



Journal of Applicable Chemistry

2020, 9 (4): 664-670

(International Peer Reviewed Journal)



New Chemistry News
N=C=N

New News of Chem (NNC)

ChemNewsNew (CNN)

Evolution of Mimics of Algorithms of Nature (E-man)

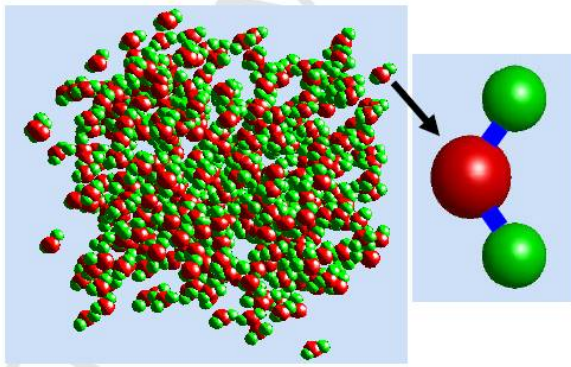
Atom search

<i>Methods.</i>				
Atom search +	Tree-seed algorithm +	Chaotic maps + Levy flight random walk	2020	Optimization
Limitations. Atom search	<ul style="list-style-type: none"> - Low convergence speed - Lack of proper balance between exploration and exploitation 			

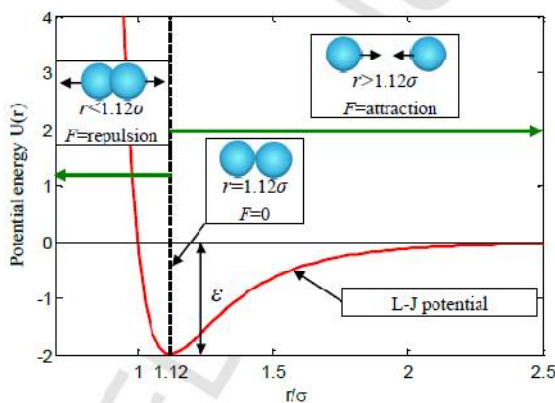
Positive Features. Tree-seed algorithm	<ul style="list-style-type: none"> + Improve exploration and exploitation capabilities + Make a proper balance between them. 			
Positive Features Chaotic maps + Levy flight random walk	<ul style="list-style-type: none"> + Improved convergence speed of ASO 			

Tree-seed algorithm. inspired by	<ul style="list-style-type: none"> ☞ Growth of trees ☞ Spreading their seeds + Has a decent exploration ability
Test.Data.Fns	40: Functions 30: Shifted and rotated benchmark functions
Test.Data.Eng	<p>Constrained engineering problems</p> <ul style="list-style-type: none"> ☞ Welded beam design ☞ Speed reducer design ☞ Pressure vessel design ☞ Tension/compression spring design <p>Unconstrained engineering problems</p> <ul style="list-style-type: none"> ☞ Gear train design ☞ Spread spectrum radar poly-phase code design ☞ Optimal thermo-hydraulic performance of an artificially roughened air heater problem

Atom search	2019
Inspired by	Basic molecular dynamics of atomic motion model of materials in nature
Application	Hydrogeologic parameter estimation
Method. Goals	<ul style="list-style-type: none"> ○ Global optimization ○ Balances explorative and exploitative search
Physics.Law	<ul style="list-style-type: none"> ▪ Atomic motion follows Newton's second law ▪ Interaction forces modelled by Lennard-Jones potential ▪ Constraint forces resulting from the bond-length potential
Achieves	<ul style="list-style-type: none"> ▪ Attractive force encourages atoms to explore entire search space extensively ▪ Repulsive force enables to exploit the promising regions intensively
Future	<ul style="list-style-type: none"> ☞ Binary version for discrete data tasks ☞ MOO <p>Operators. Evolutionary: reproduction, mutation, selection, chemotaxis, elimination, migration</p>



