**Experiments Results**

**For Particle Swarm Optimization**

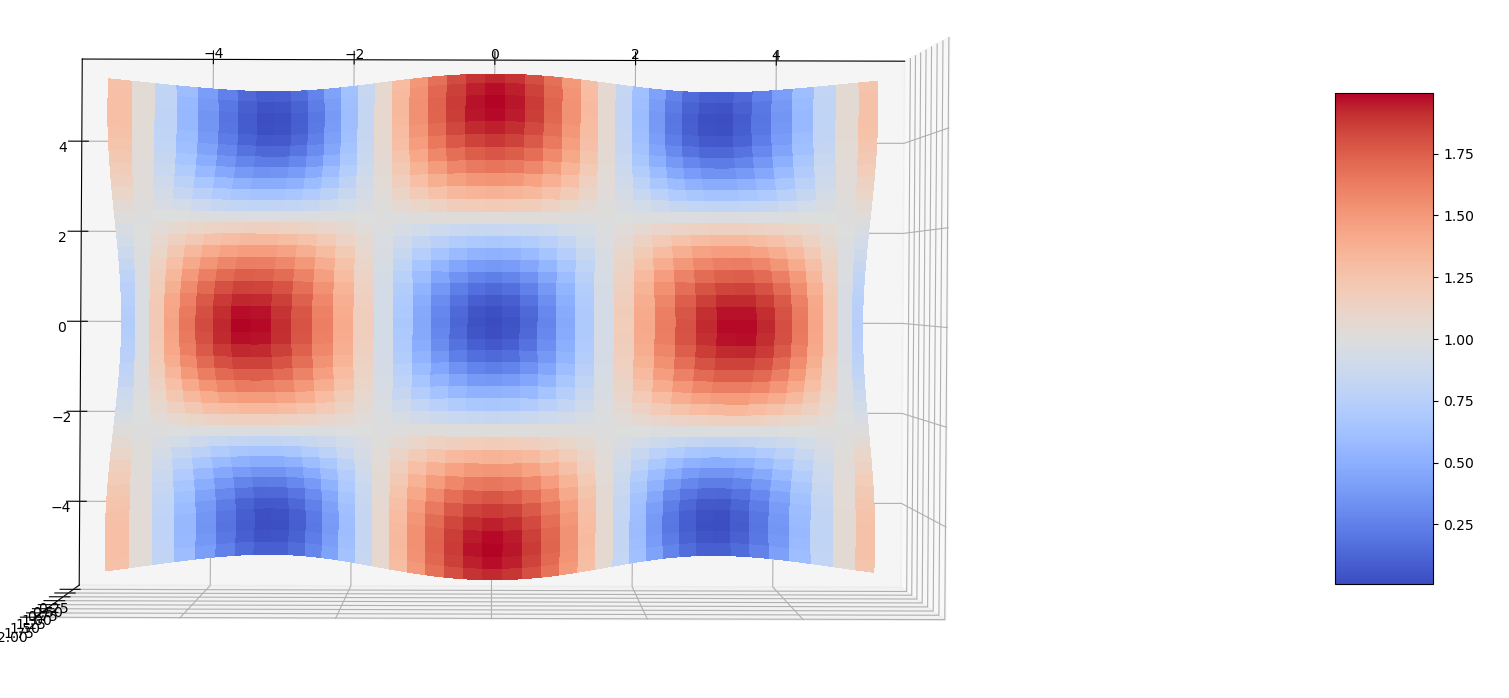
Function: **Spherical, f(0, 0) = 0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PSO Variant | Topology | Param Pair | Point of optimum | Value |
| Vanilla | Star | 1, 0.5 | ['0.0018438415', '-0.0075885779'] | 0.0000609863 |
| Vanilla | Star | 0.5, 1 | ['-0.0035508545', '0.0034669475'] | 0.0000246283 |
| Vanilla | Star | 2.05, 2.05 | ['-0.0103039090', '-0.0116961969'] | 0.0002429716 |
| Vanilla | Ring | 1, 0.5 | ['2.7649674467', '-2.6356318616'] | 0.0000627415 |
| Vanilla | Ring | 0.5, 1 | ['-5.0966001580', '-3.3075659744'] | 0.0006082512 |
| Vanilla | Ring | 2.05, 2.05 | ['-0.0188941993', '0.0073986964'] | 0.0000547669 |
| Vanilla | Four N | 1, 0.5 | ['-0.0220193050', '-0.0079308969'] | 0.0000014341 |
| Vanilla | Four N | 0.5, 1 | ['-0.8127763839', '0.0028278338'] | 0.0000055765 |
| Vanilla | Four N | 2.05, 2.05 | ['-0.0014415588', '-0.0020520563'] | 0.0000003321 |
| Inertia Weight | Star | 1, 0.5 | ['0.0000000000', '-0.0000000000'] | 0.0000000000 |
| Inertia Weight | Star | 0.5, 1 | ['-0.0000000000', '-0.0000000000'] | 0.0000000000 |
| Inertia Weight | Star | 2.05, 2.05 | ['-0.0000000000', '-0.0000000000'] | 0.0000000000 |
| Inertia Weight | Ring | 1, 0.5 | ['-0.0000000000', '0.0000000000'] | 0.0000000000 |
| Inertia Weight | Ring | 0.5, 1 | ['-0.0000000000', '0.0000000000'] | 0.0000000000 |
| Inertia Weight | Ring | 2.05, 2.05 | ['-0.0000000000', '-0.0000000001'] | 0.0000000000 |
| Inertia Weight | Four N | 1, 0.5 | ['0.0000457415', '0.0035249347'] | 0.0000124273 |
| Inertia Weight | Four N | 0.5, 1 | ['-0.0155172385', '0.0401915215'] | 0.0018561431 |
| Inertia Weight | Four N | 2.05, 2.05 | ['-0.0019287333', '-0.0000013100'] | 0.0000037200 |
| Constriction Factor | Star | 1, 0.5 | ['-0.0000000000', '-0.0000000000'] | 0.0000000000 |
| Constriction Factor | Star | 0.5, 1 | ['-0.0000000000', '0.0000000000'] | 0.0000000000 |
| Constriction Factor | Star | 2.05, 2.05 | ['0.0000000000', '0.0000000000'] | 0.0000000000 |
| Constriction Factor | Ring | 1, 0.5 | ['-0.0000000000', '0.0000000000'] | 0.0000000000 |
| Constriction Factor | Ring | 0.5, 1 | ['0.0000000000', '-0.0000000000'] | 0.0000000000 |
| Constriction Factor | Ring | 2.05, 2.05 | ['0.0000000000', '-0.0000000000'] | 0.0000000000 |
| Constriction Factor | Four N | 1, 0.5 | ['0.0006647017', '-0.0059813473'] | 0.0000362183 |
| Constriction Factor | Four N | 0.5, 1 | ['-0.0611105886', '0.1079911615'] | 0.0153965950 |
