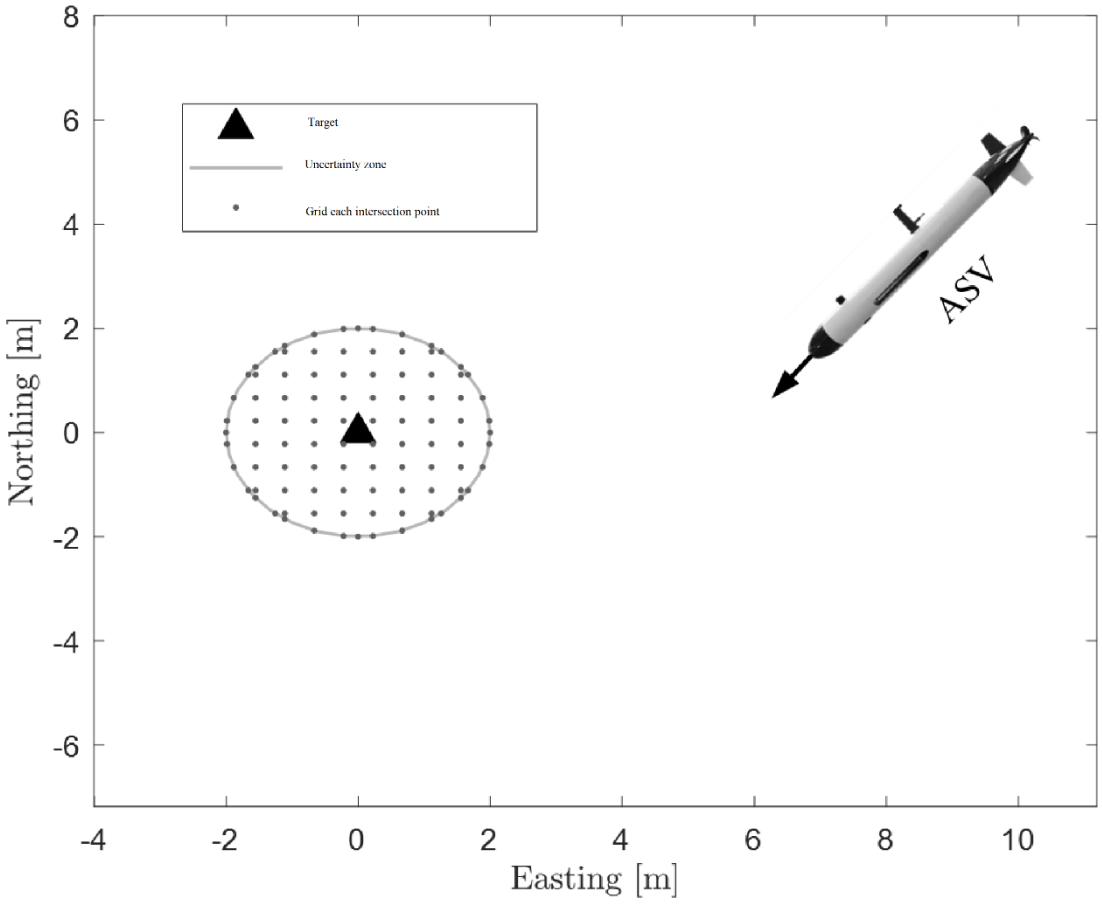

Target
Uncertainty zone
Grid each intersection point
ASV
Northing [m]
Easting [m]
8
6
4
2
0
-2
-4
-6
-4
-2
0
2
4
6
8
10

FIG. 3

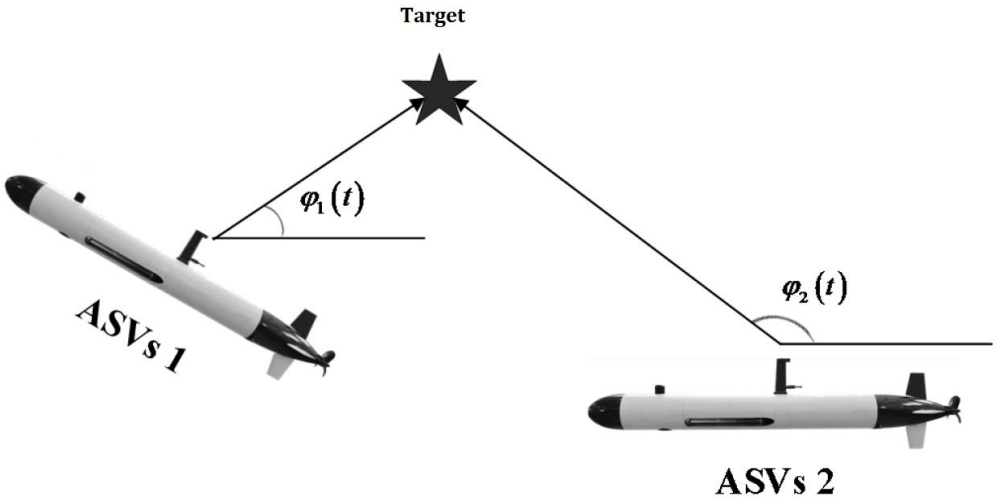

Target
$\varphi_1(t)$
$\varphi_2(t)$
ASVs 1
ASVs 2

FIG. 4

Optimal path for target localization of 1 ASVs:

