

nag_sin_integral (s13adc)

1. Purpose

nag_sin_integral (s13adc) returns the value of the sine integral $\text{Si}(x)$.

2. Specification

```
#include <nag.h>
#include <nags.h>
```

```
double nag_sin_integral(double x)
```

3. Description

The function evaluates

$$\text{Si}(x) = \int_0^x \frac{\sin u}{u} du.$$

The approximation is based on several Chebyshev expansions.

4. Parameters

x

Input: the argument x of the function.

5. Error Indications and Warnings

None.

6. Further Comments

6.1. Accuracy

If δ and ϵ are the relative errors in the argument and result, respectively, then in principle $|\epsilon| \simeq |(\delta \sin x)/\text{Si}(x)|$. The equality may hold if δ is greater than the **machine precision** (δ due to data errors etc.), but if δ is simply due to round-off in the machine representation, then since the factor relating δ to ϵ is always less than one, the accuracy will be limited by **machine precision**.

For $|x| \geq x_{\text{hi}}$, where x_{hi} is a machine-dependent value, $\text{Si}(x) = \frac{1}{2}\pi \text{sign } x$ to within **machine precision**.

6.2. References

Abramowitz M and Stegun I A (1968) *Handbook of Mathematical Functions* Dover Publications, New York ch 5.2 p 231.

7. See Also

nag_cos_integral (s13acc)

8. Example

The following program reads values of the argument x from a file, evaluates the function at each value of x and prints the results.

8.1. Program Text

```
/* nag_sin_integral(s13adc) Example Program
 *
 * Copyright 1990 Numerical Algorithms Group.
 *
 * Mark 1, 1990.
 */

#include <nag.h>
#include <stdio.h>
#include <nag_stdlib.h>
#include <nags.h>

main()
{
    double x, y;

    /* Skip heading in data file */
    Vscanf("%*[^\\n]");
    Vprintf("s13adc Example Program Results\\n");
    Vprintf("      x      y\\n");
    while (scanf("%lf", &x) != EOF)
    {
        y = s13adc(x);
        Vprintf("%12.3e%12.3e\\n", x, y);
    }
    exit(EXIT_SUCCESS);
}
```

8.2. Program Data

```
s13adc Example Program Data
      0.0
      0.2
      0.4
      0.6
      0.8
      1.0
```

8.3. Program Results

```
s13adc Example Program Results
      x      y
0.000e+00  0.000e+00
2.000e-01  1.996e-01
4.000e-01  3.965e-01
6.000e-01  5.881e-01
8.000e-01  7.721e-01
1.000e+00  9.461e-01
```