| Constriction Factor | Four N | 2.05, 2.05 | ['0.0010215005', '0.0000000003'] | 0.0000010435 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PSO Variant | Topology | Param Pair | Point of optimum | Value |
| Vanilla | Star | 1, 0.5 | ['0.0027356533', '-0.0049833220'] | 0.0064110592 |
| Vanilla | Star | 0.5, 1 | ['0.0032951942', '-0.0113594537'] | 0.0277432714 |
| Vanilla | Star | 2.05, 2.05 | ['0.0063329089', '-0.0013811960'] | 0.0083340867 |
| Vanilla | Ring | 1, 0.5 | ['-1.2441172320', '1.2343064888'] | 0.0012202069 |
| Vanilla | Ring | 0.5, 1 | ['4.9932959199', '-0.9161213742'] | 0.0120227719 |
| Vanilla | Ring | 2.05, 2.05 | ['3.4614176497', '-3.6029262706'] | 0.0032332575 |
| Vanilla | Four N | 1, 0.5 | ['-2.2418534068', '0.0100741121'] | 0.0184761354 |
| Vanilla | Four N | 0.5, 1 | ['-0.0004724137', '0.7932623615'] | 0.0008093669 |
| Vanilla | Four N | 2.05, 2.05 | ['-2.9255228036', '2.7794410356'] | 0.0218384840 |
| Inertia Weight | Star | 1, 0.5 | ['0.0000000002', '-0.0000000014'] | 0.0000000000 |
| Inertia Weight | Star | 0.5, 1 | ['0.0000000013', '0.0000000007'] | 0.0000000000 |
| Inertia Weight | Star | 2.05, 2.05 | ['-0.0000000016', '0.0000000014'] | 0.0000000000 |
| Inertia Weight | Ring | 1, 0.5 | ['-0.0000000011', '0.0000000016'] | 0.0000000000 |
| Inertia Weight | Ring | 0.5, 1 | ['-0.0000000045', '0.0000000005'] | 0.0000000000 |
| Inertia Weight | Ring | 2.05, 2.05 | ['-0.0000000025', '0.0000008639'] | 0.0000000000 |
| Inertia Weight | Four N | 1, 0.5 | ['-0.9821272969', '0.0015285671'] | 1.0280249842 |
| Inertia Weight | Four N | 0.5, 1 | ['0.0008255637', '-0.0000509149'] | 0.0001357292 |
| Inertia Weight | Four N | 2.05, 2.05 | ['0.0010755314', '-0.0000000083'] | 0.0002294927 |
| Constriction Factor | Star | 1, 0.5 | ['-0.0000000014', '0.0000000006'] | 0.0000000000 |
| Constriction Factor | Star | 0.5, 1 | ['0.0000000005', '-0.0000000000'] | 0.0000000000 |
| Constriction Factor | Star | 2.05, 2.05 | ['0.0000000005', '-0.0000000006'] | 0.0000000000 |
| Constriction Factor | Ring | 1, 0.5 | ['-0.0000000019', '0.0000000007'] | 0.0000000000 |
| Constriction Factor | Ring | 0.5, 1 | ['-0.0000000001', '0.0000000157'] | 0.0000000000 |
| Constriction Factor | Ring | 2.05, 2.05 | ['-0.0000000048', '0.0000000010'] | 0.0000000000 |
| Constriction Factor | Four N | 1, 0.5 | ['-0.0000126022', '0.0001929106'] | 0.0000074146 |
| Constriction Factor | Four N | 0.5, 1 | ['-0.0040457432', '0.0014950981'] | 0.0036905815 |
| Constriction Factor | Four N | 2.05, 2.05 | ['0.0340062909', '-0.0011244891'] | 0.2288098601 |

