

# NAG Library Function Document

## nag\_complex (a02bac)

### 1 Purpose

nag\_complex (a02bac) returns a complex number from real and imaginary parts.

### 2 Specification

```
#include <nag.h>
#include <naga02.h>
Complex nag_complex (double x, double y)
```

### 3 Description

None.

### 4 References

None.

### 5 Arguments

- |    |  |              |
|----|--|--------------|
| 1: | <b>x</b> – double                                  | <i>Input</i> |
|    | <i>On entry:</i> real part of complex number.      |              |
| 2: | <b>y</b> – double                                  | <i>Input</i> |
|    | <i>On entry:</i> imaginary part of complex number. |              |

### 6 Error Indicators and Warnings

None.

### 7 Accuracy

Not applicable.

### 8 Parallelism and Performance

nag\_complex (a02bac) is not threaded in any implementation.

### 9 Further Comments

None.

## 10 Example

This example illustrates the calls to all the complex functions in Chapter a02.

### 10.1 Program Text

```

/* nag_complex (a02bac) Example Program.
 *
 * NAGPRODCODE Version.
 *
 * Copyright 2016 Numerical Algorithms Group.
 *
 * Mark 26, 2016.
 */

#include <nag.h>
#include <stdio.h>
#include <nag_stdlib.h>
#include <naga02.h>

int main(void)
{
    Integer exit_status = 0;
    Complex v, w, z;
    double r, theta, x, y;
    Nag_Boolean equal, not_equal;

    printf("nag_complex (a02bac) Example Program Results\n");

    x = 2.0;
    y = -3.0;
    /* nag_complex (a02bac).
     * Complex number from real and imaginary parts
     */
    z = nag_complex(x, y);

    printf("  %21s  %s      %8s = %7.4f, %7.4f\n", "", "", "x, y", x, y);
    printf("  %21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex",
           "z", "(x,y)", z.re, z.im);
    /* nag_complex_real (a02bbc).
     * Real part of a complex number
     */
    printf("  %21s: %s      %8s = %7.4f\n", "nag_complex_real",
           "", "real(z)", nag_complex_real(z));
    /* nag_complex_imag (a02bcc).
     * Imaginary part of a complex number
     */
    printf("  %21s: %s      %8s = %7.4f\n", "nag_complex_imag",
           "", "imag(z)", nag_complex_imag(z));
    /* nag_complex (a02bac), see above. */
    v = nag_complex(3.0, 1.25);
    /* nag_complex (a02bac), see above. */
    w = nag_complex(2.5, -1.75);
    printf("  %21s: %s      %8s = (%7.4f, %7.4f)\n", "nag_complex", "",
           "v", v.re, v.im);
    printf("  %21s: %s      %8s = (%7.4f, %7.4f)\n", "nag_complex", "",
           "w", w.re, w.im);
    /* nag_complex_add (a02cac).
     * Addition of two complex numbers
     */
    z = nag_complex_add(v, w);
    printf("  %21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_add",
           "z", "v+w", z.re, z.im);
    /* nag_complex_subtract (a02cbc).
     * Subtraction of two complex numbers
     */
    z = nag_complex_subtract(v, w);
    printf("  %21s: %s = %8s = (%7.4f, %7.4f)\n",
           "nag_complex_subtract", "z", "v-w", z.re, z.im);
    /* nag_complex_multiply (a02ccc).

```

```

    * Multiplication of two complex numbers
    */
    z = nag_complex_multiply(v, w);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n",
           "nag_complex_multiply", "z", "v*w", z.re, z.im);
/* nag_complex_divide (a02cdc).
    * Quotient of two complex numbers
    */
    z = nag_complex_divide(v, w);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_divide",
           "z", "v/w", z.re, z.im);
/* nag_complex_negate (a02cec).
    * Negation of a complex number
    */
    z = nag_complex_negate(w);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_negate",
           "z", "-w", z.re, z.im);
/* nag_complex_conjg (a02cfc).
    * Conjugate of a complex number
    */
    z = nag_complex_conjg(w);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_conjg",
           "z", "conjg(w)", z.re, z.im);
/* nag_complex_equal (a02cgc).
    * Equality of two complex numbers
    */
    equal = nag_complex_equal(v, w);
    if (equal)
        printf(" %-21s: %s == %s\n", "nag_complex_equal", "v", "w");
    else
        printf(" %-21s: %s != %s\n", "nag_complex_equal", "v", "w");
/* nag_complex_not_equal (a02chc).
    * Inequality of two complex numbers
    */
    not_equal = nag_complex_not_equal(w, z);
    if (not_equal)
        printf(" %-21s: %s != %s\n\n", "nag_complex_not_equal", "w", "z");
    else
        printf(" %-21s: %s == %s\n\n", "nag_complex_not_equal", "w", "z");

/* nag_complex_arg (a02dac).
    * Argument of a complex number
    */
    theta = nag_complex_arg(z);
    printf(" %-21s: %s      %8s = %7.4f\n", "nag_complex_arg", "",
           "arg(z)", theta);
/* nag_complex_abs (a02dbc).
    * Modulus of a complex number
    */
    r = nag_complex_abs(z);
    printf(" %-21s: %s = %8s = %7.4f\n", "nag_complex_abs", "r", "abs(z)", r);
/* nag_complex_sqrt (a02dcc).
    * Square root of a complex number
    */
    v = nag_complex_sqrt(z);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_sqrt",
           "v", "sqrt(z)", v.re, v.im);
/* nag_complex_i_power (a02ddc).
    * Complex number raised to integer power
    */
    v = nag_complex_i_power(z, (Integer) 3);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_i_power",
           "v", "z**3", v.re, v.im);
/* nag_complex_r_power (a02dec).
    * Complex number raised to real power
    */
    v = nag_complex_r_power(z, 2.5);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_r_power",
           "v", "z**2.5", v.re, v.im);
/* nag_complex_c_power (a02dfc).
    * Complex number raised to complex power

