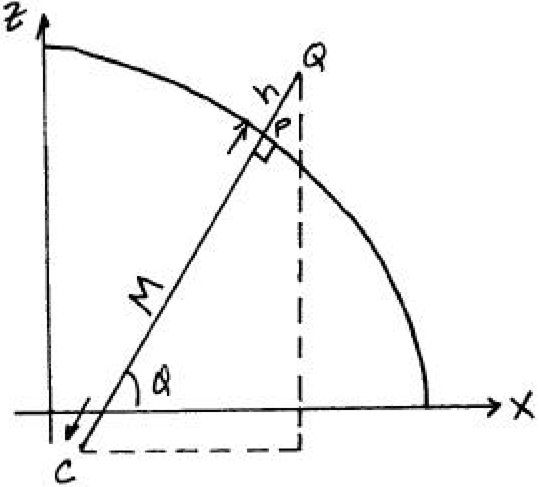
- SOLUTION BY BOWRING
  - MERIDIONAL ELLIPSE
  - Q LOCATED AT SOME ELEVATION ABOVE P ON THE ELLIPSOID
  - C - CENTER OF CURVATURE OF MERIDIAN ELLIPSE @ P
  - DISTANCE CP = MERIDIAN RADIUS OF CURVATURE, M



· X-COORDINATE of C

$$X_c = X_P - M\cos\varphi$$

· if, from geometry of meridional ellipse, $X = \frac{a\cos\varphi}{[1-e^2\sin^2\varphi]^{1/2}}$

& $M = \frac{a(1-e^2)}{[1-e^2\sin^2\varphi]^{3/2}}$, then

$$X_c = \frac{a e^2 \cos^3\varphi}{[1-e^2\sin^2\varphi]^{3/2}}$$

· if $\cos\beta = \frac{\cos\varphi}{[1-e^2\sin^2\varphi]^{3/2}}$ where β = reduced latitude

$$X_c = a e^2 \cos^3\beta$$

· similarly, the Z-coordinate of C is found to be

$$Z_c = -e'^2 b \sin^3\beta$$

· from the figure

$$\tan\varphi = \frac{Z_Q - Z_c}{X_Q - X_c}$$

$$= \frac{Z_Q + e'^2 b \sin^3\beta}{X_Q - a e^2 \cos^3\beta}$$

· IN TERMS OF X, Y, Z COORDINATES

$$\tan \varphi = \frac{Z + e'^2 b \sin^3 \beta}{\sqrt{X^2+Y^2} - a e^2 \cos^3 \beta}$$

· THIS IS BASIC EQUATION TO ITERATE. INITIAL APPROXIMATE VALUE OF β FOUND FROM

$$\tan \beta_0 = \frac{a}{b} \frac{Z}{(X^2+Y^2)^{1/2}}$$

· ANY UPDATED VALUE OF β COMPUTED FROM

$$\tan \beta = (1-f) \tan \varphi$$

· HEIGHT CAN BE DETERMINED FROM FORMULAS FOR h GIVEN PREVIOUSLY

$$h = \frac{\sqrt{X^2+Y^2}}{\cos \varphi} - N \quad ; \quad h = \frac{Z}{\sin \varphi} - N + e^2 N$$