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

Sphere		
$S(x,y,z)$	$x^2+y^2+z^2-a$	(S1)
$S_R(\varphi,\theta)$	a	(S2)
V	$\frac{4}{3}\pi a^3$	(S3)
S	$4\pi a^2$	(S4)
Ellipsoid		
$S(x,y,z)$	$\frac{x^2+y^2}{a^2}+\frac{z^2}{c^2}-1$	(E1)
$S_R(\varphi,\theta)$	$a^2c\left(a^2c^2\sin^2\theta+a^4\cos^2\theta\right)^{-\frac{1}{2}}$	(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)
Cylinder		
$S(x,y,z)$	$\begin{cases} x^2+y^2, \text{for} -c<z<c \\ z\pm c. \end{cases}$	(C1)
$S_R(\varphi,\theta)$	$\begin{cases} c/\cos\theta, \text{for} 0\le\theta\le\theta_{ed} \\ a/\sin\theta, \text{for}\theta_{ed}\le\theta\le\pi/2 \end{cases}$	(C2)
V	$\pi a^2 c$	(C3)
S	$2\pi a(a+c)$	(C4)
Parallelepiped		
$S(x,y,z)$	$\begin{cases} x\pm a, \text{for} -a\le y\le a, -c\le z\le c \\ y\pm a, \text{for} -a\le x\le a, -c\le z\le c \\ z\pm c, \text{for} -a\le x\le a, -a\le y\le a \end{cases}$	(P1)
$S_R(\varphi,\theta)$	$\begin{cases} c/\cos\theta, for\varphi\le\frac{\pi}{4}, 0\le\theta\le\tan^{-1}(a/c\cos\varphi) \\ a/\sin\theta\cos\varphi, for\varphi\le\frac{\pi}{4}, \tan^{-1}(a/c\cos\varphi)\le\theta\le\frac{\pi}{2} \\ c/\cos\theta, for\varphi>\frac{\pi}{4}, 0\le\theta\le\tan^{-1}(a/c\sin\varphi) \\ a/\sin\theta\sin\varphi, for\varphi\,\frac{\pi}{4}, \tan^{-1}(a/c\sin\varphi)\le\theta\le\frac{\pi}{2} \end{cases}$	(P2)
V	a^2c	(P3)
S	$4ac+2a^2$	(P4)