PD03

PACKAGE SPECIFICATION HSL ARCHIVE

1 SUMMARY

Given a polynomial in x, i.e.

$$P(x) = a_0 + a_1 x + ... + a_n x^n \qquad n \le 50$$

calculates the **coefficients** b_j, j=0, 1,..., n of the **polynomial under a change of variable** z=ux+v, i.e. such that

$$a_0 + a_1 x + ... + a_n x^n \equiv b_0 + b_1 (ux+v) + ... + b_n (ux+v)^n$$

ATTRIBUTES — Version: 1.0.0. **Types:** `PD03A; PD03AD.` **Calls:** `PB01.` **Original date:** June 1966. **Origin:** A.R.Curtis, Harwell.

2 HOW TO USE THE PACKAGE

2.1 The argument list

The single precision version

```
CALL PD03A(A,B,U,V,N)
```

The double precision version

```
CALL PD03AD(A,B,U,V,N)
```

`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 $P(x)$, i.e. set `A(i+1)` = a_i, i=0, 1, 2,..., n. This argument is not altered.

`B` is a `REAL` (`DOUBLE PRECISION` in the D version) array of length at least n+1 in which the routine returns the coefficients of the calculated polynomial, i.e. it sets `B(i+1)` = b_i, i=0, 1, 2,..., n.

`U` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which must be set by the user to the value of u in the change of variable z=ux+v. This argument is not altered.

`V` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which must be set by the user to the value of v in the change of variable z=ux+v. This argument is not altered.

`N` is an `INTEGER` variable which must be set by the user to n the degree of the polynomial. This argument is not altered. **Restriction:** $n \le 50$.

3 GENERAL INFORMATION

Workspace: None.

Use of common: None.

Other routines called directly: `PB01A/AD`.

Input/output: None.

Restrictions: $n \le 50$. This restriction can be relaxed by recompiling with a larger dimensioned internal work array.

4 METHOD

If $v = 0$, the coefficients are merely multiplied by the appropriate powers of u^{-1}. Otherwise the coefficients of the successive derivative polynomials

$$p^{(k)}(x) = \frac{1}{k!}\frac{d^k}{dx^k}p(x) \qquad k=0,\ 1,\ 2,...,\ n$$

are built up in a private array called `C` and for each k, `PB01A/AD` is used to evaluate

$$b_k = u^{-1} p^{(k)}\left(\frac{-v}{u}\right).$$