1 SUMMARY

Given a polynomial $C(x)=c_0+c_1x+...+c_nx^n$ of degree n **finds** the coefficients a_j j=0, 1,..., k and b_j j=1, 2,..., m of **the Padé approximation**

$$P_{k,m}(x)=\frac{a_0+a_1x+...+a_kx^k}{1+b_1x+...+b_mx^m} \qquad k+m\le n \quad k,m\le 20$$

such that the first $m+n+1$ coefficients of the Taylor series expansion of $P_{k,m}(x)$ are the same as the first $k+m+1$ coefficients of $C(x)$.

The k zeros, the m poles and residues of the approximation are also returned.

ATTRIBUTES — **Version:** 1.0.0. **Types:** `PE06A; PE06AD.` **Calls:** `FD05`, `MA21, PB01, PB02` and `PA17.` **Original date:** January 1964. **Origin:** L.Morgan, Harwell. **Language:** `PE06AD` uses `COMPLEX*16` facility.

2 HOW TO USE THE PACKAGE

2.1 The argument lists

The single precision version

```
CALL PE06A(A,B,C,K,M,N,XZ,YZ,XP,YP,XR,YR,ERROR)
```

The double precision version

```
CALL PE06AD(A,B,C,K,M,N,XZ,YZ,XP,YP,XR,YR,ERROR)
```

`A` is a `REAL` (`DOUBLE PRECISION` in the D version) array of length at least k+1 which will be set by the subroutine to the coefficients of the numerator of $P_{k,m}(x)$, i.e. `A(i+1)` is set to a_i, i=0, 1, 2,..., k.

`B` is a `REAL` (`DOUBLE PRECISION` in the D version) array of length at least m+1 which will be set by the subroutine to the coefficients of the denominator of $P_{k,m}(x)$, i.e. `B(i+1)` is set to b_i, i=0, 1, 2,..., m.

`C` is a `REAL` (`DOUBLE PRECISION` in the D version) array of length at least n+1 which the user must set the coefficients of the polynomial $C(x)$, i.e. `C(i+1)` must be set to c_i, i=0, 1, 2,..., n.

`K` is an `INTEGER` variable which must be set by the user to k the degree of the numerator of $P_{k,m}(x)$. **Restriction:** $0\le k\le 20$.

`M` is an `INTEGER` variable which must be set by the user to m the degree of the denominator of $P_{k,m}(x)$. **Restriction:** $0\le m\le 20$.

`N` is an `INTEGER` variable which must be set by the user to n the degree of the polynomial $C(x)$. **Restriction:** $n\ge k+m$.

`XZ` and `YZ` are `REAL` (`DOUBLE PRECISION` in the D version) arrays of length at least k which are set by the subroutine to the real and imaginary parts of the zeros of $P_{k,m}(x)$, i.e. zeros of the numerator.

`XP` and `YP` are `REAL` (`DOUBLE PRECISION` in the D version) arrays of length at least m which are set by the subroutine to the real and imaginary parts of the poles of $P_{k,m}(x)$, i.e. zeros of the denominator.

`XR` and `YR` are `REAL` (`DOUBLE PRECISION` in the D version) arrays of length at least m which are set by the subroutine to the real and imaginary parts of the residues of $P_{k,m}(x)$ at their respective poles.

`ERROR` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is set by the subroutine to 1.0 if no errors occurred and to –1.0 if $n<k+m$, and in that case no calculation is done.

3 GENERAL INFORMATION

Workspace: None.

Use of common: None.

Other routines called directly: MA21A/AD, PB01AS/AD, PB02AS/AD and PA17.

Portability: PE06AD uses COMPLEX*16 facility.

Input/output: None.

Restrictions: $k \leq 20$, $m \leq 20$, $n \geq k+m$. Note that the restrictions on k and m can be relaxed by recompiling with larger dimensioned private arrays AMAT and VEC.