

Matlab code:-

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% Parameters

L = 150; % length of the square domain

t_final = 500; % simulation time

n = 668; % number of grid points in each direction

dx = L/n; % grid spacing

dt = 1; % time step size

k = 1; % thermal conductivity

T_init = 0; % initial temperature

T_source = 1; % temperature of the heat source

source_speed = 5; % speed of the heat source

% Create a mask for the heat source

[X, Y] = meshgrid((1:n)*dx, (1:n)*dx);

source_mask = ((X - 0.1*L).^2 + (Y - 0.1*L).^2 <= (0.05*L)^2);

% Initial conditions

T = T_init*ones(n,n);

T_new = T;

% Initialize variables for heat source movement

heat_source_phase = 1;

% Main loop

t = 0;

while t < t_final

% Update temperature at interior points

for i = 2:n-1

for j = 2:n-1

T_new(i,j) = T(i,j) + k*dt/(dx^2)*(T(i+1,j) + T(i-1,j) + T(i,j+1) + T(i,j-1) - 4*T(i,j));

end

end

% Apply Neumann boundary conditions at edges

T_new(1,:) = T_new(2,:);
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T_new(n,:) = T_new(n-1,:);
T_new(:,1) = T_new(:,2);
T_new(:,n) = T_new(:,n-1);

% Update temperature at heat source
T_new(source_mask) = T_source;

% Update heat source position
shift = round(source_speed*dt/dx);

if heat_source_phase == 1
source_mask = circshift(source_mask, [0,shift]);
if sum(sum(source_mask(:,end-shift:end))) > 0
heat_source_phase = 2;
end
elseif heat_source_phase == 2
source_mask = circshift(source_mask, [shift,-2 ]);
if sum(sum(source_mask(end-shift:end,:))) > 0
heat_source_phase = 3;
end
elseif heat_source_phase == 3
source_mask = circshift(source_mask, [0, shift]);
if sum(sum(source_mask(:,1:shift))) > 0
heat_source_phase = 4;
end
elseif heat_source_phase == 4
source_mask = circshift(source_mask, [0,-shift]);
if sum(sum(source_mask(:,1:shift))) > 0
heat_source_phase = 5;
end
elseif heat_source_phase == 5
source_mask = circshift(source_mask, [-2,shift]);
if sum(sum(source_mask(:,end-shift:end))) > 0
heat_source_phase = 6;

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end

else heat_source_phase == 6

source_mask = circshift(source_mask, [0,-shift]);

if sum(sum(source_mask(:,1:shift))) > 0

heat_source_phase = 1;

end

end

% Update time and temperature

t = t + dt;

T = T_new;

% Plot temperature

imagesc(T);

colorbar;

axis equal tight;

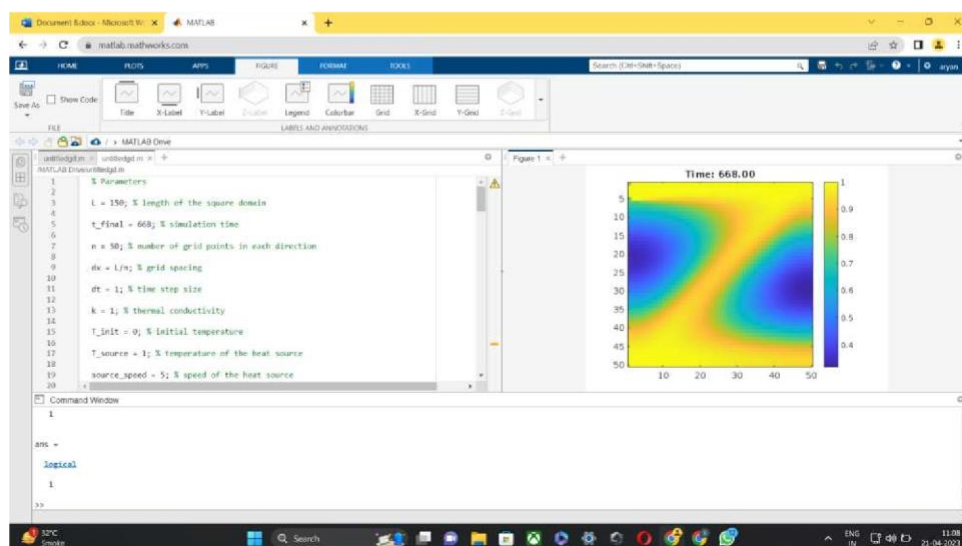
title(sprintf('Time: %0.2f', t));

drawnow;

end

```

Result:-



[Fig. After 10 rounds of moving heat source in Z shape]