iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2026 **Issue:** Conference **Month of publication:** May 2026

DOI: https://doi.org/10.22214/ijraset.2026.83384

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

Spatial Prediction of Deep Strike-Slip Earthquake and its Consequences

Subrata Kr. Debnath[1], Pranab Das Choudhury[2], Soumitra Biswas[3]
[1]Department of Basic Sciences and Humanities, Maulana Abul Kalam Azad University of Technology
[2]Department of Basic Sciences and Humanities, Maulana Abul Kalam Azad University of Technology
[3]Department of Applied Mathematics, Maulana Abul Kalam Azad University of Technology

Abstract: Causes of deep earthquake is still not very much clear to the scientific community till now. In the present paper we have tried to develop a mathematical model to understand the possible mechanism of such deep strike slip earthquake. We know that due to the pressure and temperature gradient, the rigidity of the material of the Earth gradually increases up to a certain depth from the free surface and then decreases suddenly to zero at the outer core. In the present paper the lithosphere-asthenosphere system is considered up to a depth of 200 km. from the free surface where rigidity is assumed to vary linearly with depth. We have tried to develop a model to investigate the effect of this variation of rigidity with depth on stress and strain accumulation in the lithosphere-asthenosphere system due to the movement across the long strike slip fault assumed to be situated in the elastic half-space and is assumed to be surface breaking .The associated boundary value problem is numerically solved by finite difference method in presence of discontinuity and a MATLAB program is developed . It is found that the continuous change of rigidity with depth has considerable effect on the nature of stress-strain accumulation /release in the system as compared to the elastic half-space and elastic layered model and the stress is accumulated/ released at a greater depth causing a deep strike slip earthquake.
Keywords: Aseismic Period, Depth Dependent Rigidity, Tectonic Process, Deep Strike-slip Earthquake, Spatial Prediction.

I. INTRODUCTION

The cause of Deep Earthquake is not still known to the scientific community [16]. In this paper we have investigated the possible reason of such deep strike-slip earthquake and its consequences.

In the half-space elastic representation of the lithosphere-asthenosphere system the rigidity of the material of the earth is assumed to be constant throughout, where as in the layered model the rigidity or the viscosity of different layers were taken to be different with a suitable boundary condition at the interface. But the sudden changes of the parameters were not well explained. And also, it is observed in experimental result that the rigidity of the Earth crust continuously changes with depth.

In this research, one long strike-slip fault is chosen, located in an elastic half-space whose rigidity is continuously increasing with depth. A sudden slip occurs across the fault when accumulated shear stress exceeds certain threshold value of the local frictional force. The motion across the fault is driven by forces generated by mantle convection or similar tectonic processes.

A finite difference scheme for the corresponding Neuman boundary value problem in presence of discontinuity has been developed with suitable values of the model parameters for its numerical computational works. The spatial variation in stress-strain accumulation and release for both before and after movement across the fault are obtained using the observed data in [7], [17]. Also, the associated MATLAB program is developed.

The convergence and stability analysis of the associated finite difference scheme have also been done. Higher dimensional interpolation (Lagrange's Interpolation) and higher dimensional numerical differentiation are used for stress and strain calculation.

The solution shows a significant change both in quantitative and qualitative behavior in the nature of displacement, stress and strain field as compared to the elastic half-space and elastic layered model.

In our present paper we have shown that the continuous change of rigidity of the Earth material may be one of the possible reasons for intermediate as well as deep Earthquake.

Also, spatial prediction of earthquake has been done.

In the earlier models, the Earth was represented by an elastic half space [3]-[5] ,[22] ,[23] ,[6] ,[40] ,[35] ,[31] ,[38], and/or elastic layer [41] ,[42] ,[32] ,[37], and/or elastic layer over viscoelastic half-space [30] ,[27] ,[9] ,[29] ,[12] ,[36] ,[26] ,[19], or viscoelastic layer over viscoelastic half-space [11].

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com
National Conference on Integrated Approaches to Sustainable Innovation 2026 (IASI 2026)

II. FORMULATION

One long, strike-slip, surface breaking, vertical fault F and width D is considered to be located in an elastic-half space with linearly increasing rigidity. Since the affected area, particularly for moderate earthquake is small as compared to the radius of the earth,a Cartesian coordinate system is chosen by selecting a point O on the strike of the fault as the origin, Y_1 axis along the strike of the fault, the Y_2 axis isas depicted in Figure 1 and the Y_3 axis is directed vertically downward, the fault is therefore represented by $F: (y_2 = 0, 0 \le y_3 \le D)$. Let u be the displacement component along Y_1 axis , $e_{1j}, \tau_{1j}; j = 2,3$ are the shear strain, shear stress components connected to strike slip motion and $\mu(y_3)$ is the effective rigidity which is a continuous function of depth y_3, let $\mu(y_3) = \mu_0(1 + k_e y_3), \mu_0$ is the rigidity of the free surface and k_e=0.0016/km., (the value of k_e is estimated by least square method).

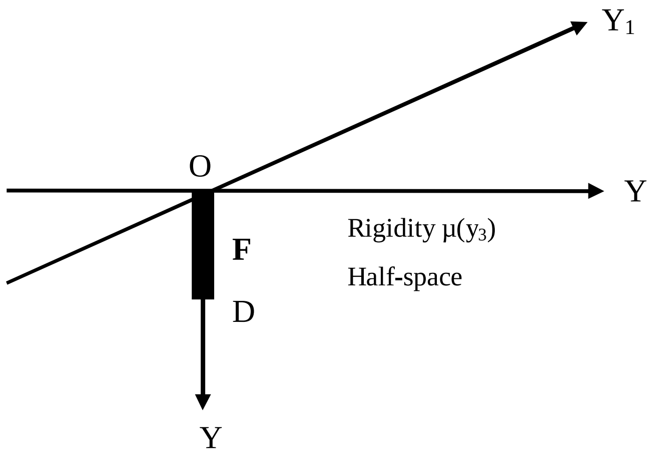


Fig. 1 The coordinate system with fault.

