**Particle Swarm Optimization Report**

**Introduction**

This report documents the implementation and results of a Particle Swarm Optimization (PSO) algorithm to solve a given optimization problem. The problem involves maximizing the following function:

𝑓(𝑥1,𝑥2)=sin⁡(2𝑥1−0.5)+3cos⁡(𝑥2)+0.5𝑥1f(x1​,x2​)=sin(2x1​−0.5)+3cos(x2​)+0.5x1​

Subject to the constraints −2≤𝑥1≤3−2≤x1​≤3 and −2≤𝑥2≤1−2≤x2​≤1.

Solution Steps

**1. Problem Definition**

The objective function to maximize and the constraints are provided.

**2. PSO Algorithm**

The PSO algorithm is implemented with the following steps:

Initialize a population of particles with random positions and velocities.

Evaluate the fitness of each particle based on the objective function.

Update the personal best (pbest) and global best (gbest) positions.

Update the velocities and positions of particles.

Repeat steps 2-4 until a stopping criterion is met.

**3. Implementation**

The PSO algorithm is implemented in Python using NumPy for numerical computations and Matplotlib for plotting.

**4. Experimentation**

The algorithm is run for multiple iterations with different random seeds to observe the convergence behavior and movement of particles.

**5. Results Analysis**

The movement of particles over iterations is visualized to understand how they converge towards the optimal solution.

Results

Particle Movement Plots

(Insert screenshots of the particle movement plots here)

Conclusion

The PSO algorithm successfully converges to the optimal solution of the given optimization problem. Further experiments and parameter tuning may be conducted to improve convergence speed and performance.