K=3. If the number of neighboring sensors is larger than K that should be kept, $F_{\text{degree}}$ does not take place, and sensors become distant from each other due to $F_{\text{cover}}$. The sensors become more distant gradually to maximize coverage, and if the number of neighboring sensors is equal to a given degree K, $F_{\text{degree}}$ takes place. As a result, a sensor draws its neighboring sensors to keep the number of neighboring sensors at the given degree K. $F_{\text{degree}}(i, j)$ means the force that the sensor $S_i$ takes from its neighboring sensor $S_j$ during the unit time, which can be expressed in equation 2.

$$F_{\text{degree}}(i, j) = \begin{cases} \frac{(-C_{\text{degree}} \cdot x_i - x_j)}{d_{ij}} & \text{if count of neighbor sensor} = k \\ 0 & \text{otherwise} \end{cases} \quad (\text{Eq. 2})$$

In equation 2, $R_c$ means communication distance while $C_{\text{degree}}$ is the constant that means force of field. Mobile sensors in MSNS are required to maximize coverage, maintain the given connectivity and avoid obstacles. To this effect, this paper defines $F_{\text{obstacle}}$.

![Figure 2. Location of Obstacle with Supersonic Waves](image)

It is assumed that mobile sensors are equipped with 16 supersonic wave sensors (sender = 8, receiver = 8) in order to obtain $F_{\text{obstacle}}$. Figure 2 shows that supersonic wave sensors locate obstacles. It is assumed that if supersonic wave distance ($R_w$) is determined and a sensor detects obstacle within the distance of $R_w$, the sensor with sensing range of $R_w$ is located in the point that is two times of the distance between the obstacle and the sensor. $F_{\text{obstacle}}$ is calculated in the same way as $F_{\text{cover}}$ in order to maximize the range of $R_w$. $F_{\text{obstacle}}(i, k)$ takes place between the sensor node $S_i$ and the obstacle $o_k$ during the unit time, which can be expressed in equation 3.

$$F_{\text{obstacle}}(i, j) = \frac{-C_{\text{obstacle}} \cdot \Delta x_j}{\Delta x_k} \quad (\text{Eq. 3})$$