The constitutive equations associated with long strike slip movement for an elastic medium are taken as follows:

$$\tau_{12} = \mu(y_3)(e_{12}) = \mu(y_3)\left(\frac{\partial u}{\partial y_2}\right) \quad (1)$$

$$\tau_{13} = \mu(y_3)(e_{13}) = \mu(y_3)\left(\frac{\partial u}{\partial y_3}\right) \quad (2)$$

The governing stress equation**:**(assuming the deformation is quasi-staticstate, with inertia terms ignored and body forces are excluded since the motion is of strike-slip type).

$$\frac{\partial}{\partial y_2}(\tau_{12}) + \frac{\partial}{\partial y_3}(\tau_{13}) = 0 \qquad (3)$$

We specify the boundary conditions assuming t = 0 indicating a moment when the regionis in aseismic state.

$$\tau_{12}(y_2, y_3) = \tau_\infty(t) \ \text{ for } \ |y_2| = d, y_3 \ge 0, t \ge 0 \quad (4)$$

On the free surface, $y_3 = 0, (-\infty < y_2 < \infty, t \ge 0)$

$$\tau_{13}(y_2, y_3) = 0 \qquad (5)$$

Also, as $y_3 \to \infty(-\infty < y_2 < \infty, t \ge 0)$

$$\tau_{13}(y_2, y_3) = 0 \qquad (6)$$

[Here $\tau_\infty(t)$ represents the driving force resulting from mantle convection or other ongoing tectonic process acting at a large distance d from the fault].

III. NUMERICAL SOLUTIONS

A. Solutions before fault movements/dislocation:

Using equations (1) & (2) in (3), we get the boundary value problem

$$\nabla^2 u + \frac{k_e}{1+k_e y_3}\frac{\partial u}{\partial y_3} = 0 \qquad (7)$$

We want to solve the boundary value problem (7) with the boundary conditions (4) to (6) by finite difference method.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com
National Conference on Integrated Approaches to Sustainable Innovation 2026 (IASI 2026)

We have the finite difference scheme as

$$\left(2 + 2\frac{h^2}{k^2} + \frac{h^2}{k}\frac{k_e}{1 + k_e y_j}\right)u_{i,j}$$
$$= u_{i+1,j} + u_{i-1,j} + \frac{h^2}{k^2}(u_{i,j+1} + u_{i,j-1}) + \frac{h^2}{k}\frac{k_e}{1 + k_e y_j}u_{i,j+1}$$
$$x_i = ih, i = 0, \pm 1, \pm 2, \dots \dots \pm 300$$
$$y_j = ik, j = 0, 1, 2, \dots \dots \dots 600 \quad (8)$$

where h=step length along Y_2 axis and k=step length along Y_3 axis.

Boundary conditions before dislocation:

$$u_{i+1,j} - u_{i,j} = \frac{\tau_\infty(t)}{\mu_0(1 + k_e y_j)}$$
$$for\ i = \pm 300, j = 0, 1, 2, 3, \dots \dots \dots .600 \quad (9)$$
$$u_{i,j+1} - u_{i,j} = 0$$
$$for\ i = 0, \pm 1, \pm 2, \dots \dots .. \pm 300, j = 0, 600 \quad (10)$$

using the boundary conditions (9) & (10) in finite difference scheme (8) we get the modified finite difference scheme as

$$(1 + \frac{h^2}{k^2})u_{i,j} - \frac{h^2}{k^2}u_{i,j-1} - u_{i-1,j} = \frac{\tau_\infty(t)}{\mu_0(1+k_e y_j)} \quad (11)$$

Numerical solution shows that τ_{12}increases over time and approaches to $\tau_\infty(t)$ as t approaches to ∞, whereas τ_{13} approaches to zero.

B. Solutions after the movements/(dislocation) across the fault:

With t = 0 indicating the re-establishment of the aseismic state, stress accumulation resumes and after that the stress continues to accumulate and when $t=T_1$ the stress component τ_{12} (which governs the strikeslip motion) exceeds the local critical value τ_c , the fault F begins to slip, thus we have a further condition is applied to characterize the resulting dislocation in displacement u caused by the slip as:

$$[u]_F = \nabla U f(y_3) H(t_1) \quad (12)$$

here, H (t_1) is the Heaviside function, $t_1 = t - T_1$, ∇U (slip across the fault) is taken to be constant , $f(y_3)$ is the slip function which satisfies (A) and $[u]_F$ is the discontinuity of u over the fault F represented by:

$$[u]_F = \lim_{(y_2 \to 0+)}(u) - \lim_{(y_2 \to 0-)}(u)$$
$$(y_2 = 0, 0 \le y_3 \le D)(13)$$

Assuming geological conditions and fault properties are so that the shear stress component τ_{12} exceeds a critical threshold value τ_c (which depends on local frictional force) where $\tau_c < \tau_\infty(t)$, the fault F begins to slip.

For the resulting stress and strain to remain bounded, the slip function must obey the restrictions, described by [Mukhopadhyay et al. [1980]as:

(B_1) The slip reaches its maximum value at the free surface.

(B_2) The magnitude of the slip diminishes to zero as we approach to the lower edge of the fault $(y_2 = 0, y_3 = D)$

The slip function $f(y_3)$must fulfill the conditions stated above.

The solution of the modified boundary value problem is taken as,

$$u = (u)_1 + (u)_2$$
$$\tau_{1j} = (\tau_{1j})_1 + (\tau_{1j})_2$$
$$e_{1j} = (e_{1j})_1 + (e_{1j})_2$$

where $(u)_1$, $(\tau_{1j})_1$,$(e_{1j})_1$respectively are displacement, stress, strain before the fault dislocation satisfying equations (1) to (6) and $(u)_2$, $(\tau_{1j})_2$,$(e_{1j})_2$; j=2, 3 respectively are displacement, stress, strain after the fault dislocation satisfying the modified boundary value problem (12), (13) & (14).