1. Initialization: $v(0)$, A_1^0, $\phi_1(0)$, $r_1(0)$, Intersection points in the grid k
2. For t=1:M do
3. $(I_\eta)^t \leftarrow (20)$
4. $\theta \leftarrow \min(\theta^t)$
5. $r_1^*(t) \leftarrow (15)$
6. $\phi_1(t) \leftarrow \phi_1(t-1) + r_1^*(t)$
7. if $r_1^*(t)=0$ do
8. $A_1^t \leftarrow A_1^{t-1} + v(t)(g(\phi_1(t)) - (g(\phi_1(t-1))$
9. else
10. $A_1^t \leftarrow A_1^{t-1} + \frac{v(t)}{r_1^*(t)}(O(\phi_1(t-1)) - O(\phi_1(t))$
11. end if
12. End for

FIG. 5

Positioning algorithm:

1. Initialization: $y_{prev}=0$, $thre = 1e-7$, $iter = 1$, Total number of iterations I.
2. Calculate the corresponding RSS ranging value received
3. Reshape equations into generalized trust region subproblems
4. While iter < I,do
5. Calculate the multiplier λ for each iteration according to the following formula

$$\left(\frac{\wp^T\omega^T\kappa-\lambda f}{\wp^T\omega\wp+\lambda D}\right)^T D\left(\frac{\wp^T\omega^T\kappa-\lambda f}{\wp^T\omega\wp+\lambda D}\right)+2f^T\left(\frac{\wp^T\omega^T\kappa-\lambda f}{\wp^T\omega\wp+\lambda D}\right)=0$$

6. Calculate the optimal value for each iteration: $\lambda^{iter*}=\max\left[-\frac{diag(\wp^T\omega\wp)}{diag(D)},\lambda\right]$
7. Calculate the optimal y for each iteration according to the following formula:

$$y^{iter}=\frac{\wp^T\omega^T\kappa-\lambda^{iter*}f}{\wp^T\omega\wp+\lambda^{iter*}D}$$

8. If $\|y^{iter}-y_{prev}\|/\|y^{iter}\|<thre$
9. $stop$
10. end if
11. $y_{prev}=y^{iter}$
12. End while

FIG. 7

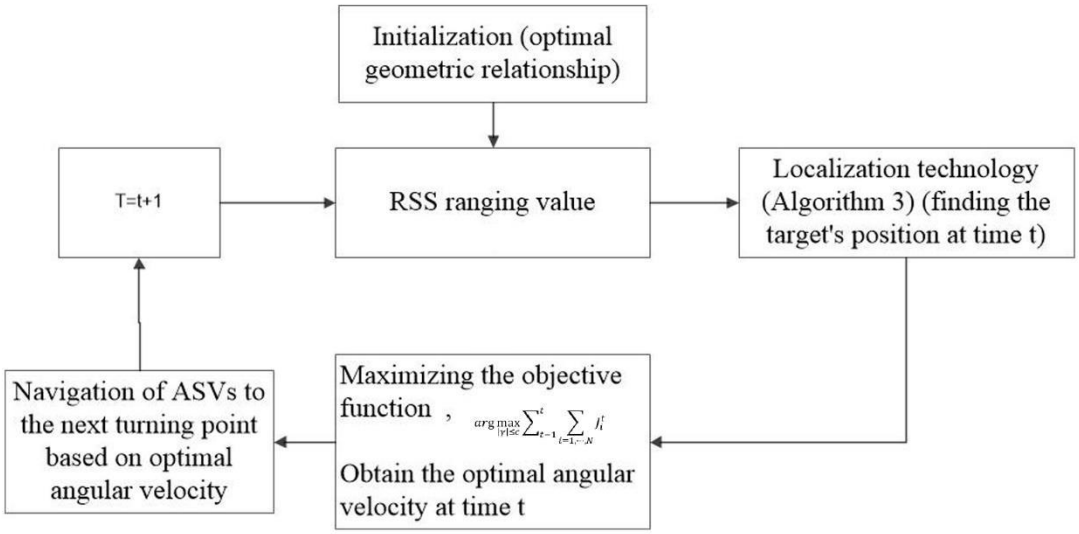


FIG. 8