Instructor Lecture and Matlab Demonstration:

Sequence of matrix-vector products: newu = Au + d

Application to pollutant in river (Project4): u is column vector of concentrations

Model: \[ u(i,k+1) = (1 - \text{vel} \frac{dt}{dx} - \text{dec} \frac{dt}{dx}) u(i,k) + \text{vel} \frac{dt}{dx} u(i-1,k) \]

\[ u(1,k) \] given source

\[ u(i,k) \] unknown concentrations for \( i = 2:n+1 \)

bbpoll1d4.m (get this off the www site)

```matlab
% bare bones version of poll1d with n = 4 cells in stream
% L = 10; n = 4; dx = L/n; x = 0:dx:L;
T = 240; K = 24; dt = T/K; t = 0:dt:T;
vel = 0.1
dec = 0.01
source = 10.0
a = 1 - (dt/dx)*vel - dt*dec % needs to be positive
b = (dt/dx)*vel
A = [a 0 0 0; b a 0 0; 0 b a 0; 0 0 b a]
d = [b*source 0 0 0]'
u = zeros(5,K+1); u(1,1:K+1) = source;
% for k = 1:K
% u(2:5,k+1) = A*u(2:5,k) + d; % intrinsic matrix-vector product
% for i = 2:5
% u(i,k+1) = b*u(i-1,k) + a*u(i,k); % sparse matrix-vector product
end
% mesh(x,t,u')
inv(eye(4) - A)*d % steady state approximation
```

poll1d.m (get this off the www site)

**Student Matlab Computations:**

Experiment with poll1d4.m: vary vel, dec, K and n

**Student Multiple Choice Questions:**

Go to moodle, login, choose ma116 and answer the multiple choice questions.