1:   **Algorithm SEIF_measurement_update($\bar{\xi}_t, \bar{\Omega}_t, \mu_t, z_t, c_t$):**

2:   $Q_t = \begin{pmatrix} \sigma_r & 0 & 0 \\ 0 & \sigma_\phi & 0 \\ 0 & 0 & \sigma_s \end{pmatrix}$

3:   *for all observed features $z_t^i = (r_t^i \ \phi_t^i \ s_t^i)^T$ do*

4:       $j = c_t^i$

5:       *if landmark j never seen before*

6:       $\begin{pmatrix} \mu_{j,x} \\ \mu_{j,y} \\ \mu_{j,s} \end{pmatrix} = \begin{pmatrix} \mu_{t,x} \\ \mu_{t,y} \\ s_t^i \end{pmatrix} + r_t^i \begin{pmatrix} \cos(\phi_t^i + \mu_{t,\theta}) \\ \sin(\phi_t^i + \mu_{t,\theta}) \\ 0 \end{pmatrix}$

7:       *endif*

8:       $\delta = \begin{pmatrix} \delta_x \\ \delta_y \end{pmatrix} = \begin{pmatrix} \mu_{j,x} - \mu_{t,x} \\ \mu_{j,y} - \mu_{t,y} \end{pmatrix}$

9:       $q = \delta^T \delta$

10:      $\hat{z}_t^i = \begin{pmatrix} \sqrt{q} \\ \text{atan2}(\delta_y, \delta_x) - \mu_{t,\theta} \\ \mu_{j,s} \end{pmatrix}$

11:      $H_t^i = \frac{1}{q} \begin{pmatrix} \sqrt{q}\delta_x & -\sqrt{q}\delta_y & 0 & 0\cdots0 & -\sqrt{q}\delta_x & \sqrt{q}\delta_y & 0 & 0\cdots0 \\ \delta_y & \delta_x & -1 & 0\cdots0 & -\delta_y & -\delta_x & 0 & 0\cdots0 \\ 0 & 0 & 0 & \underbrace{0\cdots0}_{3j-3} & 0 & 0 & 1 & \underbrace{0\cdots0}_{3j} \end{pmatrix}$

12:   *endfor*

13:   $\xi_t = \bar{\xi}_t + \sum_i H_t^{iT} \, Q_t^{-1} \, [z_t^i - \hat{z}_t^i \boxed{+} H_t^i \, \mu_t]$

14:   $\Omega_t = \bar{\Omega}_t + \sum_i H_t^{iT} \, Q_t^{-1} \, H_t^i$

15:   *return ξ_t, Ω_t*

Table 12.3   The measurement update step in SEIFs.