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NUMBER: Digital - 1 - 17 - 5 - A
NAME: Sine-cosine Routine
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DATE: December 31, 1962
SPECS: MACRO Symbolic
ABSTRACT: The purpose of this routine is to find the
                sine or cosine of a floating point number.

PROGRAM WRITEUP

1. IDENTIFICATION

1.1 PDP-1, Single Precision Floating Point Interpretive Routines;
Sine-cosine routine

2. ABSTRACT

2.1 Purpose

The purpose of this routine is to find the sine or cosine
of a floating point number.

2.2 Calling Sequences

Sine and cosine are defined as Macro instructions which
result in "jsp sin" and "jsp cos".

2.3 Storage and Execution Time

The routines require 171_8 registers. The approximate
execution times in milliseconds, are sin, 5.79; cos, 7.56.

3. PURPOSE

The floating sine-cosine routine finds the sine or cosine of a
floating point number located in floating accumulator, and leaves
the result, a floating point number, in fam and fae.

6. RESTRICTIONS

6.1 Subroutines required

The floating point interpreter and the arithmetic routines
are required for the routine.

7. PROPERTIES

7.1 Symbols defined: sin, cos

7.3 Accuracy:

At least 5 decimal places. The theoretical limit is:

$$emax = \frac{approximation - function}{function} \leq 10^{-6}$$

8. METHOD

8.1 Informal description

The program first checks the magnitude of the argument and properly adjusts it to be in the form:

$$\sin \frac{W}{2} \quad X \quad \text{where} \quad -1 \leq X \leq 1$$

The approximation used is:

$$\sin \frac{\tilde{\pi}}{2} X = C_1 \ X + C_3 X^3 + C_5 X^5 + C_7 X^7$$

where $C_1 = 1.57079$

$C_3 = -.645921$

$C_5 = .079488$

$C_7 = .00436248$

8.3 Reference

The approximation was taken from Cecil Hastings, Approximations for Digital Computers, Princeton, New Jersey, Princeton University Press, 1955, p. 139.