1 SUMMARY

To **compute the complex value of the real polynomial**

$$P(z) = a_0 + a_1 z + a_2 z^2 + \ldots + a_n z^n$$

for **complex argument** z.

The method is synthetic division by a quadratic factor, see, R. Butler and E. Kerr, 'Introduction to Numerical Methods', Pitman.

$P(z)$ and z must be Fortran `COMPLEX` variables but the calculation is carried out in real arithmetic with accumulation of intermediate results double length.

ATTRIBUTES — Version: 1.0.0. **Types:** `PB02A`; `PB02AD`. **Calls:** `FD05A`. **Language:** `PB02AD` uses `COMPLEX*16` facility. **Original date:** July 1967. **Origin:** M.J.Hopper, Harwell. **Remark:** `PB02A` was formerly called `PB02AS`.

2 HOW TO USE THE PACKAGE

2.1 The argument list and calling sequence

The single precision version

```
COMPLEX PB02A,P,Z
  - -
P=PB02A(A,N,Z)
```

The double precision version

```
COMPLEX*16 PB02AD,P,Z
DOUBLE PRECISION A
  - -
P=PB02AD(A,N,Z)
```

`A` is a `REAL` (`DOUBLE PRECISION` in the D version) array which must be set by the user to contain the coefficients of the polynomial, i.e. set `A(i+1)` = a_i, i=0, 1, 2,..., n.

`N` is an `INTEGER` variable which must be set by the user to n the degree of the polynomial.

`Z` is a `COMPLEX` (`COMPLEX*16` in the D version) variable which must be set by the user to the complex value of the point at which the polynomial is to be evaluated.

`P` is a `COMPLEX` (`COMPLEX*16` in the D version) variable set to the complex value of the polynomial evaluated at z. Note that the subroutine is a Fortran function subroutine and its type and precision must be declared in a Fortran type statement if the full precision is to be obtained.

3 GENERAL INFORMATION

Use of common: None.

Workspace: None.

Other routines called directly: None.

Portability: `PB02AD` uses `COMPLEX*16` facility.

Input/output: None.

4 METHOD

Synthetic division by a quadratic factor is used. Letting $z = x+iy$, $\alpha = -2x$ and $\beta = x^2+y^2$, and then defining r and s by

$$P(z) = (z^2+\alpha z+\beta)Q(z) + rz + s$$

where $Q(z)$ is the quotient polynomial on dividing $P(z)$ by the quadratic factor $z^2+\alpha z+\beta$, then by the remainder theorem, the value at z is $P(z) = rx+s+iry$.

See R. Butler and E. Kerr, 'Introduction to Numerical Methods', Pitman.