Function: **Rastrigin, f(0, 0) = 0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PSO Variant | Topology | Param Pair | Point of optimum | Value |
| Vanilla | Star | 1, 0.5 | ['-0.0038263095', '0.0029776787'] | 0.0000095428 |
| Vanilla | Star | 0.5, 1 | ['0.0024125767', '-0.0199165962'] | 0.0001021767 |
| Vanilla | Star | 2.05, 2.05 | ['0.0028899888', '-0.0197720622'] | 0.0001020074 |
| Vanilla | Ring | 1, 0.5 | ['-0.4849809929', '2.8876100808'] | 0.0000150474 |
| Vanilla | Ring | 0.5, 1 | ['5.1200000000', '4.9940896237'] | 0.0001040904 |
| Vanilla | Ring | 2.05, 2.05 | ['0.4276161820', '-5.1200000000'] | 0.0000569752 |
| Vanilla | Four N | 1, 0.5 | ['-0.6905906315', '0.0004524408'] | 0.0000030468 |
| Vanilla | Four N | 0.5, 1 | ['-0.6780857496', '0.1140060833'] | 0.0000015617 |
| Vanilla | Four N | 2.05, 2.05 | ['-0.0552087336', '-0.0269627753'] | 0.0000110439 |
| Inertia Weight | Star | 1, 0.5 | ['0.0000000103', '-0.0000000126'] | 0.0000000000 |
| Inertia Weight | Star | 0.5, 1 | ['-0.0000000093', '-0.0000000018'] | 0.0000000000 |
| Inertia Weight | Star | 2.05, 2.05 | ['0.0000000083', '-0.0000000112'] | 0.0000000000 |
| Inertia Weight | Ring | 1, 0.5 | ['0.0000000043', '0.0000000054'] | 0.0000000000 |
| Inertia Weight | Ring | 0.5, 1 | ['0.0000000055', '0.0000000058'] | 0.0000000000 |
| Inertia Weight | Ring | 2.05, 2.05 | ['0.0000030475', '0.0000001632'] | 0.0000000000 |
| Inertia Weight | Four N | 1, 0.5 | ['0.0043957228', '-0.0325605242'] | 0.0002749637 |
| Inertia Weight | Four N | 0.5, 1 | ['-0.0031589012', '-0.0287954890'] | 0.0002124860 |
| Inertia Weight | Four N | 2.05, 2.05 | ['-0.0014981519', '-0.0000000402'] | 0.0000011228 |
| Constriction Factor | Star | 1, 0.5 | ['-0.0000000022', '-0.0000000092'] | 0.0000000000 |
| Constriction Factor | Star | 0.5, 1 | ['-0.0000000085', '-0.0000000082'] | 0.0000000000 |
| Constriction Factor | Star | 2.05, 2.05 | ['-0.0000000059', '0.0000000145'] | 0.0000000000 |
| Constriction Factor | Ring | 1, 0.5 | ['0.0000000011', '0.0000000190'] | 0.0000000000 |
| Constriction Factor | Ring | 0.5, 1 | ['-0.0000000077', '-0.0000000038'] | 0.0000000000 |
| Constriction Factor | Ring | 2.05, 2.05 | ['0.0000000010', '-0.0000000311'] | 0.0000000000 |
| Constriction Factor | Four N | 1, 0.5 | ['-0.0120857980', '0.0395415538'] | 0.0004642894 |
| Constriction Factor | Four N | 0.5, 1 | ['-0.0002784008', '0.0161002048'] | 0.0000649070 |
| Constriction Factor | Four N | 2.05, 2.05 | ['0.0008361626', '0.0004086316'] | 0.0000003915 |

