3.8.4 Other lattice scales

The preceding two sections illustrated the use of the lattice cell approach, first on the small scale associated with an individual fuel rod and then on the somewhat larger scale associated with an individual control rod. Finally it should be noted that many other lattice cell approaches are possible. For example the square cross-section fuel assembly sketched in figure 1 is repeated across a PWR core and this can be utilized to investigate inhomogeneous effects on that scale. For
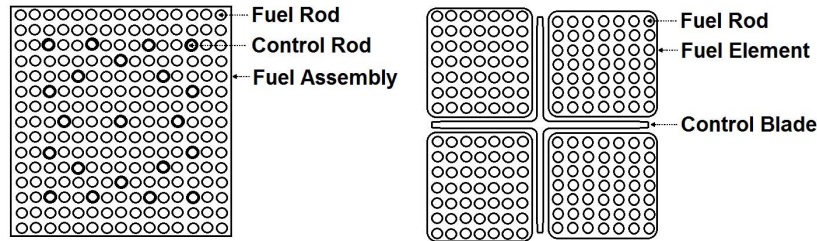

Figure 1: Cross-sections of PWR (left) and BWR (right) fuel assemblies.

such square cross-section lattice cells the diffusion equation 5, section 3.6.3, has solutions of the form

$$\phi = C \cos\left(B_m x/2^{1/2}\right)\cos\left(B_m y/2^{1/2}\right) \tag{1}$$

where the origin of the (x, y) coordinate system is taken to be the center of the square cross-section. Solutions like equation 1 combined with the fact that the diffusion equations permit superposition of solutions allow the construction of a variety of other lattice cell solutions to that equation.

However, it is important to note in closing that these diffusion equation approaches involve many approximations and can only be considered to provide qualitative estimates and guidance. Precise, quantitative assessment of the neutronics of a reactor core are much more complex (see, for example, Duderstadt and Hamilton 1976) and require much greater computational effort.