function [rate, time] = microcircuit\_model(duration, columns, units, C, tau\_vector, Iext\_vector, sigma, dt, ds, r)

%time steps;

t\_steps = 0:dt:duration;

D = length(t\_steps);

%tau\_vector

tau\_all = repmat(tau\_vector,columns,1);

%external\_input\_vector

Iext\_all = repmat(Iext\_vector, columns,1);

%noise\_vector

sigma\_all = repmat(sigma, columns\*units,1);

% transfer functions:

F = @(x) x./(1 - exp(-x/1));

%downsampling

D\_ds = length(0:ds\*dt:duration)-1;

time = 0:ds\*dt:(D\_ds-1)\*ds\*dt;

rate = zeros(columns\*units,D\_ds);

tt = 0;

%Model simulation

for t = 1:D

u = C\*r + Iext\_all;

K = feval(F,u);

r = r + dt\*(-r + K)./tau\_all + sqrt(dt)\*sigma\_all.\*randn(columns\*units,1);

r = abs(r);

if mod(t,ds)==0

tt=tt+1;

rate(:,tt) = r;

end

end