EE362 Induction Machine

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Induction Motor Tests

No-load test

It is the same as open circuit test of transformer. It gives information about ***rotational loss*** and ***excitation current***.

Since there is no load;

$$s = 0$$

Then equivalent circuit becomes;

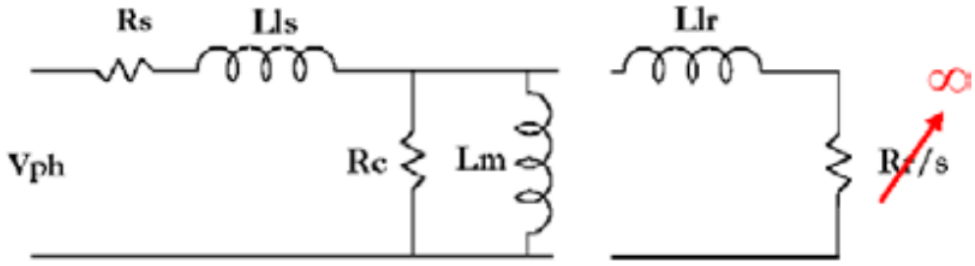

Figure 1: No-load equivalent circuit

The values we obtain from no load test are;

Table 1: test result

$V_{linetoline}$	I_0	I_{max}	P	f_s
208 V	1.5A	1.7 A	49	60 Hz

$$V_{ph} = \frac{208}{\sqrt{3}} = 121.1V$$

$$cos(\phi) = \frac{\frac{P_{3\phi}}{3}}{V_{ph} I_{Ph}} = 0.09$$

$$\phi = 84.8\,\text{deg}$$

$$I_m = I_0 sin(\phi) = 1.485A$$

$$I_c = I_0 cos(\phi) = 0.135A$$

Now assuming R_c is much greater than R_s;

$$L_m = X_m = \frac{V_{ph}}{2\pi f_s I_m}$$

$$L_m = 0.23H$$

$$R_c = \frac{V_{ph}}{I_c}$$

$$R_c = 900ohm$$

Locked rotor test

Since rotor is stationary with mechanical brake, $f_r = 0$ and

$$s = 1$$

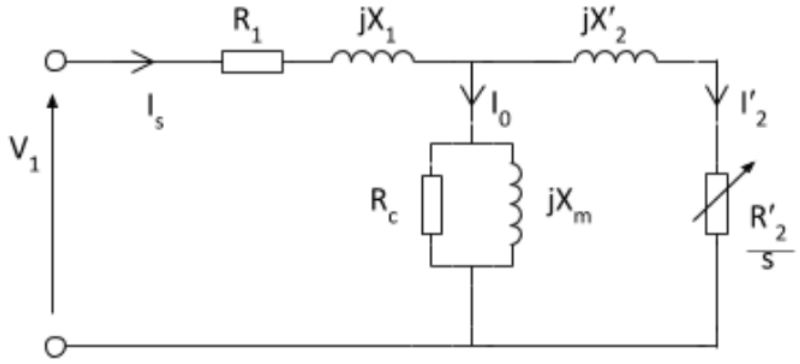

Figure 2: Locked-rotor test equivalent circuit

Find R_1 with dc resistance test. How?

DC resistance test

If machine is Y-connected, put dc supply (low voltage reference to its rated) measure the current.

$$2R_Y = \frac{V_{in}}{I_{measured}}$$

$$R_Y = \frac{1}{2}\frac{V_{in}}{I_{measured}}$$

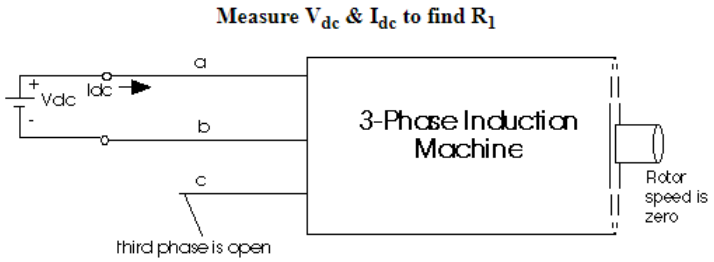

Figure 3: Testing dc resistance for Y-connected ac machine

If ac machine delta connected,

$$\frac{V_{in}}{I_{measured}} = R_d||2R_d$$

$$R_d = \frac{3}{2}\frac{V_{in}}{I_{measured}}$$

Now ac resistance of R_1 is approximately $R_{1_{ac}} = 1.1R_{1_{dc}}$

$$V_{ph} = I$$

Example

For an induction motor following test results are obtained;

Table 2: Test results

	Line voltage	Line current	Input power
Locked rotor test	130 V	77 A	6.4 kW
No-load test	415 V	22.8 V	1.65 kW

Machine rating; 30kW 3-ph, 50 Hz, 4-pole, 415 V, delta-connected

$$r_{1_dc} = 0.44 \ ohm$$

Assume $X_1 = X_2$

Solution

$$r_{1_ac} = 1.1 r_{1_dc} = 0.48 \, ohm$$