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Relationship between earthquake fault triggering and societal behavior using ant colony optimization

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Abstract
In this analysis, we use the ant behaviour in simulating a framework for analysis of complex interplay amongst short time-scale deformation, long time- scale tectonics for positive stress coupling and slip interactions in earthquake genesis modeling. Using the proposed improved ant colony algorithm for global optimization the best solution ants within the search and the circulation of the optimal solution as the initial solution search, to expand its search, to avoid falling into local optimum of trigger zones analysis for earthquake occurrences. In order to validate the avalanche behaviour and corresponding nucleation we best solution as the initial solution is adopted in order to widen searching scope to avoid getting into local optimum . In this proposed framework, an ant colony model is simulated to identify the physical framework of identifying trigger basins for the precursors to geodynamic model of propagation for precursory stress-strain signals. The disturbances at trigger basins cause the collapse of a subsystem leading to stress evolution and slip nucleation. Trigger basins help identify the zone of earthquake source nucleation as an index of α and µ for strain analysis. The stress strain network can be interpreted by the increase in steady-state energy transmitted due to redistribution of stress accumulation into the earth tectonic framework. Sand pile behaviour model has been modeled through ant colony optimization for forecasting of likelihood time of triggering influences of lithosphere on the basis of critical zones of lithosphere where dump of elastic pressure is possible. The ant colony adaptive framework consisted of vertices representing the stress-strain component and edges, representing scored transformations for global coupling effects have been constructed for dynamic monitoring of stress and strain behaviour. Triggering basins serve as harbingers of large earthquake where stress-strain interactions have been analyzed by the quasi-static mechanics of seismic precursory stress-strain propagation in the crustal lithosphere. The study shows that dynamic variation of stress drop due to saved up pressure can be modeled by ant colony framework for steady state release due to trigger and global correlation framework. The simulation framework shows that with time, spatial triggering points can be negatively coupled and these interact with lesser impact, while positive coupling occurs only with more distant zones of stress generation for geodynamic frameworks, suggesting that the structural heterogeneities within the causative rocks associated with cracks and pores can dictate the pattern of stress – strain interactions and earthquake generating processes.
Keywords: crack–porous, ant colony, geo-dynamical framework, stress-strain transmission, emergence

