

## Annex B. Analytical Descriptors of Particle Shape

Table B.1 presents analytical descriptors such as surface description in Cartesian coordinates  $S(x, y, z)$ , in spherical coordinates  $S_R(\varphi, \theta)$ , volume  $V$  and surface area  $S$ .

**Table B.1.** Summary of analytical descriptors of particles shapes

<b>Sphere</b>		
$S(x, y, z)$	$x^2 + y^2 + z^2 - a$	(S1)
$S_R(\varphi, \theta)$	$a$	(S2)
$V$	$\frac{4}{3}\pi a^3$	(S3)
$S$	$4\pi a^2$	(S4)
<b>Ellipsoid</b>		
$S(x, y, z)$	$\frac{x^2+y^2}{a^2} + \frac{z^2}{c^2} - 1$	(E1)
$S_R(\varphi, \theta)$	$a^2 c (a^2 c^2 \sin^2 \theta + a^4 \cos^2 \theta)^{-\frac{1}{2}}$	(E2)
$V$	$\frac{4}{3}\pi a^2 c$	(E3)
$S$	$A_{ell} = 4\pi \left( \frac{(aa)^p + (ac)^p + (ca)^p}{3} \right)^{1/p}, p = \frac{8}{5} \approx 1.6$	(E4)
<b>Cylinder</b>		
$S(x, y, z)$	$\begin{cases} x^2 + y^2, \text{ for } -c < z < c \\ z \pm c. \end{cases}$	(C1)
$S_R(\varphi, \theta)$	$\begin{cases} c/\cos \theta, \text{ for } 0 \leq \theta \leq \theta_{ed} \\ a/\sin \theta, \text{ for } \theta_{ed} \leq \theta \leq \pi/2 \end{cases}$	(C2)
$V$	$\pi a^2 c$	(C3)
$S$	$2\pi a(a + c)$	(C4)
<b>Parallelepiped</b>		
$S(x, y, z)$	$\begin{cases} x \pm a, \text{ for } -a \leq y \leq a, -c \leq z \leq c \\ y \pm a, \text{ for } -a \leq x \leq a, -c \leq z \leq c \\ z \pm c, \text{ for } -a \leq x \leq a, -a \leq y \leq a \end{cases}$	(P1)
$S_R(\varphi, \theta)$	$\begin{cases} c/\cos \theta, \text{ for } \varphi \leq \frac{\pi}{4}, 0 \leq \theta \leq \tan^{-1}(a/c \cos \varphi) \\ a/\sin \theta \cos \varphi, \text{ for } \varphi \leq \frac{\pi}{4}, \tan^{-1}(a/c \cos \varphi) \leq \theta \leq \frac{\pi}{2} \\ c/\cos \theta, \text{ for } \varphi > \frac{\pi}{4}, 0 \leq \theta \leq \tan^{-1}(a/c \sin \varphi) \\ a/\sin \theta \sin \varphi, \text{ for } \varphi > \frac{\pi}{4}, \tan^{-1}(a/c \sin \varphi) \leq \theta \leq \frac{\pi}{2} \end{cases}$	(P2)
$V$	$a^2 c$	(P3)
$S$	$4ac + 2a^2$	(P4)