The reformulated boundary value problem becomes

$$\nabla^2(u)_2 + \frac{k_e}{1+k_e y_3}\frac{\partial(u)_2}{\partial y_3} = 0 \quad (14)$$

where $(u)_2$ satisfies 2-dimensional Laplace equation (14).
With modified boundary conditions (12) & (13) and the rest of boundary conditions remains unchanged.
A finite difference approach is employed to solve the resulting boundary value problem (finite difference method with discontinuity) and get the modified finite difference scheme as:

$$\left(2+2\frac{h^2}{k^2}+\frac{h^2}{k}\frac{k_e}{1+k_e y_j}\right)(u)_{2_{i,j}} = (u)_{2_{i+1,\ j}} + (u)_{2_{i-1,\ j}} + \frac{h^2}{k^2}[(u)_{2_{i,\ j+1}} + (u)_{2_{i,\ j-1}}] + \frac{h^2}{k}\frac{k_e}{1+k_e y_j}(u)_{2_{i,\ j+1}}$$

$$x_i = ih,\quad i = 0, \pm1, \pm2, \dots\dots\dots \pm 300$$

$$y_j = jk,\quad j = 0, 1, 2, \dots\dots\dots 600 \qquad (15)$$

with the modified Boundary conditions after dislocation as:

$$(u)_{2_{i+1,j}} - (u)_{2_{i,j}} = 0$$

$$for\ i = \pm300, j = 0, 1, 2, 3, \dots .600 \qquad (16)$$

$$(u)_{2_{i,j+1}} - (u)_{2_{i,j}} = 0$$

$$for\ i = \pm1, \pm2, \dots\dots\dots\dots . \pm300, j = 0, 600 \qquad (17)$$

$$(u)_{2_{i,j+1}} - (u)_{2_{i,j}} = \nabla U f(y_j)$$

$$for\ i = 0, j = 0, 1, 2, 3, \dots\dots\dots\dots\dots .600 \qquad (18)$$

Using the boundary conditions (16) to (18) in(15), we get

$$(u_2)_{i,j} = \frac{1}{(1+\frac{h^2}{k^2})}[\nabla U f(y_j) + (u_2)_{i-1,j} + \frac{h^2}{k^2}(u_2)_{i,j-1}] \qquad (19)$$

C. Analysis of Stability and Convergence:

Considering the linear partial differential equation

$$f_1 u_{y_2 y_2} + f_2 u_{y_3 y_3} + f_3 u_{y_2} + f_4 u_{y_3} + f_5\, u = f_6 \text{for a region R,}$$

The difference scheme is of the form

$$\beta_0\, u((y_2)_i, (y_3)_j) + \beta_1\, u((y_2)_i + h_1, (y_3)_j) + \beta_2\, u((y_2)_i, (y_3)_j + h_2) + \beta_3\, u((y_2)_i - h_3, (y_3)_j)$$

$$+\beta_4\, u((y_2)_i, (y_3)_j - h_4) = (f_6)_{ij} \qquad (20)$$

where $f_1, f_2, f_3, f_4, f_5, f_6$ are continuous functions of y_2 and y_3 and following [14], we get coefficient values as:

$$\beta_0 = (f_6)_{i,j} - [\frac{1}{h_1 h_3}\{2(f_1)_{i,j} + (h_3 - h_1)(f_3)_{i,j}\} + \frac{1}{h_2 h_4}\{2(f_2)_{i,j} + (h_4 - h_2)(f_4)_{i,j}\}]$$

$$\beta_1 = \frac{2(f_1)_{i,j} + h_3(f_3)_{i,j}}{h_1(h_1+h_3)}, \qquad \beta_2 = \frac{2(f_2)_{i,j} + h_4(f_4)_{i,j}}{h_2(h_2+h_4)}$$

$$\beta_3 = \frac{2(f_1)_{i,j} - h_1(f_3)_{i,j}}{h_1(h_1+h_3)}, \qquad \beta_4 = \frac{2(f_2)_{i,j} - h_2(f_4)_{i,j}}{h_2(h_2+h_4)}$$

(21)

Applying difference scheme (8) at every node in the defined domain yields an algebraic system with an equal number of equations and unknowns, representable as a matrix equation.

AX=B (22)

Under the following conditions

$$2(f_1)_{i,j} > \max[h_3|(f_3)_{i,j}|, h_1|(f_3)_{i,j}|]$$

$$2(f_2)_{i,j} > \max[h_2|(f_4)_{i,j}|, h_4|(f_4)_{i,j}|] (23)$$

We have β_0<0 and $|\beta_0|>\beta_1+\beta_2+\beta_3+\beta_4$(24)

i.e.the coefficient matrix A has positive off-diagonal entries, negative diagonal entries, and is diagonally dominant. Therefore, matrix A is irreducible, and these properties lead us to assume that the converging nature of the algebraic system.
In our linear partial differential equation problem given by (7), we havef_1=f_2=1,f_3=f_5=f_6=0 and $f_4 = \frac{k_e}{1+k_e y_3}$ for square grids h=k.
So,the condition (23) is fulfilled for all values of y_3 and k_e=0.0016/km.
An important point is that the elliptic equation approach based on support operators (which have applied in this finite difference scheme) that automatically gives the stability of the finite-difference schemes [39].

IV. NUMERICAL CALCULATIONS

Based on [1] and newer studies on rheological natureof crust and upper mantle of the Earth by [17], [35].
The model parameter values are taken as:$\mu_0 = 3 \times 10^{10}$ N/m^2.
D = 10 km (Fault depth from free surface ; most major earthquake faults are found a depth of approximately 10 to 15 kilometres).
$\tau_\infty(t)$ = Constant = $\tau_\infty = 2 \times 10^7$N/m^2. [post-seismic data indicate that in most cases, the stress released during major earthquakes is around 2×10^7N/m^2 or less; in rare instances, it may reach up to 4×10^7N/m^2].
We take the slip function $f(y_3) = (1 - \frac{3}{D^2}{y^2}_3 + \frac{2}{D^3}{y^3}_3)$ with ∇U = 0.01 m, fulfilling the restrictions described above in (B_1) to (B_2).
MATLAB program

```
clc; clear; close all;
% Define grid parameters
i_min = -300; i_max = 300; % Range for i
j_min = 0; j_max = 600; % Range for j
h = 1; % Step size in x-direction
k = 1; % Step size in y-direction
% Grid size
Nx = i_max - i_min + 1;
Ny = j_max - j_min + 1;
% Initialize U(i,j) matrix with zeros
U = zeros(Nx, Ny);
% Definey_j values
yj = linspace(j_min, j_max, Ny); % Creates y-values in range [0, 600]
% Precompute constant term
r = (h^2) / (k^2);
% Finite Difference Iteration
for i = 2:Nx % Loop over i (x-direction)
for j = 2:Ny % Loop over j (y-direction)
% Compute source term
source_term = h * (2/ 3*1000) *(1 + 0.0016 * yj(j));
% Compute u(i,j) using the finite difference scheme
U(i,j) = (r * U(i,j-1) + U(i-1,j) + source_term) / (1 + r);
end
end
% Display computed matrix
disp('Computed U(i,j) values:');
disp(U);
```

V. RESULTS AND DISCUSSIONS

A. Spatial variation before movement across the Fault

1) Causes of Deep strike-slip Earthquake:

The reason of deep and intermediate strike-slip Earthquake is not clear to the seismologist [16]. From the Figure **2**, it is observed that as we move down to earth the shear stress continues to accumulate at the greater depth. We thus may conclude that the continuous variation of rigidity with depth may be a possible reason of such deep-Earthquake.