1. Introduction

Understanding earthquake source dynamics is a challenging problem in seismology. Earthquake faulting is mainly controlled by multi-scales dissipation processes within the fault interface, and by the geometry of pre-existing faults. Conventional models trying to interpret the physical state of the crust before and after earthquake occurrence often fail to explain the associated fault dynamics and stress transfer mechanism involved in seismogenesis (Mishra et al,2002;Mishra et al,2003). Coupled natural system occurs as a consequence of tipping points. Firstly, the complex components for dynamics required for understanding fault rupture mechanisms is seen as either having many constraints or so cumbersome that one ultimately loses sight of the original problem of analysis of seismogenesis (Mishra,2012). This argumentation is faulty on several counts; first, what appears to be very complex behavior can often be described by simple equations or pattern behavior of precursory components. Second, the purpose of a synchronization of fault segments for seismicity analysis is not to explain every detail of an evolutionary process of interaction between the stress and strain components, but its fundamental behavior. Models imitating the complex interplay between local dynamics and long range interactions for fault networks has long been of interest in the geodynamic framework of fault dynamics. The system can be made analogous to a two-dimensional interacting fault network based dynamic system undergoing quasi static evolution. Uniform distribution of seismic cohesive forces is non-existent in fault networks as because of the three dimensionality of fault system (Zhao et al., 2002; Mishra and Zhao, 2003). For earthquakes, both inter-state and internal stress accumulation patterns actually occur with the same statistical pattern. Using the proposed optimization analysis realistic distribution of the cohesive forces that modify specific or general patterns in the study of trigger zones responsive to earthquake occurrences has been questioned in this study. The degree of cohesiveness in the rock assemblage varies inversely with pores and cracked percentage in the total volume of rock and the behavior of stress – strain generation changes with fluid contents of the cracked volume of rock matrix (Singh et al., 2011). Slip is v=Δu where Δu is the slip in the large earthquake that ruptures the fault and v is its geological slip rate of the fault. The slip Δu is proportional to fault length, the faults will be considered to equal length so that the frequency of each fault ωi is proportional to its slip rate vi.When the force exerted in one block exceeds a threshold value – the maximal static friction – one block slips; this will redefine forces on its nearest neighbors inducing further slips and eventually resulting in a chain reaction. The necessity to analyze continuous non-consecutive cellular automata exhibit self-organized critically, demonstrating the generality of the phenomenon (Bak, 1996). Fractal dimension of seismicity, or b-value of seismologist, could be related to the rheology of the viscoelastic lithosphere (Singh et al., 2012b). Many works (Stein, 1999,Scholz, 2002) based on investigations for static or dynamic stress transfer has been well reviewed on the fault system dynamics and their long range interactions that have found to exhibit strong indications of synchrony in fault behavior (Scholz, 2010) in the stress-slip based interaction framework.It is necessary to analyze whether the stable buildup of stress over a large dimensional area for a certain time scale of days to years be monitored for assessing increased probability of earthquake in specific areas. In the pre-slip interpretation, the seismic nucleation phase represents the very last stage of failure within the pre-slip zone before the propagation along the fault with large slip and high rupture velocity begins, and thus explains the duration of the seismic nucleation phase as the time required for the final rupture of the pre-slip zone. An alternative explanation can be provided by cascade (or runaway) model that explains the seismic nucleation which manifests increasingly larger sub-events: a large earthquake occurs when a smaller earthquake triggers a cascade of increasingly larger slip events. Nucleation stage in the near-field of a large earthquake can be well understood from precursory micro-earthquakes triggering and earthquake delay, or deferment, due to earthquake generated changes in stress helps to understand and adequately model the mechanics of local inter-earthquake and intra-earthquake triggering. We have several sets of questions, such as: Do earthquake induced static or dynamic stress changes trigger subsequent earthquakes? Is there a triggering threshold? Dynamic strains may be the cause of some of the distant triggering, but, large regions of the earth's crust are not responding to these strain changes by producing triggered earthquakes. Effect of violent conflict is "often like an earthquake: it's caused by the slow accumulation of deep and largely unseen pressures beneath the surface of our day-to-day affairs. At some point these pressures release their accumulated energy with catastrophic effect. When there is a conflict of smaller events extrapolated to larger events like earthquakes. How conflict will vary depending on the nature of the medium and the subject, and this may be land or groups of people. Some are going to take part in the event while others are not original; so as a big event is occurring a deviation or drift will always occur, and this can be done by monitoring the offset fault rupture displacement. The main aim of the work is to investigate the emergence of trigger events in hierarchical fault systems due to variation of seismicity patterns through evolutionary optimization technique of ant colony framework. The idea of the seismogenic crust to have seismic zones or basins that trigger large motions is a conclusive evidence of the phenomena conducive stress accumulates in critical state (Evison and Rhoades, 2004, Scholz, 1991) has been introduced over the years as a possible explanation for the widespread occurrence of space-time long-range correlations in earthquakes dynamics. Displacement produced at distant points in an infinite isotropic elastic medium due to the application of impulsive stress dynamics in the development and evolution of the rupture due to stress failure as a process in time. Fault succession occur in areas with strong frictional plate coupling (asperities) – where stronger stress can build up in a wide area. Various mechanical models of the earthquake source process can be used to make interpretations of tectonic processes. Bankwitz,1980 has deduced that the energy of earthquakes is radiated to a significant part from relatively small, numerous fault planes and not from large single faults whereby evolution of pre-seismic slip to seismic rupture requires understanding the evolutionary dynamics of the local and global correlated framework of stress-strain behavior whose impact on the overall organization of the underlying tectonic strata can be neither assessed nor understood in isolation.

