Combat potential refers to the combat effectiveness of a fighter (or other combatant, such as a ship).

This paper combines two algorithms, the "Artificial Fish Swarm Algorithm," which is good at global searching but bad at local searching, and "Harmony Search," which finds great solutions but is strongly dependent on starting conditions (and thus performs better at local than global search) to create an algorithm that performs well at every level.

This problem is formulated as minimizing the total lethality of an opposing force of fighters. No fighter can target more than one target, and all targets must be targeted by one fighter.

This paper uses multiple artificial fish swarms to hunt down local optimum, and a genetic algorithm to generate better and better fish swarms. If a local optimum is found, the fish "jump" away randomly, to avoid falling into a trap.

Once the standard error of the fish is small enough (they are tightly clustered in the search space) or the number of generations has gone on long enough (they are likely close to optimal solution), the algorithm switches to a harmony search.

```
┌──────────────────┐
│    Improved      │
│  artificial fish │◄──────────────────────────┐
│ swarm algorithm  │                           │
└──────────────────┘                           │
         │                                      │
         ▼                                      │
        No                                      │
    ◇ se < se_def ? ◇──────────────┐           │
         │                          │           │
        Yes                         ▼           │
         │                         No           │
         │              ◇ gen < gen_switch ? ◇──┘
         │                          │
         │                         Yes
         ▼                          │
┌──────────────────┐               │
│    Improved      │◄──────────────┘
│  harmony search  │
└──────────────────┘
         │
         ▼
┌──────────────────┐
│      Switch      │
└──────────────────┘
```

Improved artificial fish swarm algorithm

$se < se_{def}$? — No / Yes

$gen < gen_{switch}$? — No / Yes

Improved harmony search

Switch

Harmony memory initialization
(the previous artificial fish swarm)

Rand < HMCR?
Yes   No

Selecting harmony from
harmony memory

Rand < PAR?
No
Yes

Pitch
adjustment

New harmony
improvisation

Fitness valuable
calculation

The new fitness value better
than the worst one?

Yes

Updating harmony
memory

Meeting
termination
criterion?
No

Yes

Input best
solution

Artificial fish swarm
initialization

Subpopulation 1   · · ·   Subpopulation n

Swarm
behaviour

Follow
behaviour

gen$'$ > n
No
Yes

Leap
behaviour

$\frac{Y_c}{n_f} < \delta \cdot Y_i$
No
Yes

$\frac{Y_m}{n_f} < \delta \cdot Y_i$
No
Yes

Prey
behaviour

Prey
behaviour

Selection for best artificial
fish in subpopulation 1

· · ·

Selection for best artificial
fish in subpopulation n

Obtaining the global
best artificial fish

Satisfying switch
condition?
No

Yes