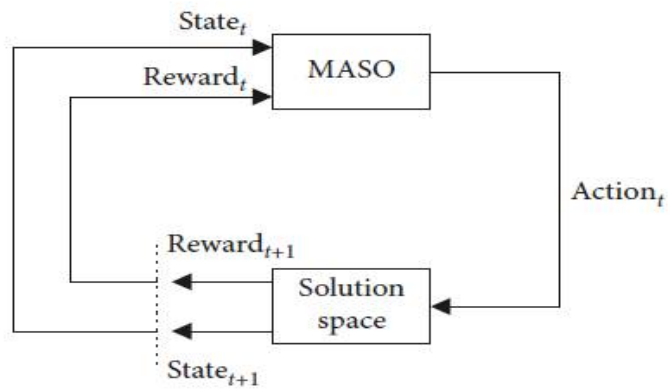
Water molecules and their composition.



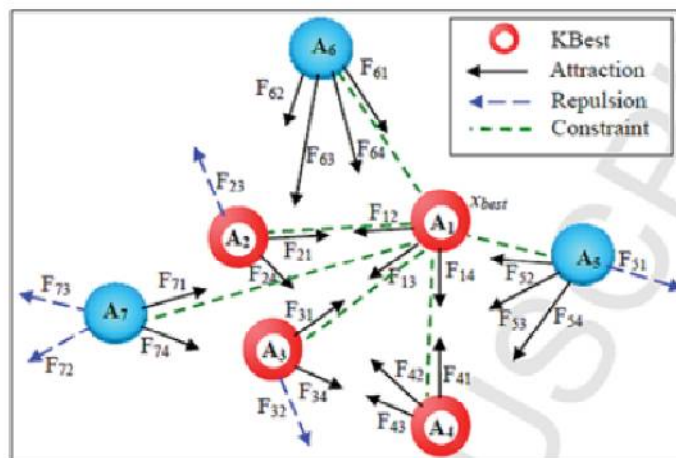
L-J potential curve

Atom search	2020	Optimization
Based on	Atom force motion model in molecular dynamics <ul style="list-style-type: none"> - Slow search speed - Low precision Remedy : Modified atom search	
Operators.Modified atom search	<ul style="list-style-type: none"> ☞ Immunologic mechanism operator <ul style="list-style-type: none"> + utilize the dominant position in the current atom population so that the speed, accuracy, and domain search ability of the atom ☞ Chaotic operator ☞ Reinforcement learning <ul style="list-style-type: none"> + Dynamically adjusts vaccination probability + Balances global exploration ability and local exploitation ability 	
Positive features.	+ Obj.Fn need not to be convex, continuous, or derivable	
Test data	21 benchmark functions Permutation flow shop scheduling problem	

Principle.
reinforcement learning
operator



Atom search	2019	Optimization
Inspired by	☞ Atomic movement in the nature	
Based on	☞ Interaction forces between atoms or molecules	
Application	<ul style="list-style-type: none"> ☞ Power losses minimization, IEEE 33-bus radial distribution Network ☞ Distribution network reconfiguration 	
Compared with	<ul style="list-style-type: none"> ✓ Tabu search ✓ Enhanced GA ✓ GA with varying population size ✓ Bacterial foraging ✓ PSO + HBMO ✓ Modified Honey Bee Mating ✓ PSO + GA using graph theory ✓ ACO 	



