**MATLAB EXERCISE 2.24** **Parallel-plate capacitor with multiple sectors.** Repeat the previous MATLAB exercise but for a parallel-plate capacitor with $N$ dielectric sectors placed like in Fig.2.13(b) (from the book). *(ME2_24.m on IR)*

**SOLUTION:**

We test the program for $N = 3$, the separation between the plates $d = 1$ cm, and the material parameters for the dielectric sectors 1, 2, and 3 given by polystyrene ($\varepsilon_r = 2.56$, $E_{cr} = 20$ MV/m), quartz ($\varepsilon_r = 5$, $E_{cr} = 1000$ MV/m), and silicon ($\varepsilon_r = 11.9$, $E_{cr} = 30$ MV/m). The breakdown occurs in dielectric sector 1. The breakdown voltage of the capacitor is $V_{cr} = 200$ kV.

```
%
%   Book: MATLAB-Based Electromagnetics (Pearson Prentice Hall)
%   Author: Branislav M. Notaros
%   Instructor Resources
%   (c) 2011
%
%   This MATLAB code or any part of it may be used only for
%   educational purposes associated with the book
%
%
%

% Parallel-plate capacitor with N dielectric sectors.
% This program calculates breakdown voltage in parallel plate capacitor
% with arbitrary number of dielectric sectors normal to the capacitor
% plates.

clear all;
close all;

% Number of dielectric sectors
N = input('Enter the number of dielectric sectors normal to capacitor plates: ');

% Dielectric strength for each dielectric sector
for i = 1:N
    Ecr(i) = input(['Enter dielectric strength (in MV/m) for ',int2str(i),'. sector: ']);
    Ecr(i) = Ecr(i)*10^6;
end;
% The plate separation
d = input('Enter the plate separation (in mm) of the capacitor: ');
d = d/1000;

% Maximum of electric field intensity vector in each sector - before breakdown
[Emin,index] = min(Ecr);
fprintf(['Breakdown occurs in ',int2str(index),'. dielectric sector']);
% Breakdown voltage
Vcr = Emin*d;
fprintf('Breakdown voltage is: %f V.\n',Vcr);
```