

3.6.7 Lattice cell calculations

A third set of assumptions involve the averaging over the various materials that make up a reactor core. The fuel rods, control rods, moderator, coolant channels, etc. in a reactor are usually arranged in *lattice cells* that are repeated across the cross-section of the core (see section 4.3.4). Thus there are several structural or material scales (dimensions), a small common scale being the diameter of the fuel rods. Another, larger scale would be the dimension of the lattice. In the preceding sections it was assumed that the core was effectively homogeneous; this is the case when the material inhomogeneity dimension is small compared with the typical mean free path of the neutrons. In a light water reactor (LWR) the typical mean free path is of the order of centimeters and therefore comparable with the diameter of a fuel rod. In contrast, a fast breeder reactor has typical mean free paths of the order of tens of centimeters but similar fuel rod dimensions and so the inhomogeneity is less important in fast reactor calculations.

When, as in a LWR, the inhomogeneity is important there will be significant differences between the neutron flux within the fuel rods and that in the moderator or coolant. Practical reactor analysis and design requires detailed calculation of these differences and this is effected using numerical codes called *heterogeneous lattice cell calculations*. Approximate diffusion theory methods used to evaluate these inhomogeneity effects in real reactors are briefly discussed in section 3.8.