The proposed article aims at the modeling of a geodynamical framework for key mathematical properties of emergence of steady state fault behavior by studying characteristic precursory stress strain model in complex systems (Crucitti et al,2004). By correlating the ant colony[Dorigo et a.,1996] framework with fault dynamics behavior, present study works on the mathematical challenges of the impact of collective behavior of ant colonies in projecting cascading failure by the inherent path seeking activity define the fault dynamics for dynamic stresses and strains for space and time in large geodynamic networks having strain deformation [Lieb et al,2009] pattern in the fault zone. In 1992 Dr Dorigo and his group began developing Ant Colony Optimisation (ACO), an algorithm that looks for solutions to a problem by simulating a group of ants wandering over an area and laying down pheromones. Fault behavior and stress drop in critical conditions can be studied by the typical features of self organizing dynamics and local heterogeneity for evolution of stress [Wang and Huang, 2005] from nature. Heterogeneity of the spatio-temporal process of the system is the tendency of the system to maintain the condition of stability in the active state of dynamic equilibrium. Local heterogeneity and global correlations for static stress strain effects has been found to effect the steady state effects of stress drop inherent in the interplay of stress strain interactions. The global coupling effect on the near neighborhood blocks is really significant as the process reflects long range interactions. In this paper, the geodynamic interacting system validated by means of ant colony interaction framework for spatial identification of trigger basin earlier formulated using geodynamic model and precursory scale increase based global synthetic model. Part 2 describes several concepts for long range inter-connected dynamic behavior models in complex system networks; part 3 deals with evaluation of static stress changes of static stress changes and long range correlation in global and local dynamics in a geodynamic framework ; Part 4 shows an ant colony approach in dynamic neighborhood analysis for models to explain their emergence and projection for trigger function due to interactions between stress and strain. Part 5 gives interpretation of the results and also opens up avenues for future work using ant colony method to improve search space projection of trigger point.

2. Configurational comparisons and meta-analyses in seismogenesis

The complex system analysis can be mapped as an evolving graph model with trigger points representing realistic deformation due to stress strain deformations equivalent to physical entities for vertices of the graph, and the edges of the graph (infinite two dimensional lattice) evolving over time under the action of forces. We try to establish the behavior patterns of the domino analysis by reverse analysis of the behavior of the avalanche in sand pile model as in fig 1. The sand pile evolutionary model starts with sand deposition followed by an avalanche and then deposition at the bottom. This evolutionary system has a series of critical states and a number of endogenous and exogenous behavior patterns [Dutta et al., 2012a] which give a contrasted opinion about the feasibility of earthquakes prediction from impossibility (full chaos) to probabilistic long term prediction (weak chaos). By analyzing the behavior of the pre-slip model, the graph has been simulated in rounds for analyzing the tendency of the network to evolve towards patterns with a critical character. We analyze the system to find for the emergence of component failure from multitude of local interactions in complex systems as stress strain interaction in tectonic earthquake genesis can be explained and predicted. In recent years, the research area revolving around self-organization and emergence involves extracting pattern optimized features in ant colonies as correlation agents to analyze global behavior evolution and emergence from the many relations of multiple simple behaviors (Cornfold et al., 2004). A series of observations can be inferred conspicuously from nonlinear dynamics agents for the laws of socio-dynamics for fluctuations, transitions and effect of heterogeneity response for a multi-component system. A series of questions can be analyzed in identifying the processes that lead to either positive or negative feedbacks to perturbations? How the system responds non-homogenous organization works toward a tipping point? It is a known fact that system's trajectory changes once a tipping point is reached? The natural system behavior is the analysis of the steady state changes. However, it can be analyzed that the behavior originates from predefined basins in large scale behavior. The causative behavior of individual structures play a distinct role in geodynamic environment interactions. The limitation for conventional process for complex system is non-linear, and emergent properties and dynamics leading to more static and characteristic behavior function. The goal of this chapter is to describe the contribution of ant colony based algorithm which we propose in the understanding of the lithosphere dynamics and the unique challenges to map connectiveness of basins based on emergent properties, multiple equilibrium, path dependence, and nonlinearities inherent in the bound system that has been ignored (Rial et al 2004). The predictability of catastrophic events is based on work by (Sornette,2002) who proposed that underlying cause of catastrophic failure can be sought months and even years before the abrupt catastrophic event in the build-up of stress for a cascade failure like an accelerating rise of a bubble where the nearest neighbors interact in normal system (Laughlin and Joannopoulos,1978). A complex system is driven away from equilibrium by observing interacting components for the system which is likely part of that bubble that can be analyzed by the offset value at the perimeters of the changing system or the fault rupture offset (Oglesby,2008) . The global coupling parameter not only reflects the situation of long range interactions but also the neighborhood region for the slip motion of individual blocks or agents. The proposed algorithm is an effort to map possibilities to use as a graph, which is a set of connected entities. This graph will follow the evolution of the simulation. When an entity appear, a vertex will appear in the graph, when a communication will be established between two entities, an edge will appear between the two corresponding vertices. Qualitative analysis of the redistribution of stresses in an elastic medium having scaling behavior for faults show inhomogenity of stresses localized at tips of such fault zones shows .We will use such a graph to represent the application, and will try to find clusters of highly communicating entities in this graph by coloring it, assigning a color to each cluster. Drifting is caused by a steady, unyielding, outside force, while shifting is typically caused by gravity and a change in equilibrium. Drifting requires a continuing energy source, but shifting requires a disturbance. The system based approach can be done in the following manner.

