ELLIOTT 903

Volume 2: PROGRAMMING INFORMATION

Part 2: PROGRAM DESCRIPTIONS

Section 12: QSIN (B. 4)

Contents

Chapter 1: DESCRIPTION

1. 1 INTRODUCTION.

1. 1. 1 Purpose.

To calculate

$\frac{1}{2} \sin \pi x$

and $\frac{1}{2} \cos \pi x$

where x is the fraction in the accumulator.

1. 1. 2 Form of Distribution.

The program is distributed as a machine code tape for input by T2 or SIR.

1. 1. 3 Method of Use.

The routine is assembled as a block of the user's program and used as a sub-routine. It may be run at any program level and in any store module.

1. 1. 4 Accuracy.

The maximum error is $2^{-15} (\simeq .00003)$

1. 2 FUNCTIONS.

1. 2. 1 Number Type.

The operand, x, and the result must be treated by the programmer as pure fractions.

To enable this to be done QSIN calculates

$\frac{1}{2} \sin \pi x$

and $\frac{1}{2} \cos \pi x$

Note, therefore that on entry, the accumulator holds the value of an angle as a fraction of π radians (180^{o}).

1. 2. 2 Entry and Exit.

Entry is made by

(for assembly by SIR)

```
11 QSIN
 8 QSIN+1
```

(for translation by T2).

```
11  0;N
 8  1;N
```

Where N is the number of the block,

On exit

$\frac{1}{2}$ sin π x is in the accumulator and in QSIN + 67 (67;N)
$\frac{1}{2}$ cos π x is in QSIN + 68 (68;N)

1. 2. 3 Identifiers.

QSIN must be declared as a global identifier in all blocks of the users program which refer to it.

On the library tape, a mnemonic label and identifier list are separated from the coding by several inches of blank tape: the mnemonics must not be loaded into the tape reader if the tape is to be translated by T2.

1. 3 METHOD USED.

1. 3. 1 Notation.

On entry, the accumulator contains a fraction, x.

$$x = \tfrac{1}{2}(n + y)$$

such that n is an integer and $-\tfrac{1}{2} \leq y < \tfrac{1}{2}$

If $Z = \tan(\pi y/4)$

$S = \tfrac{1}{2} \sin(\pi y/2)$

$C = \tfrac{1}{2} \cos(\pi y/2)$

a) The program computes

$$Z = \frac{4y}{4 - y^2} P(y^2)$$

Where P is a power series which is rapidly convergent when y is in the specified range.

b)

$$S = \frac{Z}{1 + Z^2}$$

$$C = \tfrac{1}{2}\left\{\frac{1 - Z^2}{1 + Z^2}\right\}$$

and the values are found as shown in the table below:

n	$\frac{1}{2}$ sin π x	$\frac{1}{2}$ cos π x
-2	-S	-C
-1	-C	S
0	S	C
1	C	-S

1. 4 TIME TAKEN.

1. 4 - 1. 8 milliseconds.

1. 5 STORE USED.

74 consecutive locations, and the appropriate B-register.