2) Spatial prediction of Earthquake:

In Figure 3, assuming the value of critical stress τ_c = 200 bar, we see that at the nearer points of the fault for example y_2= -2 kilometers the accumulated shear stress exceeds τ_c at a depth 93km (approx..) i.e, the Deep-earthquake may occur. Similarly, the other deep earthquake may be predicted spatially.This spatial prediction of deep earthquake well agrees the data accessed on 26th May 2025 at 03:19:44 (IST), Lat: 24.21, Long: 94.44 (Myanmar), depth 96 km. (https://seismo.gov.in).Similarly,the spatial prediction of intermediate earthquake is also clear from Figure 3.

3) Symmetry /anti-symmetry nature of displacement:

From the Figure 4,we see that the displacement is not symmetric nor anti-symmetric with respect to $y_2 = 0$for all values of $y_3 \geq 0$. i.e, physically the opposite two block across the fault does not displace in the same ways.

B. Spatial variation after dislocation along the Fault

1) Shear Stress variation with depth:

From the Figure 5 it is observed that after the occurrence of deep strike slip earthquake the shear stress accumulation pattern drastically changes. Initially it accumulates at a higher rate near the free surface then decreases up to a certain depth (120km approx..), then again continues to accumulates at higher depth.Hence the possibility of shallow and intermediate earthquake (depth 5 to 80km.) is enhanced due to the deep earthquake.

2) Symmetry /anti-symmetry nature of displacement:

From the Figure 6 and Figure 7,we see that the symmetry and anti-symmetry nature of displacement about the fault remain unchanged as that before the fault movement but a quantitative change is observed and the displacement gradually decreases with distance from the fault and almost vanishes at distance $y_2 = -200$km.

Figure 10 & 11 shows the surface displacement after earthquake in the elastic two-layered model [32].The displacement is observed to be anti-symmetric across the fault and is of magnitude of few centimeters whereas in our model the surface displacement in not symmetric nor anti-symmetric i.e, a qualitative change is observed. Also, in our model the displacement is of order few millimeters. Therefore, a quantitative change is also observed in our model.

3) Displacement with the Variation of depth of the fault:

To locate the fault (specially for oceanic active buried fault) and to find its depth of the fault is a technologically challenging task but by measuring free surface strain/displacement using our scheme, we can easily do it and Figure 8 shows, the free surface displacement due to different depth of the fault.It is observed that as depth of the fault increases the displacement decreases.

4) Variation of displacement of different values of Slip:

From the Figure9, it indicates that with increasing slip, displacement increases with depthand attains its maximum near the middle of the fault and then decreases attaining minimum near the bottom edge of the fault then after again increases with depth.

5) Surface Shear Strain Variation:

Figure 12 indicates, the magnitude of shear strain at the free surface is of order 10^{-4} which well agrees with the observed data [16] and [37]. Therefore, our depth dependent model well agrees with observed ground deformation.

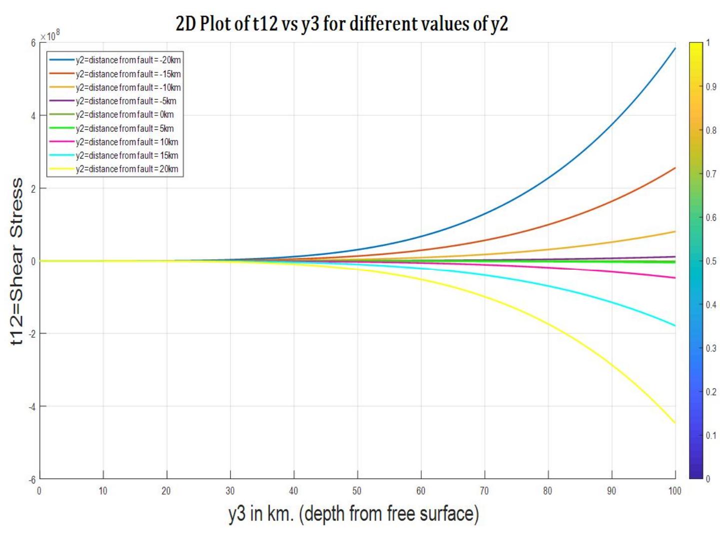


Fig. 2 Shear Stress τ_{12} vs. y_3 for different values of y_2(before fault dislocation)

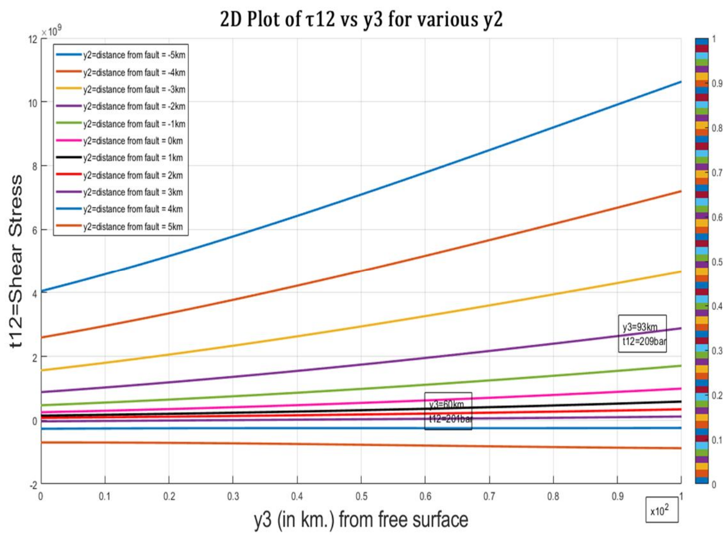


Fig. 3 Shear Stress τ_{12} vs. y_3 for different values of y_2 (before fault dislocation)

