\sin(m^{1/2}A). \end{cases}$$

Here m is a fixed constant whose value is one of 1, -1 or 0. We should impose some interpretations when $m=0$ and $m=-1$; precisely, we put

$$A=y/x \quad \text{for} \quad m=0; \qquad A=\operatorname{arctanh}(y/x) \quad \text{for} \quad m-=1.$$

For simplicity, we always assume $x\geqq 0$, and further $x\geqq|y|\geqq 0$ for $m=-1$. It is easily seen that $A=S/2R^2$, where S is the area of the domain surrounded by x axis, the radius vector OP and the curve of constant radius R passing through P.

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