2.1 ***Robust algorithm of ant colony based search in finding trigger basins of attraction***

The complex system analysis can be mapped as an evolving graph model with trigger points representing realistic deformation due to stress strain deformations equivalent to physical entities for vertices of the graph, and the edges of the graph (infinite two dimensional lattice) evolving over time under the action of forces. The possibilities for these models are: a rigid fault with stick-slip, a stress- or strain-singularity in an elastic medium, or some complicated fracture process. Domino nature of earthquake analysis based interaction of segments in trigger basins have been said to make windows of fully chaotic behavior in consequence of failure that causes seismic events along the faults. We try to establish the behavior patterns of the domino analysis by reverse analysis of the behavior of the avalanche in sand pile model as shown in **Figure 1.** The sand pile model is to be estimated along a line or at a finite difference from the plane boundary representing the earth surface. In the case of impulsive loading the initial conditions will involve discontinuities of stress behavior along certain boundaries. Plates and membranes having discontinuous change in the cross-sectional area at section of stress discontinuity. Force extension relation neglecting elastic strains helps consider material as rigid for piece wise linear force extension is $F=F_0+\lambda(t)$ where F is the membrane force at any instant on the cross-section normal to the plane of motion. In the absence of body forces the equation of motion of an isotropic elastic medium are satisfied if displacement is given by $q=\text{grad}\varphi+\text{rot } A$ where φ and A satisfy the wave equation The sand-pile evolutionary system has a series of critical states and a number of endogenous and exogenous behavior patterns (Mishra et al,2007 a,b) which identify quasi-periodic events in earthquake model (Figure 1). Vulnerabilities to threshold change, which in turn constitute leverage points in the dynamics of systems that make them especially sensitive to perturbations. A series of questions can be analyzed in identifying the processes that lead to either positive or negative feedbacks to perturbations. How the system responds non-homogenous organization works toward a tipping point? It is a known fact that system's trajectory changes once a tipping point is reached? The causative behavior of individual structures play a distinct role in geodynamic environment interactions. The limitation for conventional process for complex system is non-linear, and emergent properties and dynamics leading to more static and characteristic behavior function. The ant colony based algorithm which we propose is for better understanding of the dynamics of the lithosphere and the unique challenges to map connectiveness of basins based on emergent properties, multiple equilibrium, path dependence, and nonlinearities inherent in the bound system that has been so far ignored (Rial et al 2004). The predictability of catastrophic events is based on work by (Sornette, 2002) who proposed that underlying cause of catastrophic failure can be sought months and even years before the abrupt catastrophic event in the build-up of stress for a cascade failure like an accelerating rise of a bubble where the nearest neighbors interact in normal system (Laughlin and Joannopoulos,1978). A complex system is driven away from equilibrium by observing interacting components for the system by studying offset value for the difference between observed and predicted horizontal and vertical displacements for the fault rupture offset (Oglesby,2008). The local coupling parameter not only reflects the situation of short range interactions but also the neighborhood region for the slip motion of individual blocks or agents. As the external stress increases, micro ruptures occur within the medium which locally redistribute stress, creating stress fluctuations within the rock which trigger process of stress relaxation. In the ant colony clustering algorithm each