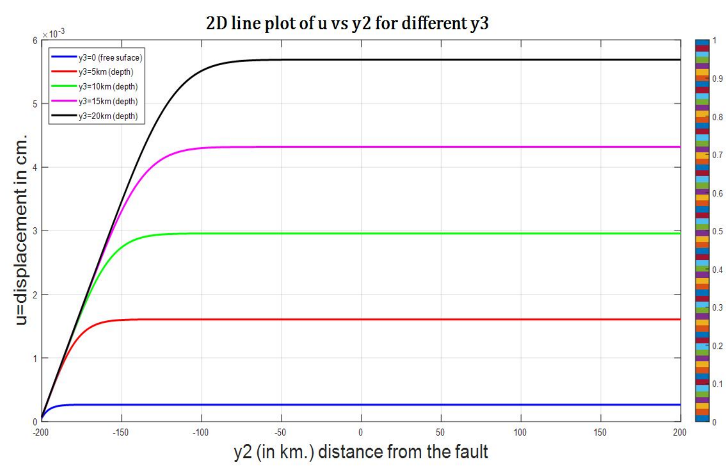


Fig. 4 Displacement u vs. y_2 for different values of y_3 (before fault dislocation)

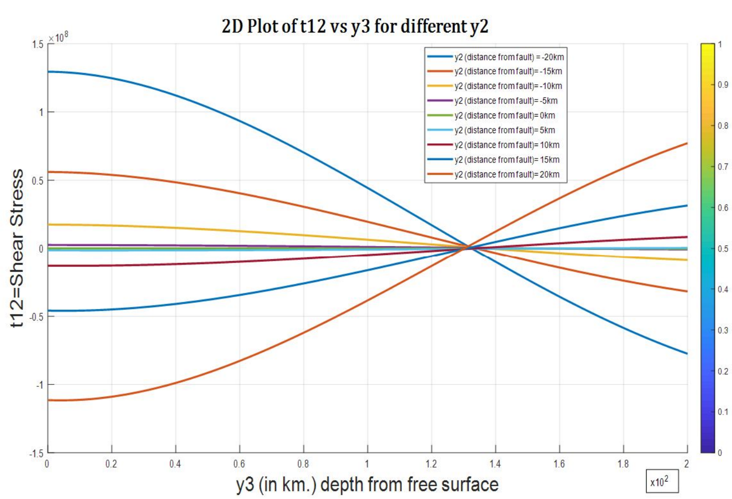


Fig. 5 Shear Stress τ_{12} vs. y_3 for different values of y_2 (after fault dislocation)

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com
National Conference on Integrated Approaches to Sustainable Innovation 2026 (IASI 2026)

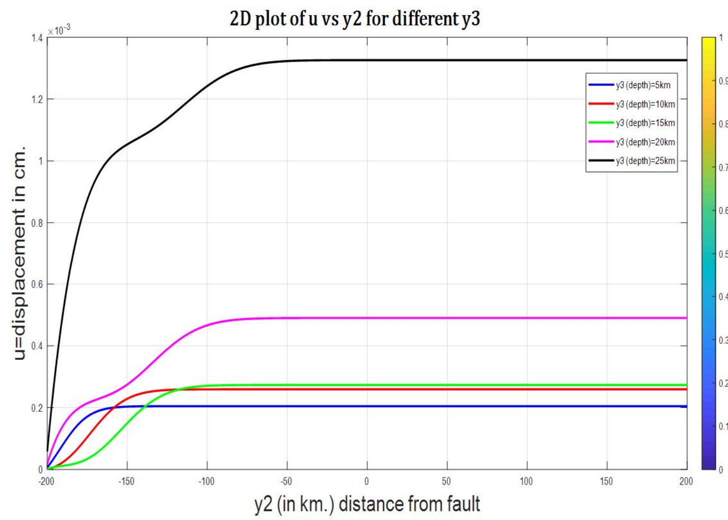


Fig. 6 Displacement u vs. y_2 for different values of y_3 (after fault dislocation)

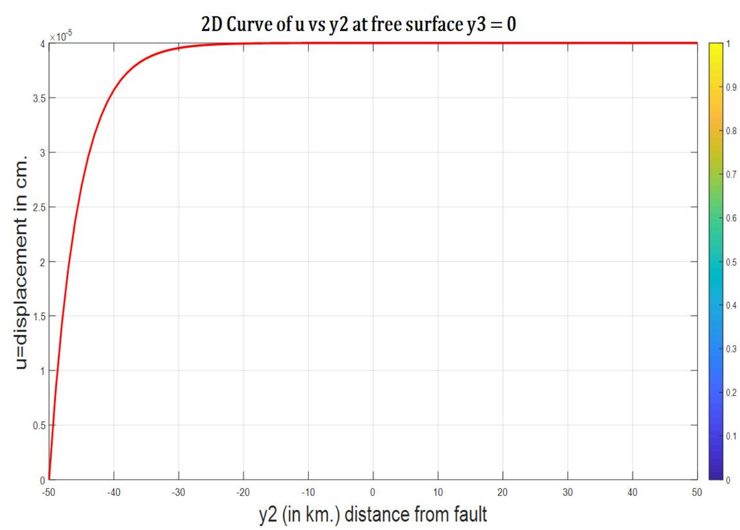


Fig. 7 Displacement u vs. y_2 at free surface y_3=0 (after fault dislocation)

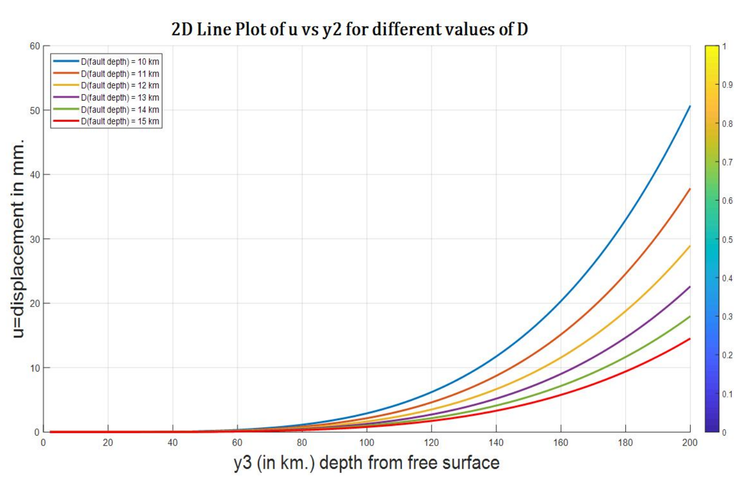


Fig. 8 Displacement u vs. y_3 for different values of the depth D of the fault (after fault dislocation)

