7.1.3 P386 Starting of 1Φ I/M

1Φ I/M with one stator winding does not produce starting torque, hence, an auxiliary winding is used on the stator in addition to the main winding, and start the motor as a two phase motor.

The two windings should be:

1) placed in the stator with their axes displaced by 90°E in space.
2) have impedances, such that the currents in the main and auxiliary windings are phase shifted from each other «optimum by 90°».

Since in the running condition the 1Φ I/M can develope a torque with only the main winding, hence in most motors a centrifugal switch is connected in the auxiliary circuit and in about 75% of the synchronous speed the centrifugal switch operates and disconnect the auxiliary winding from the supply.

Example 7.3 P387 (Read in the book)

من المعروف ان المحرك الكهربي الاحادي الطور لا يولد عزم بدء ولغرض تكوين عزم توليد عزم بدء تستخدم ملف مساعد (auxiliary winding) بالاضافة الى الملف الرئيسي (main winding) في الجزء الثابت (stator) على شرط ،

1) ان تكون هناك ازاحه بين محور الملفين المساعد والرئيسي بزاوية 90°E

2) ان تحقق ممانعة الملفين المساعد والرئيسي فرق بالطور بين تياري الملفين (زاوية مثالية 90°)

في اغلب المحركات يتم فصل دائرة الملف المساعد عندما تصل سرعة المحرك الى حوالي 75% من السرعة التزامنية وذلك عن طريق ربط مفتاح الطرد المركزي centrifugal switch الذي يربط على التوالي مع دائرة الملف المساعد وذلك لان المحرك الكهربي الاحادي الطور بامكانه ان يولد عزم اشتغال بملف واحد هو الملف الرئيسي

مثال 7.3 في p 387 (يتم قراءته في الكتاب)

قيمة العزم الابتدائي في المحرك الاحادي الطور هو صفر وذلك بسبب وجود pulsating flux وعدم وجود rotating flux من اجل المستحيل توليد rotating flux بوجود ملف واحد، لذلك نربط ملف اخر يدعى بالملف المساعد. وهناك شرطان اساسيان لغرض توليد rotating flux ،

Classification of 1Φ IIM;

1- Split phase induction motor

All the split phase induction motors have two stator windings, a main (or running) winding and an auxiliary (or starting) winding. Both these windings are connected in parallel but their magnetic axes are space displaced by 90° electrical. If the two winding currents are shifted in time phase, a rotating field is created which is necessary for the production of starting torque. In order to achieve this, main winding is designed to have lower resistance (thick wire) and higher leakage reactance, whereas the auxiliary winding is made to posses higher resistance (thin wire) and lower leakage reactance. The use of thin wire for auxiliary winding is permissible because this winding is in circuit during starting only. Since the reactance is proportional to the square of turns, the auxiliary winding has less number of turns as compared to those in the main winding. In addition, the leakage reactance of the main winding is increased somewhate by placing it in the bottom of slots and that of auxiliary winding is reduced slightly by placing it in the top of the slots. Since main winding has higher leakage reactance as compared to that of the auxiliary winding, the main winding current Im lags the auxiliary winding current Ia as show in the phasor diagram in fig 13.b. This phasor diagram, representing the conditions at starting, reveals that current Ia reaches its maximum first and after some time, determined by the angle (α), the current Im reaches maximum. As a result of this, stator field

reaches its maximum first along the auxiliary winding axis and after sometime it becomes maximum along the main winding axis. This means that the stator field is first directed along the auxiliary winding axis and sometime later, along the main winding axis. In this manner, a rotating field is produced and rotor starts rotating from the auxiliary winding to main winding.

If the direction of rotation is to be reversed, interchange two terminals either of the auxiliary or of the main winding.

The two windings are in space quadrature but the two currents are not in time quadrature, therefore the motor at the time of starting behaves as an unbalanced 2-phase induction motor.

The starting winding is disconnected automatically by means of a centrifugal switch cs at about 70% to 80% of synchronous speed.

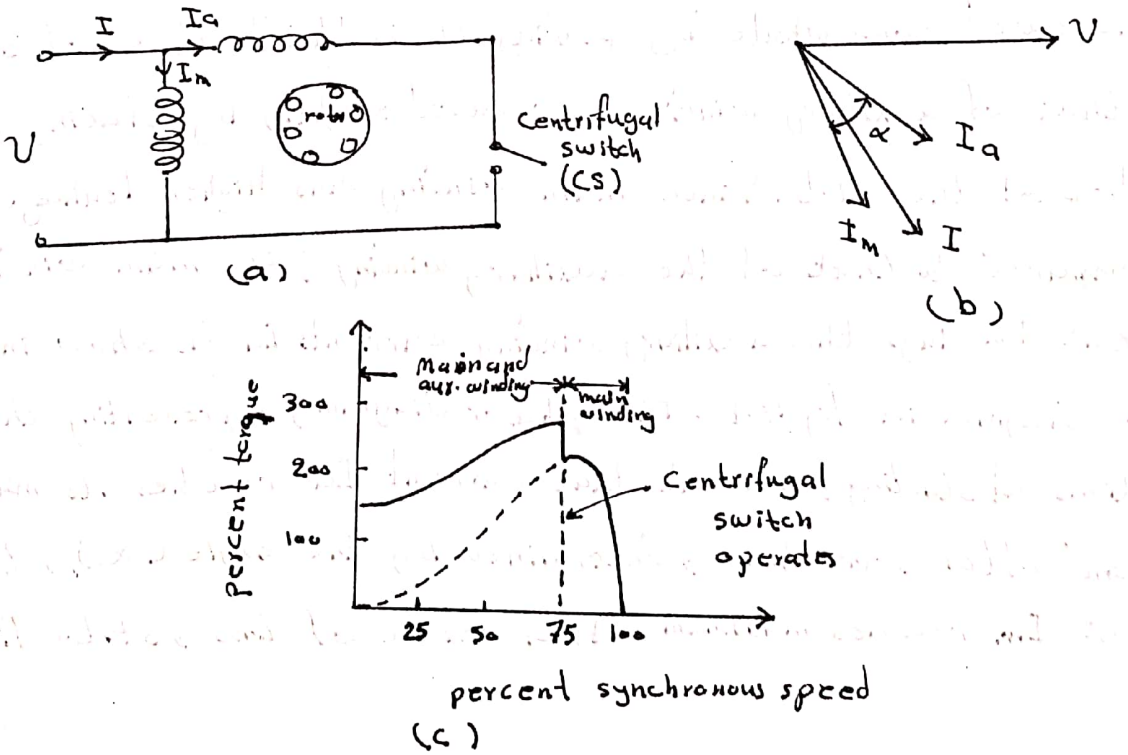

Fig. 13