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|  | **Representation** | **Recombination** | **Mutation** | **Parent Selection** | **Survivor Selection** | **Application** |
| **GA** | Bit-strings | 1-point crossover | Bit flip | FPS + Roulette wheel\* | Generational | Optimization and search problems |
| **ES** | Real-valued vector | Discrete or intermediary\* | Gaussian perturbation\* | Uniform random | (μ,λ) or (μ+λ)\* | Problem space and search space are identical.  Self-adaptation of σ |
| **EP** | Real-valued vector | None | Gaussian perturbation | Deterministic  (each parent one offspring) | Probabilistic (μ+μ) | Generate AI  finite-state machine |
| **GP** | Tree structures | Exchange subtrees | Replace subtree | FPS | Generational | Sequence induction, pattern recognition, planning |
| **DE** | Real-valued vector | Uniform crossover | Differential mutation\* | Given individual deterministically + uniform random selection of 3 necessary other vectors | Deterministic elitist | Optimize multidimensional real-valued functions |
| **PSO** | Real-valued vector | None | Adding velocity vector\* | Deterministic (each parent creates one offspring via mutation) | Generational | Find the best solution in a search space |

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|  | **Binary** | **Integer** | **Real-valued vector** | **Permutation** | **Tree** |
| **Mutation** | Bit-flip | Random setting | Uniform mutation | Swap mutation | Replace 1 subtree |
|  |  | Creep mutation | Nonuniform mutation | Insert mutation |  |
|  |  |  | Self-adaptive mutation\* | Scramble mutation |  |
|  |  |  |  | Inversion mutation |  |
| **Recombination** | 1-point crossover | 1-point crossover | Simple arithmetic crossover | Order 1 crossover | Exchange 2 subtrees |
|  | n-point crossover | n-point crossover | Single arithmetic crossover | Partially mapped crossover\* |  |
|  | Uniform crossover | Uniform crossover | Whole arithmetic crossover | Cycle crossover\* |  |
|  |  |  | Blend crossover | Edge recombination |  |

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| Population Management | Parent Selection | Survivor Selection | Diversity |
| Generational model | Fitness Proportional Selection\* | Age-based replacement | Fitness sharing\* |
| Steady-state model | Rank-based Selection\* | Replace worst | Crowding\* |
|  | Tournament Selection | Elitism | Speciation |
|  | Uniform Selection | Round-Robin tournament | Island Model EAs |
|  |  | (μ,λ) or (μ+λ)\* | Cellular EAs |

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|  | LOWER PART | UPPER PART |
| METHOD | EA | Tuner |
| SEARCH SPACE | Solution vectors | Parameter vectors |
| QUALITY | Fitness | Utility |
| ASSESSMENT | Evaluation | Test |

Average performance by solution quality, speed (MBF, AES)

Success rate = % runs ending with success

Robustness = variance in those averages over different problems

Parameter control

1. Mutation step size
2. Penalty coefficients