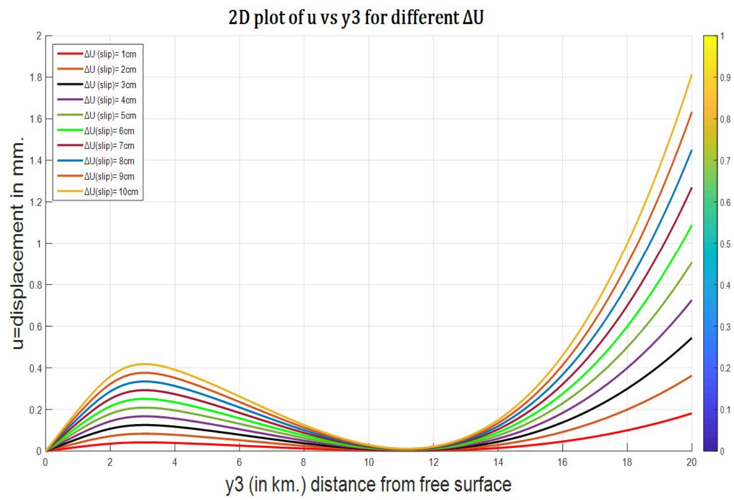


Fig. 9 Displacement u (in cm.) vs. y_3 for different values of slip ΔU (in cm).

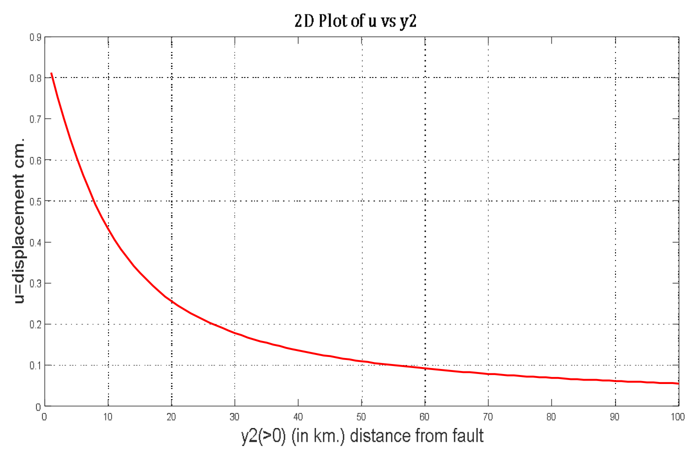


Fig. 10 Surface Displacement u vs $y_2(>0)$ (distance from the fault) after earthquake

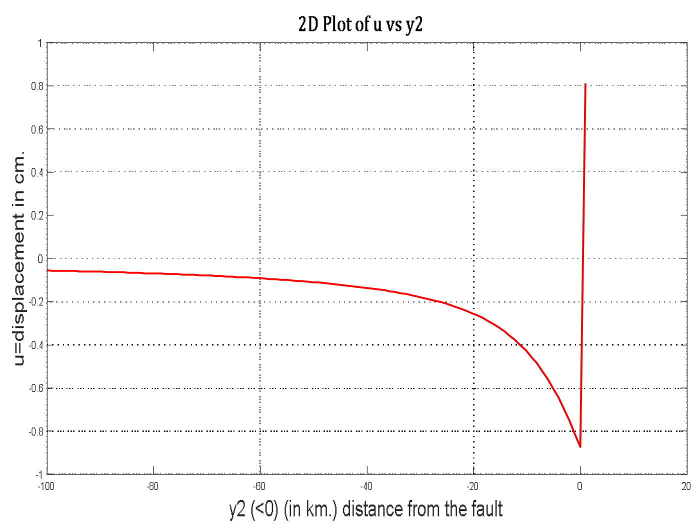


Fig. 11 Surface Displacement u vs y_2 (<0) (distance from the fault) after earthquake

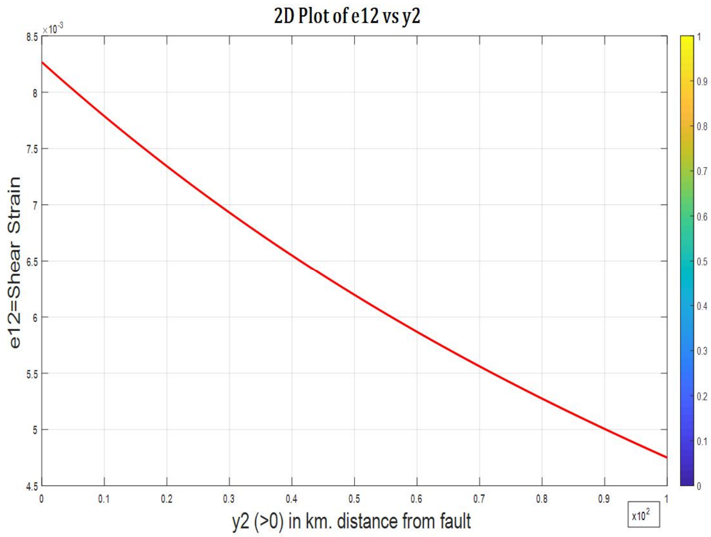


Fig. 12 Surface Shear Strain e_{12} vs y_2 (>0) (distance from the fault) after earthquake

VI. CONCLUSION

The variation of rigidity with depth from the free surface of the Earth may be responsible for greater rate of accumulation of elastic energy at the greater depth leading to deep strike slip Earthquake and as a consequence, the deep earthquake triggers the possibility of shallow earthquakes.This spatial prediction of deep earthquake well agrees with the data accessed on 26th May 2025 at 03:19:44 (IST), Lat: 24.21, Long: 94.44 (Myanmar), depth 96 km. (https://seismo.gov.in).Similarly,the spatial prediction of intermediate earthquake is also clear from Figure 3.