Function: **Griewank, f(0, 0) = 0**

Function: **Rosenbrock, f(1, 1) = 0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PSO Variant | Topology | Param Pair | Point of optimum | Value |
| Vanilla | Star | 1, 0.5 | ['0.9949126684', '0.9888107792'] | 0.0001341322 |
| Vanilla | Star | 0.5, 1 | ['0.9627659355', '0.9298958104'] | 0.0022729642 |
| Vanilla | Star | 2.05, 2.05 | ['1.0137416461', '1.0315727783'] | 0.0017103425 |
| Vanilla | Ring | 1, 0.5 | ['1.8883784617', '3.2578906128'] | 0.0000099057 |
| Vanilla | Ring | 0.5, 1 | ['5.1200000000', '-0.2982977997'] | 0.0054705450 |
| Vanilla | Ring | 2.05, 2.05 | ['-2.8096706988', '-3.1623900684'] | 0.0015545873 |
| Vanilla | Four N | 1, 0.5 | ['1.3521139776', '1.0150995024'] | 0.0002841895 |
| Vanilla | Four N | 0.5, 1 | ['1.0013764059', '0.4551095122'] | 0.0002069466 |
| Vanilla | Four N | 2.05, 2.05 | ['2.4118379118', '0.6996069442'] | 0.0005326470 |
| Inertia Weight | Star | 1, 0.5 | ['1.0000000000', '1.0000000000'] | 0.0000000000 |
| Inertia Weight | Star | 0.5, 1 | ['1.0000000000', '1.0000000000'] | 0.0000000000 |
| Inertia Weight | Star | 2.05, 2.05 | ['1.0000009671', '1.0000019035'] | 0.0000000000 |
| Inertia Weight | Ring | 1, 0.5 | ['1.0000000805', '1.0000001597'] | 0.0000000000 |
| Inertia Weight | Ring | 0.5, 1 | ['0.9999981718', '0.9999966084'] | 0.0000000000 |
| Inertia Weight | Ring | 2.05, 2.05 | ['0.9716041116', '0.7535776012'] | 0.0001072682 |
| Inertia Weight | Four N | 1, 0.5 | ['1.0189657164', '1.0383860442'] | 0.0003605992 |
| Inertia Weight | Four N | 0.5, 1 | ['0.9862101678', '0.9726026419'] | 0.0001901656 |
| Inertia Weight | Four N | 2.05, 2.05 | ['1.1442461209', '1.3092608874'] | 0.0208070901 |
| Constriction Factor | Star | 1, 0.5 | ['1.0000000000', '1.0000000000'] | 0.0000000000 |
| Constriction Factor | Star | 0.5, 1 | ['1.0000000000', '1.0000000000'] | 0.0000000000 |
| Constriction Factor | Star | 2.05, 2.05 | ['1.0000000000', '1.0000000000'] | 0.0000000000 |
| Constriction Factor | Ring | 1, 0.5 | ['0.9999998166', '0.9999991013'] | 0.0000000000 |
| Constriction Factor | Ring | 0.5, 1 | ['0.9999999906', '0.9999999705'] | 0.0000000000 |
| Constriction Factor | Ring | 2.05, 2.05 | ['0.9821753950', '0.9829056423'] | 0.0000009757 |
| Constriction Factor | Four N | 1, 0.5 | ['0.9812695417', '0.9627945264'] | 0.0003517399 |
| Constriction Factor | Four N | 0.5, 1 | ['1.0004792388', '1.0009610920'] | 0.0000002302 |
| Constriction Factor | Four N | 2.05, 2.05 | ['0.9871693063', '0.9744382520'] | 0.0001650490 |