data object is represented with an agent whereby the corresponding to each ant in the colony and activity space being a two dimensional grid. Ant calculates the similarity of the nodes and those within the viewing radius. In the process of clustering analysis ant picks up the node most dissimilar to the entire neighborhood by decision to pick and drop elements to the neighborhood. The analysis is done in the following manner whereby the initial cluster centers are chosen randomly as the hills in the sand pile as in **Figure 1**. Devising a lattice model of sand in a rotating cylinder for equations to model sand pile dynamics and ripple formation for sand pile relaxation a situation where reorganization of a maxima and minima within the pile dominates the flow. This self organization for sand pile for slow rotation or tilt driving occurs in the form of rotation and deposition. In order to analyze the flow start searching with ***n*** ants for optimum value in search space for randomness through rules which constantly change based on initial conditions. Initialize ant position and movement in positive and negative direction for correlation. Stress analysis for particles can be thought of as dense liquid. The effect is to randomize the direction of motion of every particle at every time step as time step is a collision step that leads to stress. Stress state in jth site. ϵ is the longitudinal strain change in length in the plane of motion λ. Force required by the membrane for its yielding will depend on boundary displacement and boundary tractions known under strain states and stress tensor given by the two-dimensional coordinates.The triggering will have an impact velocity which depends on the yield stress and strain hardening rate. Ants after the completion of the search, mobile according to the rules for the next search. In this paper, the improved ant colony algorithm, ant colony after the completion of the cycle get the optimal solution as the starting position, when the other ants next cycle the ants of mobile rules is divided into two parts: First, ants of the last cycle did not find the optimal solution to the optimal solution the mobile; another part of the ants to obtain the optimal solution in the field of optimal solution search in order to find a better solution. After the completion of the cycle, the ants will last cycle ants find the optimal solution for the transfer. Pheromone will be more for ants that choose the shorter path, the amount of pheromone on the short path will lead to high concentrations of pheromone more ants choose this branch, eventually all the ants are concentrated to this branch. Each ant choices are determined according to the size of the amount of pheromone on the path. Compute the random triggering points for slip changes in the block that needs adjustment if ant a carries item **0** and there is no item in location **p** if suit(**o**)=**l**;pick up other similar item; in neighborhood else if suit(**o**)==**O**;expand radius until suit(**o**)==l, save location **p** and radius into ant a's memory, drop the item **o**. Slip motion of block changes equilibrium of the global stress field that disturbs balance for fault network through pheromone trails in the global network. The pheromone trials can have a total of $\mathbf{2^4}$ or **16** values depending on the combination of compressive and extensive stress and strain respectively between **0** and **1**. In order to understand the suitability of a complex adaptive system approach, the graph based geodynamical framework model is proposed to interpret the interaction between pair wise stress-strain effects for environmental decision making involved in complex system dynamics. In the proposed work an effort has been made to map the steady-state increase of stress strain behavior in a complex dynamics (as in **fig 2**) and find the non random trigger basin in hyper-structures as a result of neighborhood interactions. This method to analyze long range correlations and coupling effects in the inherent stress-strain field identifies steady state stress accumulation and distribution.

