## 1 SUMMARY

To calculate the **cartesian co-ordinates** $x$, $y$, $z$ of a point given in **spherical co-ordinates** $r$, $\theta$, $\phi$ or vice versa. The transformations are: option (1)

$$x = r\sin\theta\cos\phi, \quad y = r\sin\theta\sin\phi, \quad z = r\cos\theta.$$

and option (2)

$$r = \sqrt{x^2+y^2+z^2}, \quad \theta = \arctan\left(\frac{\sqrt{x^2+y^2}}{z}\right), \quad \phi = \arctan\left(\frac{y}{x}\right).$$

**ATTRIBUTES — Version:** 1.0.0. **Types:** `GA01A`; `GA01AD`. **Original date:** April 1964. **Origin:** A.Hearn, Harwell.

## 2 HOW TO USE THE PACKAGE

### 2.1 The argument lists

*The single precision version*

```
CALL GA01A(R,THETA,PHI,X,Y,Z,N)
```

*The double precision version*

```
CALL GA01AD(R,THETA,PHI,X,Y,Z,N)
```

`R` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is used to hold the value of the $r$ component of the spherical co-ordinates. If the polar to cartesian transformation has been chosen (`N=1`) it must be set by the user, otherwise (for `N=2`) it is set by the subroutine.

`THETA` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is used to hold the value of the $\theta$ component of the spherical co-ordinates. If `N=1` it must be set by the user, otherwise if `N=2` it is set by the subroutine. **Restriction:** $0 \leq \theta \leq \pi$.

`PHI` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is used to hold the value of the $\phi$ component of the spherical co-ordinates. If `N=1` it must be set by the user, otherwise if `N=2` it is set by the subroutine. **Restriction:** $0 \leq \phi \leq 2\pi$.

`X` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is used to hold the value of the $x$ component of the cartesian co-ordinates. If the cartesian to polar transformation has been chosen (`N=2`) it must be set by the user, otherwise (for `N=1`) it is set by the subroutine.

`Y` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is used to hold the value of the $y$ component of the cartesian co-ordinates. If `N=2` it must be set by the user, otherwise if `N=1` it is set by the subroutine.

`Z` is a `REAL` (`DOUBLE PRECISION` in the D version) variable which is used to hold the value of the $z$ component of the cartesian co-ordinates. If `N=2` it must be set by the user, otherwise if `N=1` it is set by the subroutine.

`N` is an `INTEGER` variable which must be set by the user to either one or two. Set `N` to

1 for the transformation from polar to Cartesian.

2 for the transformation from Cartesian to polar.

Note: if $x = y = 0$ in the transformation of Cartesian to polar $\phi$ is set to its previous value or to zero if no previous value has been computed.

## 3 GENERAL INFORMATION

**Use of common:** None.

**Workspace:** None.

**Other routines called directly:** None.

**Input/output:** None.

**Restrictions:** $0 \leq \theta \leq \pi$, $0 \leq \phi \leq 2\pi$.