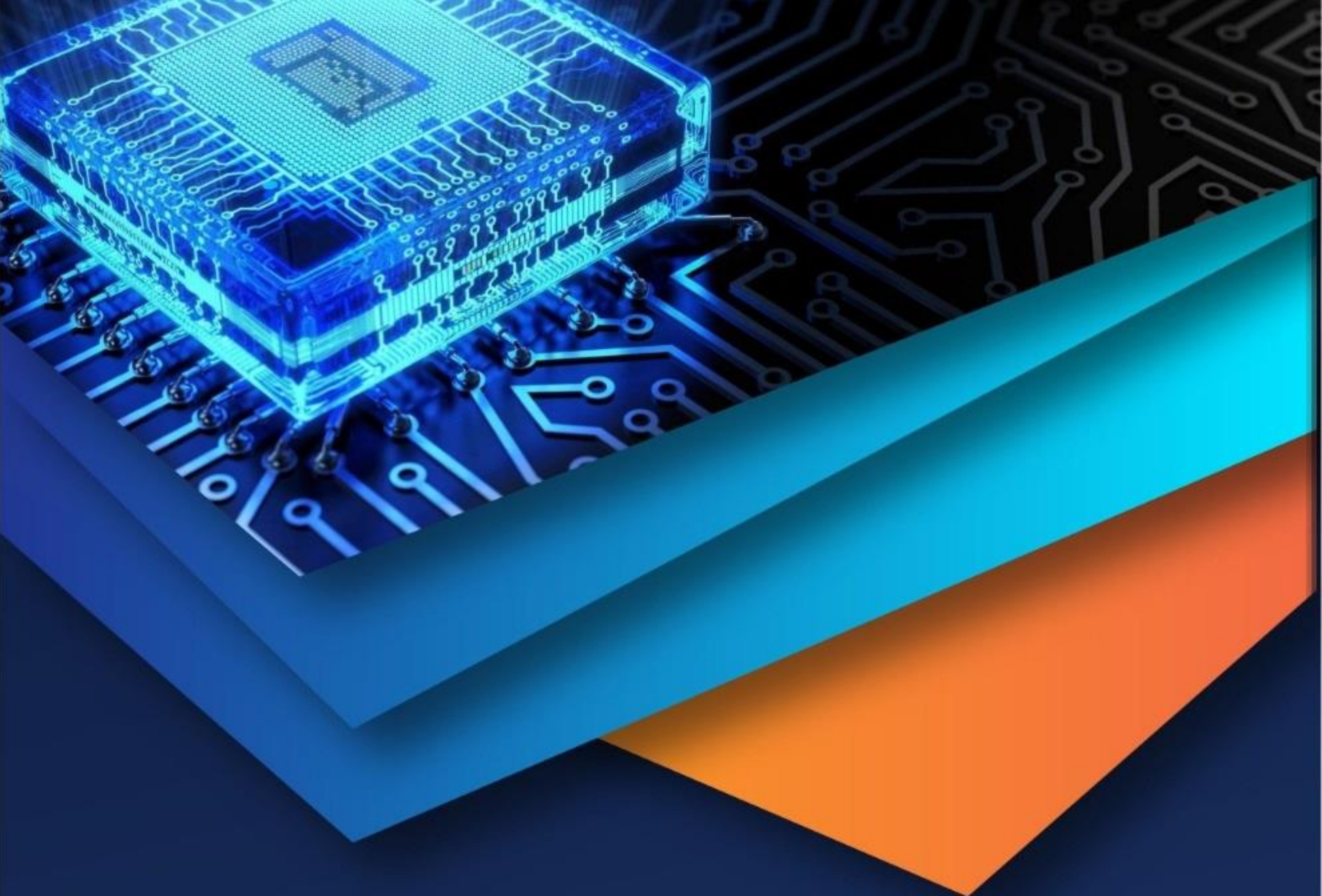
VII. ACKNOWLEDGMENT

All the authors deeply acknowledge their institutions for allowing them to pursue the research.

REFERENCES

[1] K. Aki and P. G. Richards, Quantitative Seismology: Theory and Methods, 2nd ed., W. H. Freeman, San Francisco, California, 1980.
[2] A. Ben-Menahem and A. Gillon, “Crustal deformation by earthquakes and explosions,” Bulletin of the Seismological Society of America, vol. 60, no. 1, pp. 193–323, 1971.
[3] M. A. Chinnery, “The deformation of the ground around surface faults,” Bulletin of the Seismological Society of America, vol. 51, pp. 355–372, 1961.
[4] M. A. Chinnery, “The strength of the Earth’s crust under horizontal shear stress,” Journal of Geophysical Research, vol. 69, pp. 2085–2089, 1964.
[5] M. A. Chinnery, “The vertical displacements associated with transcurrent faulting,” Journal of Geophysical Research, vol. 70, pp. 4627–4632, 1965.
[6] M. A. Chinnery and B. J. Dushan Jovanovich, “Effect of the Earth’s layering on earthquake displacement field,” Bulletin of the Seismological Society of America, vol. 62, pp. 1629–1646, 1972.
[7] P. Chift, J. Lin, and U. Barcktiausen, “Marine and Petroleum Geology,” Marine and Petroleum Geology, vol. 19, pp. 951–970, 2002.
[8] C.-Y. Wu, X.-Y. Liu, A. Scarpas, and X. R. Ge, “Spectral Element Approach for Forward Model of 3D Layered Pavement,” Journal of CMES, vol. 12, no. 2, pp. 149–157, 2006.
[9] S. C. Cohen, “Post seismic viscoelastic surface deformations and stress-I: Theoretical considerations, displacements and strains calculations,” Journal of Geophysical Research, vol. 85, no. B6, pp. 3131–3150, 1980.
[10] S. C. Cohen, “Post seismic deformation and stress diffusion due to viscoelasticity and comments on the modified Elsasser model,” Journal of Geophysical Research, vol. 97, no. B11, p. 15395, 1992.
[11] S. K. Debnath and S. Sen, “Pattern of stress-strain accumulation due to a long dip-slip fault movement in a viscoelastic layer over a viscoelastic half-space model of the lithosphere–asthenosphere system,” International Journal of Applied Mechanics and Engineering, vol. 18, no. 3, pp. 653–670, 2013.
[12] U. Ghosh, A. Mukhopadhyay, and S. Sen, “On two interacting creeping vertical surface-breaking strike-slip faults in a two-layered model of lithosphere,” Physics of the Earth and Planetary Interior, vol. 70, pp. 119–129, 1992.
[13] J.-W. Huang, T. Bohlen, and B. Milkereit, Numerical Solutions of Seismic Scattering in Heterogeneous Media, vol. 31, no. 09, 2006.
[14] M. K. Jain, S. R. K. Iyengar, and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th ed., New Age International Publishers, 2009.
[15] J. Kasahara, “Crustal deformation associated with a fault formation estimated by the finite element method,” Bulletin of the Earthquake Research Institute, vol. 53, pp. 339–357, 1978.
[16] K. Kasahara, Earthquake Mechanics, Cambridge University Press, 1981.
[17] S.-I. Karato, “Rheology of the Earth’s mantle: A historical review,” Gondwana Research, vol. 18, no. 1, pp. 17–45, 2010.