3. Geodynamic framework with global correlation and coupling behavior

Geodynamic Monitoring (GDM) as specified by (Godzikovskaya and Strom, 2007; Utkin and Yurokov, 2009) represents a predictive system design for studying the intense-deformed condition of separate blocks of an earth's crust based on occurrence of deterministic modeling of natural and dynamic processes. The most notable feature of earthquake model lies in the spring block system as proposed by (Burridge and Knopoff,1967) to sand pile model proposed by (Bak and Tang,1989). When stress is applied to the material at elevated temperatures, creep occurs by a process of dislocation movement or simply stress directed diffusion of vacancies in the crystal lattice (Mishra et al., 2008). Potential energy release is dependent on the cumulative energy due to fault crack for energy associated with faulting in pre-stressed medium for change in potential energy and thereby energy needed to create new surface at the edge of expanding fault zone. Difference between potential and rupture energy equivalent to stress accumulated strain is physically measurable where Δu_i is change of displacement σ_{ij} is change of stress associated S is the spherical surface of radius R at source. Boundary displacements or boundary tractions are known under strained state and stress tensor will be given by eulerian coordinates for strain tensor may also be referred under the same system $\tau_{ij}= \lambda\delta u_{ij}I_1 + 2\mu\epsilon_{ij}$.Diffusional creep depends on re-distribution of local vacancy concentrations subjected to normal stress behavior. When a vacancy is formed at the boundary subjected to a tensile stress, σ a force σb^2 tends to move distance, b; where b^3 is directly proportional to Ω the atomic volume. The energy required to create the vacancy is reduced by amount σΩ. By similar measure energy required to create boundary at compressive is increased by amount σΩ. Vacancy concentration differences exists between boundaries tensile and compressive as $\Delta C=2Cv\ \sigma\Omega/KT$. P_j is the probability of accepting or emitting a vacancy interface is the poor vacancy source and sink on particle free regions of the boundary causing the stress to increase at the particle and decrease at the rest of boundary. Creep can occur at grain boundary diffusion by loop shrinkages occur by lattice diffusion. The cellular automation model is the best way to validate long range elastic interaction and short range precursory behavior for the geodynamic system. The geodynamics involved in radon monitoring allows to study dynamics (changes) in intense deformed conditions of the block of rocks (compression or a stretching) involving speed of processes of dynamics(stress changes) of rocks in preparation of earthquake. Radon monitoring variations and co-evolutionary deformations (Rusov et al, 2006) of the rock mass helps to analyze stress dynamics (changes) in intense deformed conditions of the block of rocks (compression or a stretching) for geodynamic processes in rocks. At various stages of accumulation of elastic energy in the block, there is a probability of external influence on the block and dump of the elastic energy which has been saved up in this block. The short-term forecast of especially large earthquakes (M ≥6) based on size triggering functions dumps the saved up pressure on all surface of the Earth in critical points arising in an earth's crust. Inside the Earth are created zones of increased and decreased pressure of the liquid core. Unequal pressure distribution causes deformations of Earth's crust and mantle. In order to explain the behavior of the fault model system we need to analyze the seismo-active local coupling states of the faults, which we can take as the coupling function. Pre-slip patterns are linked to parameter changes (structural perturbation) responding as anomalies and a single triggering function driven by rock permeability changes induced by crustal deformations (Caracausi,2009). In an earthquake, these zones strain in response to both the total stress (due to co-seismic CZ weakening) and co-seismic stress change (due to permanent CZ weakness). Dynamic stress triggers can be projected on graph as they get distributed through networks for interacting paths stress distributes between nodes of the fault to maintain stability where the resulting stress relaxations is not a starting event but results in continuous interaction among the triggering events projected in the graphical framework. Where the size of the pheromone on the path ij represents the pheromone evaporation coefficient, on behalf of the coefficient of residual pheromone for the increase of the pheromone,

$\tau_{ij} \leftarrow (1-\rho)\tau_{ij}$ (1) the ants was proportional to the length of the path given in equa 2.

$$\tau_{ij} \leftarrow \tau_{ij} + \sum_{k=1}^{m} \Delta \tau_{ij}^{k} \quad (2)$$

4. System Model and Simulation

Ant colony behavior is found to emerge periodically in swarms and establish perimeter barriers involving interactions among individual agents to study processes of collective action. Transient dynamic stress spreads homogenously with adjustments connected to static stress changes.Global correlation or static stress/strain effects play a significant role in the generation of earthquakes.Simulation features the use of dynamic spatial patterns to explore the dynamics of complex systems for representation of spatial processes and spatial interaction. The stress strain network can be interpreted by the increase in steady-state energy transmitted to the surface acting as a source of redistribution of energy into the earth tectonic framework. A fault system is a simple one dimensional framework of a chain of blocks interacting in the local level globally coupled in a rigid plate. The behavior of the system at jth site ;

