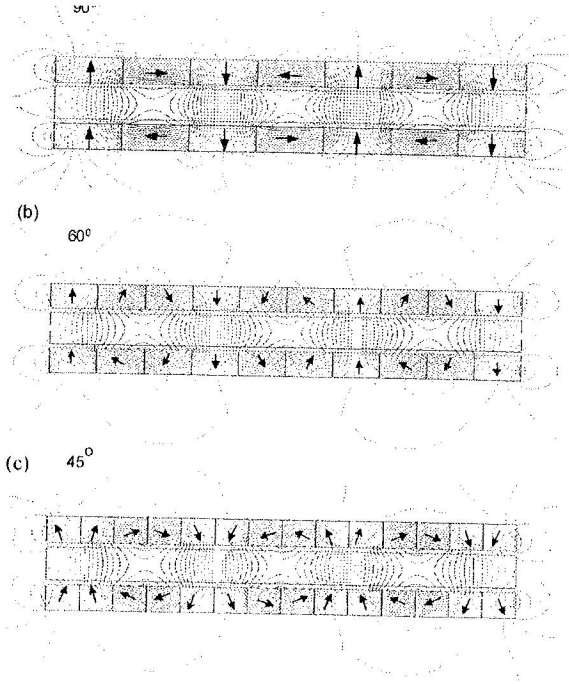

Figure 6.5. Arrangement of the twin rotor PMs in 90°, 60°, and 45° Halbach array.

To obtain a high power (or high torque) density motor, the magnetic flux density in the air gap should be as high as possible. This can be achieved by using PMs arranged in "Halbach array" (Figs 3.15, 6.3 and Fig 6.4). The magnetic flux density distribution excited by Halbach arrays is described by eqns (3.42) to (3.46). In practice, the angle between magnetization vectors of adjacent magnets is 90°, 60° or 45° (Fig. 6.5).

6.3 Air gap magnetic flux density

Fig. 6.6 shows the results of the 2D FEM modelling of the magnetic field in the air gap of a coreless AFPM brushless machine. NdFeB magnets with remanent flux density $B_r = 1.2$ T and coercivity $H_c = 950$ kA/m have been considered. The thickness of each PM has been assumed 6 mm, the coreless stator winding thickness is 10 mm and one-sided air gap thickness equals to 1 mm.

With the aid of Halbach array a high peak value (over 0.6 T) of the normal component of the magnetic flux density has been excited. This value is sufficient to obtain a high electromagnetic torque. The peak value of the flux density can be even higher for the optimized magnetic circuit of an AFPM ma-