1. **Initialize Parameters for HBA and GA**: Define parameters for HBA (population size n, iterations etc).

Define parameters for GA (population size n, generations, crossover probability mutation probability etc.)

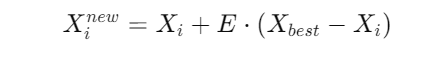
2. Generate initial population *X for* HBA.

3. Compute the fitness *f(Xi)* for each individual *Xi*

*4.* Iterate through HBA Generations:

For *iter=*1 to *max\_iter*

*5.* Update positions using the exploration equation.



exploitation equation



where *E and F are* exploration and exploitation factor respectively

6. Implementing Genetic Algorithm

* **Selection:** Select parents from the current population based on fitness.
* **Crossover:** Perform crossover with probability *pc.*



* **Mutation:** Perform mutation with probability *pm*.



* **Evaluate Fitness:** Compute fitness for offspring.
* **Update Population:** Replace the old population with the new population (offspring).

7. Compute fitness *f(Xi)* for the updated population.

8. Return the best solution found *Xbest*  and its fitness *f(Xbest)*

Reference:

<https://mealpy.readthedocs.io/en/latest/pages/models/mealpy.evolutionary_based.html> #module-mealpy.evolutionary\_based.GA

<https://mealpy.readthedocs.io/en/latest/pages/models/mealpy.swarm_based.html#module-mealpy.swarm_based.HBA>