F(j,t+1)=f1(f(j,t)) + local interaction +global coupling effects

Slip motions of the block change at seismo-dynamic equilibrium condition disturbs balance of the system which depends on the dynamic network of stress-strain relations. When the stress of the block exceed the value of a threshold value or maximum friction then the block slips to a new position. The study of complex system studies can be done for emergent and autocatalytic mass behaviors around heterogeneous fields related to the combination of stress and strain where heterogeneity plays the catalyst behind the genesis of new features. Steady state framework for stress-strain interaction at random trigger basins based on increasing transitions is shown in Figure 2. The correlated trigger basins for seismic basins for seismic evolution based near neighborhood search for increasing energy transitions is shown in Figure 3. The processes related to the earthquake generation are characterized by some internal dynamical structure that are not completely random (Rundle and Klein, 2000; Matcharashvili and Ghlonti, 2002). Each ant starts with the same search radius, and then automatically adjusts the neighborhood radius around its position and memorizes the size of the pure neighborhood during the clustering process. Zones for finding ants are attracted are covered by pheromones and maintained. As the zone is less affected ant pheromones leave a trail which allows other ants to follow.This is similar to earthquake domain pattern where aseismic slip becomes predictive. Ants as agents when once in stampede mode particle interactions like repulsion and friction (Helbing et al., 2000). If the new position of slip is better than the original position, then replace with the new location, for the original position; or retain the original position as slip change. Search step size should be reduced with the increase of the number of iterations in order to be able to get a more accurate solution search.The iteration method reveals better learning coefficient for the dynamic model (Figure 4). This pheromone trial is naturally related with the proposed correlation measures around local neighborhoods. The rate of increase or drop and rise of elastic energy involved in the process through multi-agent based study reflects dynamical regime of seismic processes by calculation of their measurable characteristics is important in the search for possible earthquake predictive dynamical markers for trigger basins placed at equidistant intervals [Figure 2] in effect of global and local stress field.The study proposes a system of ant colony framework in relation to global correlation interaction with precursory phenomena shows that nearest neighbor faults will be negatively coupled and positive coupling will occur only with more distant faults as shown in Figure 3. This can be mapped as spatial points in the stress strain two dimensional function for nearest neighbor function of compressive/extensive based stress strain values. For a case of compressive stress compressive strain block. A block interacting with another compressive stress compressive strain block B if bvalueA > bvalueB, the interaction may result in an earthquake towards block A since block B shows greater dilation properties at the shearing surface of interaction between block A and B. Once in the pure neighborhood, we again perform near neighborhood iteration for initializing cluster centers µ1….,µk; based on mode and then re-compute cluster centers(means of data points in cluster).Select modes as the initial cluster centers . Compute the region in the grid balance where the most pure and tallest and dense cluster is located. This is a region which may trigger the earthquake occurrence in the future.Neighborhood radius is the size of a pure neighborhood for the search of a trigger function calculated with the following routine while Suite T(0)=0.In actual cases the global coupling effects can be negative as shown by the reduced activity of earthquakes at near and far earthquake sources.Enhanced clustering activity is observed at points far away after n time period showing that steady state trigger basins have an active impact in the global field of stress evolution and slip nucleation at spatial points which interact among themselves. Fast global optimization with fast searching rate and high optimizing precision spatial existence of seismogenesis for a critical value of stress and strain condition.

5. Results of simulation and discussion

Optimization involves analysis of the stress strain components for a self organizing framework where performing solution components removed as iteration solution as shown in Figure 4. Largest strain changes that occur at the last stages of failure and the amplitude or size of the strain change are related to nucleation patch moment release. The results strongly outline that using long-term radon monitoring, to interpret self organizing networks that interact in bound dynamic environment act as triggering basins. Simulations prove that there is a close proximity of local dynamics and long range interactions having a connection with stress evolution. Dynamics of change of concentration of radon before tectonic event has a characteristic kind and will trigger based on the attractor states for the system when compliant zones deform in response to a nearby earthquake. Energy of tectonic processes considerably exceeds the increment of the energy due to the formation of the area of increased tectonic activity and therefore local heterogeneous factors cannot distort the regular tectonic processes far off its hypocenter. The ant colony framework implemented in with the number of solution space searching feasible solution having improved ant colony algorithm is capable of global optimization, avoiding premature convergence phenomenon, so as to achieve better optimization results. Distributions of local stress in homogeneities is capable of generating large earthquake occurrences. In the future, the work will involve on how the trigger basins change with local heterogeneity and how does stress strain condition affect the state of clusters during the development of a seismogenic process. However long term analysis of temporal clustering of events suffer from a few drawbacks which can be interpreted based on the analysis of a 3-D seismic tomography based model design (Mishra, 2004; Mishra et al., 2008; Singh et al., 2012a, b).

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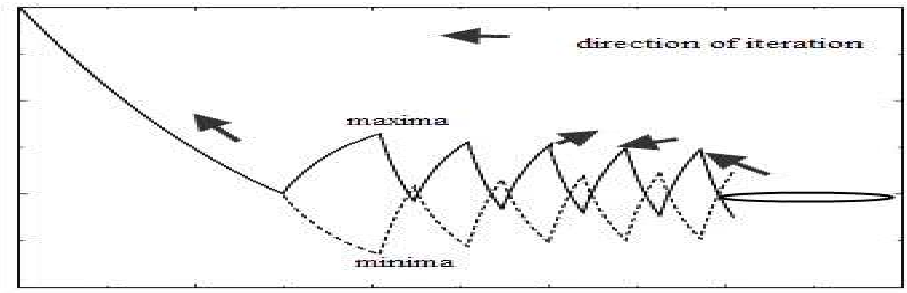

