**%% Part B – coexistence**

r0 = [-0.03; -0.05]; % population reproduction rates, per hour

CSD = 10; % total initial cells

K = 1e5; % Michaelis-Menten coefficient, fmole/ml

ExtTh = 1e-16;

DilTh = 1e16; % coculture dilution threshold

tau0 = 0;

tauf = 300; % in hours

dtau = 0.01; % in hours, cell growth update and uptake timescale

at = 1; % avg. consumption values (fmole per cell); alpha\_ij: population i, resource j

bt = 1; % avg. production rates (fmole per cell per hour); beta\_ij: population i, resource j

Nr = 1; % number of rounds of propagation

KC = K\*[1.1 0;

1 1];

rc = [10; 13]; % Nc\*1 matrix of resource-mediated fitness benefit

Nc = length(r0);

Nm = length(KC);

rp0 = 1/Nc\*ones(1,Nc);

%% Connectivity, Nm\*Nc

P = [1 1; 0 1]; % consumption

R = [0 0; 1 0]; % release

%% Rates, Nm\*Nc

alpha = at\*P; % consumption rates

beta = bt\*[0 0; 1 0]; % mediator release rates

beta0 = bt\*[100 0]; % resource supply rates

%% interaction matrix, Nc\*Nm

A = (P.\*alpha)'; % consumption matrix

B = (R.\*beta)'; % release matrix

**%% Part C – exclusion**

r0 = [-0.03; -0.05]; % population reproduction rates, per hour

CSD = 10; % total initial cells

K = 1e5; % Michaelis-Menten coefficient, fmole/ml

ExtTh = 1e-16;

DilTh = 1e16; % coculture dilution threshold

tau0 = 0;

tauf = 300; % in hours

dtau = 0.01; % in hours, cell growth update and uptake timescale

at = 1; % avg. consumption values (fmole per cell); alpha\_ij: population i, resource j

bt = 1; % avg. production rates (fmole per cell per hour); beta\_ij: population i, resource j

Nr = 1; % number of rounds of propagation

KC = K\*[1 0;

1 1]; % Nm\*Nc, Kij values

rc = [12; 9]; % Nc\*1 matrix of resource-mediated fitness benefit

Nc = length(r0);

Nm = length(KC);

rp0 = 1/Nc\*ones(1,Nc);

%% Connectivity, Nm\*Nc

P = [1 1; 0 1]; % consumption

R = [0 0; 1 0]; % release

%% Rates, Nm\*Nc

alpha = at\*P; % consumption rates

beta = bt\*[0 0; 1 0]; % mediator release rates

beta0 = bt\*[100 0]; % resource supply rates

%% interaction matrix, Nc\*Nm

A = (P.\*alpha)'; % consumption matrix

B = (R.\*beta)'; % release matrix

**%% Part D – resurgence**

r0 = [-0.02; -0.01]; % population reproduction rates, per hour

CSD = 10; % total initial cells

K = 1e5; % Michaelis-Menten coefficient, fmole/ml

ExtTh = 1e-16;

DilTh = 1e16; % coculture dilution threshold

tau0 = 0;

tauf = 3000; % in hours

dtau = 0.01; % in hours, cell growth update and uptake timescale

at = 1; % avg. consumption values (fmole per cell); alpha\_ij: population i, resource j

bt = 0.1; % avg. production rates (fmole per cell per hour); beta\_ij: population i, resource j

Nr = 1; % number of rounds of propagation

KC = K\*[1 0;

2 1]; % Nc\*Nm

rc = [15; 25]; % Nc\*1 matrix of resource-mediated fitness benefit

Nc = length(r0);

Nm = length(KC);

rp0 = 1/Nc\*ones(1,Nc);

%% Connectivity, Nm\*Nc

P = [1 1; 0 1]; % consumption

R = [0 0; 1 0]; % release

%% Rates, Nm\*Nc

alpha = at\*P; % consumption rates

beta = bt\*[0 0; 10 0]; % mediator release rates

beta0 = bt\*[10 0]; % resource supply rates

%% interaction matrix, Nc\*Nm

A = (P.\*alpha)'; % consumption matrix

B = (R.\*beta)'; % release matrix