2. From fig. 5.4, it is seen that the mna shifts in the direction of rotation for generator operation, and in the direction opposite to rotation for motor operation. Thus brush shift (which is in the same direction as the mna shift) cannot be used with motors intended to run in both directions, or with machines intended for variable mode of operation :if brush shift is correct for one case, it is incorrect for the other.

3. Brush shift :causes demagnetizing armature reaction

Because of these disadvantages, brush shift is used only in small fractional horsepower machines (rated power less than one hp) where it is not economical to use interpoles. Brush shift was also used in old machines before the invention of interpoles.

6.9 Exercises

6.1 The armature of a dc machine has 268 coils and rotates at 900 rpm. Each brush covers four commutator segments. Find the time for one revolution of the armature, and the interval during which a brush short-circuits a coil.

6.2 The armature of an 8-pole machine has 375 coils connected in simple lap. Each segments of the commutator are 9.5 mm wide, and the mica insulation between segments is 1.3 mm wide. The brush width is 38mm.

a. Find the diameter of the commutator.

b. Find the commutation interval.

c. for what fraction of a revolution is a coil short-circuited by brushes? For what fraction is it active?

d. on average, how many coils are short-circuited by brushes at any given instant?

6.3 A 4-pole lap-wound dc machine has 65 armature coils; the inductance of each coil is 0.02 mH. Each brush covers two commutator segments; the width of insulation between adjacent segments is 1/7 the width of the copper. The armature current is 80 A, and the speed is 1150 rpm. Assuming linear commutation, find the reactance voltage in coils under-going commutation.

6.4 An 8-pole dc generator has 156 slots and 312 commutator segments. The armature coils are connected in simple lap, with each coil made up of four turns. The armature rotates at 670 rpm; its length and diameter are 40 cm and 30 cm respectively. Each brush covers 3.5 segments.

a) Find the time interval during which the coil is short –circuited by brush.

b) If the machine is fitted with interpoles, find the number of turns of each interpole coil.

6.5 A shunt motor draws 75 A at 220 V and 650 rpm. The field current is 3 A. the armature has 41 slots, and the commutator has 123 segments. Each armature coil has 4 turns and carries a current of 12 A. if the machine has interpoles, how many turns should each interpole coil have?

6.6 A 4- pole dc motor has interpoles, and rotates counterclockwise.

a) Draw a developed diagram indicating the currents in the armature, main field coils, and interpole coils. Also sketch the various mmf distributions, and the resultant air gap flux distribution.

b) draw the machine cross-section and sketch the flux distribution.

6.7 show by means of suitable diagrams that when the direction of rotation of a motor is reversed, the interpoles continue to do their job correctly.

6.8 in which mode of operation of a dc machine does the interpole have the polarity of the main pole that comes after it ?

6.9 justify the following statement: if the interpole winding is left unexcited, commutation will be much worse than if the machine did not have interpoles.

6.10 draw a developed diagram covering two poles of a large machine that has interpoles as well as compensation windings. Indicate all currents, and sketch their mmf distributions. Also sketch the resultant flux density distribution in the air gap.

6.11 A 6-pole dc machine has 95 slots, the armature winding is connected in simple wave with 2 coil sides per slot per layer, and 3 turns per coil. The pole arc covers 70% of the pole pitch.

a) Find the number of turns in each interpole coil if the machine has interpoles but no compensation winding.

b) Find the number of conductors in each pole face if the machine is fitted with a compensation winding.

c) Find the number of turns in each interpole coil if the machine has interpole as well as a compensating winding.

6.12 in section 5.5 it was stated that the brushes may be shifted from the q-axis unintentionally, for example due to incorrect positioning, or they may be shifted intentionally to improve commutation, as explained in section 6.5.3. in section 5.5 it was also stated that, when the brushes are shifted, armature reaction may be magnetizing or demagnetizing. Sketch suitable developed diagrams to verify that when the brushes are shifted to improve commutation, armature reaction is always demagnetizing.

6.13 give two ways in which over commutation can occur.

6.14 on which axis of the machine does each of the following act:

(i) shunt field winding, (ii) series field winding, (iii) permanent magnets, (iv) demagnetizing armature reaction, (v) normal armature reaction, (vi) interpole winding, and (vii) compensating winding.

6.1 66. 7 ms, 1 ms. **6.2** a. 1.3m; b. (9/n) ms; c. 7.25%, 92.75%; d. 27.2 coils. **6.3** 0.5316V. **6.4** a. 1 ms; b. 24 turns. **6.5** 17 turns.

6.11 a. 59 turns; b. 66 conductors; c. 18 turns.