Figure 1. Sand grain drop model followed by avalanche and deposition

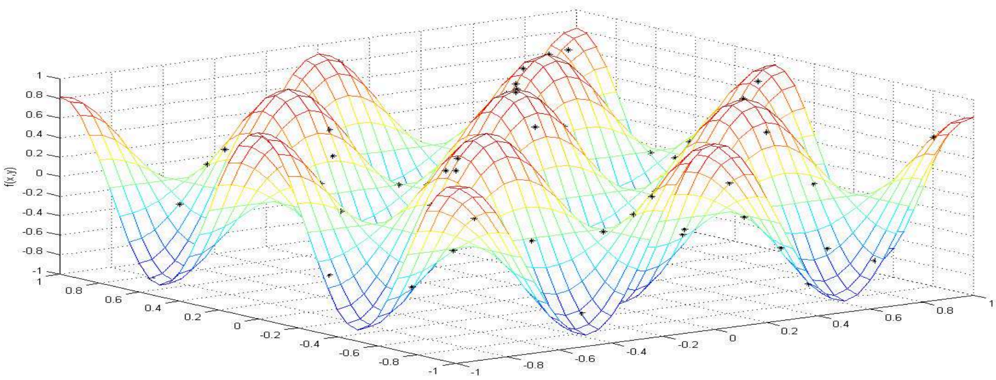

Fig 2: Steady state framework for stress strain interaction at random trigger basins based on increasing energy transitions

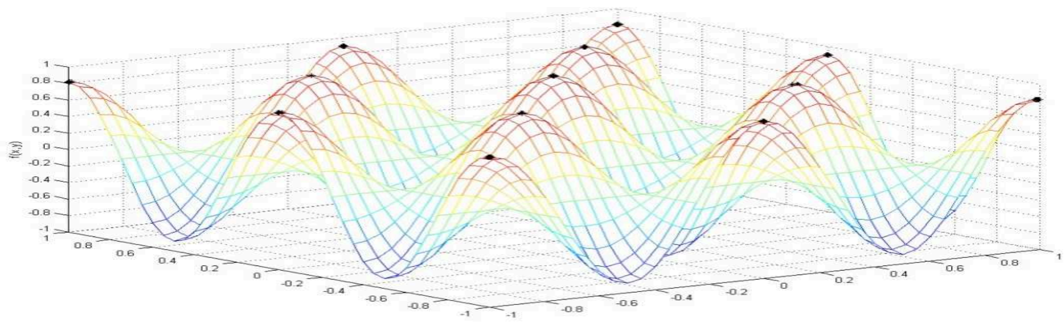

Fig 3: Correlated trigger basins for seismic evolution based on near neighbourhood search for increasing energy transitions

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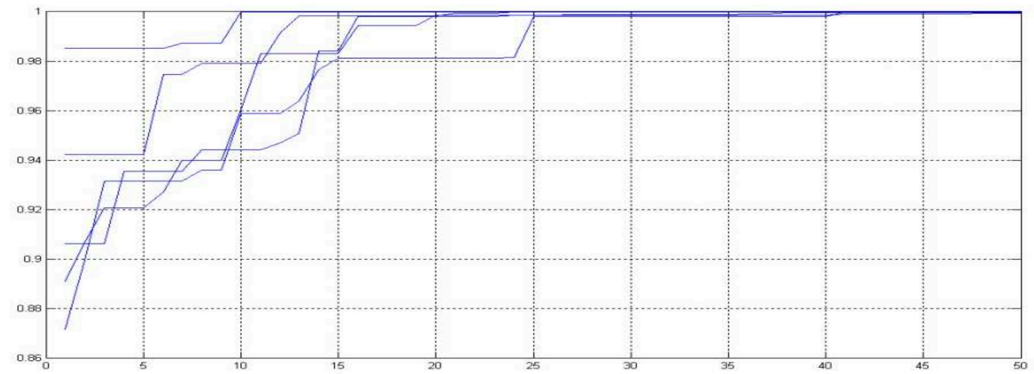

No of nodes passed by ants in finding trigger basins

Fig 4: Iterations taken by ants in hyper-structure for identifying trigger basins in seismic cycles