Geocentric to Geodetic Transformation (Vincenty 1980)

$$b = a(1 - f) \tag{1}$$

$$P^2 = X^2 + Y^2, \qquad r^2 = P^2 + Z^2 \qquad (2)\ \&\ (3)$$

$$h' = r - a + \frac{(a - b)Z^2}{r^2} \tag{4}$$

$$a' = a + h', \qquad b' = b + h' \qquad (5)\ \&\ (6)$$

$$\tan \phi' = \left(\frac{a'}{b'}\right)^2 \left(\frac{Z}{P}\right) \left[1 + \frac{1}{4} \frac{e^4 h' a\,(Z^2 - P^2)}{a'^{\,4}}\right] \tag{7}$$

$$\cos^2 \phi' = \frac{1}{1 + \tan^2 \phi'}, \qquad \sin \phi' = \cos \phi' \tan \phi' \qquad (8)\ \&\ (9)$$

$$T = \frac{(P - h' \cos \phi')^2}{a^2}, \qquad U = \frac{(Z - h' \sin \phi')^2}{b^2} \qquad (10)\ \&\ (11)$$

$$h = h' + \frac{1}{2}\left[\frac{T + U - 1}{\frac{T}{a} + \frac{U}{b}}\right] \tag{12}$$

$$\phi = \tan^{-1}\left[\left(\frac{a}{b}\right)^2 \frac{(Z - e^2 h \sin \phi')}{P}\right] \tag{13}$$

$$\lambda = \tan^{-1}\left(\frac{Y}{X}\right) \tag{14}$$

Another method would be to iterate for an "exact" solution as described by Leick (1990) using equations 6.31 to 6.36.

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