[18] R. A. Koseluk and R. E. Bischke, “An elastic rebound model for normal fault earthquakes,” Journal of Geophysical Research, vol. 86, no. B2, pp. 1081–1091, 1981.
[19] P. Kundu, S. S. Mondal, and D. Mondal, “Creeping effect across a buried, inclined, finite strike-slip fault in an elastic-layer overlying an elastic half-space,” GEM-International Journal on Geomathematics, vol. 12, no. 2, 2021.
[20] A. E. H. Love, A Treatise on the Mathematical Theory of Elasticity, Cambridge University Press, 1892.
[21] Y. Mamada, Y. Kuwahara, H. Ito, and H. Takenaka, “3-D finite difference simulation of seismic fault zone waves—Application to the fault zone structure of the Mozumi-Sukenobo fault, central Japan,” Earth Planets Space, vol. 54, pp. 1055–1058, 2002.
[22] T. Maruyama, “Statical elastic dislocations in an infinite and semi-infinite medium,” Bulletin of the Earthquake Research Institute, Tokyo University, vol. 42, pp. 289–368, 1964.
[23] T. Maruyama, “On two dimensional dislocations in an infinite and semi-infinite medium,” Bulletin of the Earthquake Research Institute, Tokyo University, vol. 44, part 3, pp. 811–871, 1966.
[24] M. Matsu’ura and R. Sato, “Static deformation due to fault spreading over several layers in multilayered medium Part-II: Strain and tilt,” Journal of the Physics of the Earth, vol. 23, no. 1, pp. 12–33, 1975.
[25] H. L. Melosh and A. Raefsky, “Anelastic response of the Earth to a dip-slip earthquake,” Journal of Geophysical Research, vol. 88, no. B1, pp. 515–526, 1983.
[26] S. C. Mondal and S. Debsarma, “A mathematical model to study the stress distribution due to a strike slip fault creeping with a reducing velocity,” Bulletin of Calcutta Mathematical Society, vol. 110, no. 4, pp. 265–280, 2018.
[27] A. Mukhopadhyay and P. Mukherjee, “On stress accumulation and fault slip in lithosphere,” Mausam, vol. 30, no. 2–3, pp. 353–358, 1979.
[28] A. Mukhopadhyay, S. Sen, and B. P. Paul, “On stress accumulation in a viscoelastic lithosphere containing a continuously slipping fault,” Bulletin Society of Earthquake Technology, vol. 17, no. 1, pp. 1–10, 1980.
[29] A. Mukhopadhyay, S. Sen, and B. P. Paul, “On stress accumulation near a continuously slipping fault in a two layered model of lithosphere,” Bulletin Society of Earthquake Technology, vol. 17, no. 4, pp. 29–38, 1980.
[30] A. Nur and G. Mavko, “Post-seismic viscoelastic rebound,” Science, vol. 183, no. 4121, pp. 204–206, 1974.
[31] S. Rani and S. J. Singh, “Static deformation of a uniform half space due to a long dip-slip fault,” Geophysical Journal International, vol. 109, pp. 469–476, 1992.
[32] K. Rybicki, “The elastic residual field of a very long strike slip fault in the presence of a discontinuity,” Bulletin of the Earthquake Research Institute, vol. 61, pp. 79–92, 1971.
[33] K. Rybicki and K. Kasahara, “A strike-slip fault in a laterally inhomogeneous medium,” Tectonophysics, vol. 42, no. 2–4, pp. 127–138, 1977.
[34] R. Sato, “Stress drop of finite fault,” Journal of Physics of the Earth, vol. 20, no. 4, pp. 397–407, 1972.
[35] R. Sato and M. Matsu’ura, “Static deformation due to fault spreading over several layers in multilayered medium Part-I: Strain and tilt,” Journal of the Physics of the Earth, vol. 23, no. 1, pp. 12–33, 1975.
[36] J. C. Savage, “Displacement field for an edge dislocation in layered half space,” Journal of Geophysical Research, vol. 103, no. B2, pp. 2439–2446, 1998.
[37] P. Segal, Earthquake and Volcano Deformation, Princeton University Press, 2010.
[38] S. Sen, S. Sarker, and A. Mukhopadhyay, “A creeping and surface breaking long strike-slip fault inclined to the vertical in a viscoelastic half space,” Mausam, vol. 44, no. 4, pp. 365–372, 1993.
[39] M. Shashkov, Conservative Finite-Difference Methods on General Grids, 1st ed., CRC Press, 1996.
[40] S. J. Singh and M. Rosenman, “Quasi static deformation of a viscoelastic half-space by a displacement dislocation,” Physics of the Earth and Planetary Interiors, vol. 8, no. 1, pp. 87–101, 1974.
[41] J. A. Steketee, “On Volterra’s dislocations in a semi-infinite medium,” Canadian Journal of Physics, vol. 36, no. 2, pp. 192–205, 1958.
[42] J. A. Steketee, “Some geophysical applications of the theory of dislocations,” Canadian Journal of Physics, vol. 36, no. 9, pp. 1168–1198, 1958.
[43] J. Wahir and M. Wyss, “Interpretation of post-seismic deformation with a viscoelastic relaxation model,” Journal of Geophysical Research, vol. 85, no. B11, pp. 6471–6477, 1980.
[44] J. L. White, Finite Elements in Linear Viscoelasticity, Defence Technical Information Centre, Ft. Belvoir, 1968.
[45] M. Yang and M. N. Toksoz, “Time dependent deformation and stress relaxation after strike slip earthquakes,” Journal of Geophysical Research, vol. 86, no. B4, pp. 2889–2901, 1981.
[46] S. Zhao, R. D. Muller, Y. Takahashi, and Y. Kaneda, “3-D finite-element modelling of deformation and stress associated with faulting: effect of inhomogeneous crustal structures,” Geophysical Journal International, vol. 156, pp. 1–18, 2004.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)