```

```

    */
    v = nag_complex_c_power(z, w);
    printf(" %-21s: %s = %8s = (%7.4f,%8.4f)\n", "nag_complex_c_power",
           "v", "z**w", v.re, v.im);
    /* nag_complex_log (a02dgc).
     * Complex logarithm
     */
    v = nag_complex_log(z);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_log",
           "v", "log(z)", v.re, v.im);
    /* nag_complex_exp (a02dhc).
     * Complex exponential
     */
    z = nag_complex_exp(v);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_exp",
           "z", "exp(v)", z.re, z.im);
    /* nag_complex_sin (a02djg).
     * Complex sine
     */
    v = nag_complex_sin(z);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_sin",
           "v", "sin(z)", v.re, v.im);
    /* nag_complex_cos (a02dkc).
     * Complex cosine
     */
    v = nag_complex_cos(z);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_cos",
           "v", "cos(z)", v.re, v.im);
    /* nag_complex_tan (a02dlc).
     * Complex tangent
     */
    v = nag_complex_tan(z);
    printf(" %-21s: %s = %8s = (%7.4f, %7.4f)\n", "nag_complex_tan",
           "v", "tan(z)", v.re, v.im);
    /* nag_complex_divide (a02cdc), see above. */
    v = nag_complex_divide(nag_complex_sin(z), nag_complex_cos(z));
    printf(" %-21s:%13s = (%7.4f, %7.4f)\n", "nag_complex_divide",
           "sin(z)/cos(z)", v.re, v.im);

    return exit_status;
}

```

## 10.2 Program Data

None.

## 10.3 Program Results

nag\_complex (a02bac) Example Program Results

```

                                x, y = 2.0000, -3.0000
nag_complex      : z = (x,y) = ( 2.0000, -3.0000)
nag_complex_real :      real(z) = 2.0000
nag_complex_imag :      imag(z) = -3.0000
nag_complex      :      v = ( 3.0000, 1.2500)
nag_complex      :      w = ( 2.5000, -1.7500)
nag_complex_add  : z = v+w = ( 5.5000, -0.5000)
nag_complex_subtract : z = v-w = ( 0.5000, 3.0000)
nag_complex_multiply : z = v*w = ( 9.6875, -2.1250)
nag_complex_divide : z = v/w = ( 0.5705, 0.8993)
nag_complex_negate : z = -w = (-2.5000, 1.7500)
nag_complex_conjg : z = conjg(w) = ( 2.5000, 1.7500)
nag_complex_equal : v != w
nag_complex_not_equal: w != z

nag_complex_arg  :      arg(z) = 0.6107
nag_complex_abs  : r = abs(z) = 3.0516
nag_complex_sqrt : v = sqrt(z) = ( 1.6661, 0.5252)
nag_complex_i_power : v = z**3 = (-7.3438, 27.4531)
nag_complex_r_power : v = z**2.5 = ( 0.7153, 16.2522)
nag_complex_c_power : v = z**w = (43.1428, -19.5581)

```

```
nag_complex_log      : v = log(z) = ( 1.1157,  0.6107)
nag_complex_exp      : z = exp(v) = ( 2.5000,  1.7500)
nag_complex_sin      : v = sin(z) = ( 1.7740, -2.2355)
nag_complex_cos      : v = cos(z) = (-2.3747, -1.6700)
nag_complex_tan      : v = tan(z) = (-0.0569,  0.9814)
nag_complex_divide   : sin(z)/cos(z) = (-0.0569,  0.9814)
```

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