Forces of an atomic system k=5

a)	A new hybrid chaotic atom search optimization based on tree-seed algorithm and Levy flight for solving optimization problems	Title
	https://doi.org/10.1007/s00366-020-00994-0 Engineering with Computers 2020;	Journal
	SaeidBarshandeh, Maryam Haghzadeh	Author(s)
b)	Atom search optimization and its application to solve a hydrogeologic parameter estimation problem	Title
	doi.org/10.1016/j.knosys.2018.08.030 Knowledge-Based Systems (2019)	Journal
	Weiguo Zhao, Liying Wang, Zhenxing Zhang	Author(s)
c)	Modified Atom Search Optimization Based on Immunologic Mechanism and Reinforcement Learning	Title
	https://doi.org/10.1155/2020/4568906 Mathematical Problems in Engineering, Volume 2020, Article ID 4568906, 22 pages	Journal
	Yanming Fu, Zhuohang Li, ChiwenQu ,Haiqiang Chen	Author(s)
d)	Atom Search optimization Algorithm for Optimal Radial Distribution System Reconfiguration	Title
	2019 International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE) 978-1-7281-1006-6/19/\$31.00 ©2019	Journal
	Salah Kamel1, Hanan Hamour1, Mohammed Hassan Ahmed2, Loai Nasrat1	Author(s)

Atom search ~~~~~]]]]]]]]]]]

Physics Inspired Methods (Phys.IM)

Physics based Methods	Inspired by	
	Phenomena/Process/Happenings in nature	Laws/Theories
Annealing Simulated	Annealing process of molten metals	Boltzmann's probability function
Atom	Atoms in nature	Basic molecular dynamics

Big Bang–Big Crunch	<ul style="list-style-type: none"> ○ The energy dissipation (Big Bang) ○ center of mass (Big Crunch) 	Random solutions
Closed universe	Dynamics of universe	Cosmological theory If generated energy by Big Bang is smaller than gravitational energy Then expansion will be stopped
Black-Hole	Black hole concept	
Charged System	Physics; mechanics	Coulomb Newton laws
Gravitational	Gravitational forces produced by the interaction of masses of a set of bodies	Law of gravity Interactions between masses
Gravitational Space	Gravitational field for global optimization	Einstein's theory of relativity
Gravitation field	Gravitational effect	Astronomy theory solar nebular disk model of planetary formation

Magnetic field Electro	Attraction-repulsion forces among electromagnets	Principles of magnetic field theory
Magnetic field	Magnetic field theory	
Magnetic Hysteretic	Demagnetization process of Magnetic materials	
Magnetism Electro Like	Attraction–repulsion mechanism	
Multi-Verse	White hole, black hole, wormhole in cosmology	
Physics Artificial	Similar to other gravitation-based Algorithms larger mass attract small masses	Astronomy theory solar nebular disk model of planetary formation
Radiation Integrated	Gravitational radiation in the curvature of space-time	Einstein's theory of general relativity
Ray light	<ul style="list-style-type: none"> ○ Transition of ray from one medium to another ○ Optical refraction and reflection of light rays 	Snell's law: relation between incidence and fraction angles
Superposition Weighted	Attraction	Superposition principle
Thermal Exchange	Thermal energy transfer	Newton's law of cooling

Physics based Methods	Inspired by Phenomena/Process/Happenings in nature
Collision Particles	<ul style="list-style-type: none"> ○ Nuclear collision reactions ○ Particularly scattering and absorption
Collision objects	Collision between bodies
Force Central	Gravitational kinematics: motion of objects or probes under influence of gravity
Galaxy Based	Spiral arms of galaxies in the outer space
Harmony Search	Improvisation of the music player
Hysteretic Opt-Magnetic	Demagnetization procedure
Ion Motion	<ul style="list-style-type: none"> ○ Ions motion ○ Interactions between anion and cations
Lightning	Natureof lightning attachment process.
Water Drops Intelligent	Behavior of rivers in finding the best path Natural water drops that flow in rivers
Water cycle	Characteristics of rivers and streams that Flow into the seas
Water- Flow-	Water always moves from higher places to lower ones Erosion capability & Sediments depositing to overcome obstacles
Water Hydrological Cycle	Continuous movement of water in nature
Rain water	Pattern of physically rain water movements
Water River Formation Dynamics	River formation by water
Water-Turbulent Flow-	Concepts of fluid mechanics
Spiral optimization	Analogy of spiral phenomena in nature

ACS.org ; sciencedirect.com : Information Source

R. Sambasiva Rao, School of Chemistry
Andhra University, Visakhapatnam
rsr.chem@gmail.com