



## Question

Asked 3rd Sep, 2015

**Robert Carl Nelles**

Does anybody know the **best way to measure  $L_d(i_d, i_q)$ ,  $L_q(i_d, i_q)$**  and  $\Psi_{IPM}(i_d, i_q)$  of an IPMSM connected to a converter and a load machine?

I have tried the methods of institutes in Nurmberg/Erlangen and Torino, but get failures to the worths of  $L_d(i_d, i_q)$  and  $L_q(i_d, i_q)$  the producer gives to us.

I want to create a Lookup-Tables of  $L_d(i_d, i_q)$ ,  $L_q(i_d, i_q)$ ,  $\Psi_{IPM}(i_d, i_q)$ .

PMSM

Electrical Machines

Permanent Magnet Synchronous Motor

Parameter Identification

Measurement

Electrical Measurements

Electrical Drives

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**Jaydeepsinh Baria**

Birla Vishvakarma Mahavidyalaya Engineering College

if i know the value of  $L_d$  and  $L_q$  then how can i calculate value of machine total inductance

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## Answers (9)

**Saurabh Bajpai**

B.N. College of Engineering&amp;Technology

**Steps to determine Inductance( $L_d$ )**

1. Align the rotor to phase A. Phase A is connected to the positive potential (+) and phase B and C are grounded (-).
2. Lock the rotor shaft.
3. Apply negative step voltage. Phase A is grounded (-) and phases B and C are connected to the positive potential (+).

Usual level of the current is about 10% of the rated phase current.

4. Measure the step response of the current by a current probe.

5. Calculate inductance  $L_d$

**Steps to determine Inductance( $L_q$ )**

1. Align the rotor to the q-axis. Connect the phase B terminal to the positive potential (+) of the voltage source and phase

C is grounded (-). Phase A terminal is floating.

2. Lock the rotor shaft firmly because current step response in q-axis creates torque.

3. Generate a current step response in this configuration: phase A is connected to the positive potential (+) of the voltage

source and phases B and C are grounded.

4. Calculate inductance  $L_q$

[Cite](#) 1 Recommendation



[Robert Carl Nelles](#)

Thanks for your answer, but i think, this is not what i really look for.

I look for a method, so I can calculate  $L_d$  and  $L_q$  dependent on my currents  $i_d$  and  $i_q$ .

I can generate currents  $i_d$  and  $i_q$  with my inverter into the machine. Unfortunately I have no other kind of power supply at the moment.

Can anybody help me please, if somebody know something, let me know :)

Are there any specialists here? ;)

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[Jitendra Nath Rai](#)

Delhi Technological University, Government of NCT of Delhi, India

I agree with the answer given by Saurabh.

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[Jiri Dusek](#)

Moog Brno

As you can apply D,Q currents, you just need to lock the rotor and apply desired currents, and read the step response, then calculate the  $L_d$ ,  $L_q$ .

If you lock the rotor as described earlier, you just need to apply desired constant current to phase A and negative half of its value to the B and C phases. In first case, due to the alignment, the A current will be actually applied in D axis, in second case, it will be applied in Q axis. Then again, just read the step response and calculate the  $L_d$ ,  $L_q$ .

But if you can apply the DQ currents directly, I assume the second paragraph just describes what the inverter does for you when you asking for DQ current - it just applies the Park/Clark transformation based on the rotor position.

[Cite](#)



[Robert Carl Nelles](#)

The Problem is, I have a three-phase voltage inverter. So i can apply D, Q currents at locked rotor, but what step response I choose?

There is no real chance to create DC voltage (duty cycle is max. 0.55).

And Mr. Bajpai, I know the paper of freescale, you copy and paste it from.

But I want a simple solution how to measure the values at my dSpace test bench.

[Cite](#)



[Hasan Bali](#)

University of Duhok

To get the accurate values of  $L_d$  and  $L_q$  of PMSM you must use FEM.

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[Robert Carl Nelles](#)

I have no FEM-Model, the producer only give us some data, but it has to be verified and the values are without cross-coupling effects.

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[Abdul Waheed](#)

Dong-A University

is there anyone how knows that how to calculate the  $L_d$  and  $L_q$  values for LSPM motor through (FEM) Maxwell Ansys software..??

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[Jaydeepsinh Baria](#)

Birla Vishvakarma Mahavidyalaya Engineering College

if i know the value of  $L_d$  and  $L_q$  then how can i calculate value of machine total inductance

[Cite](#)

ar questions and discussions

**How can I determine the Direct and Qaudrature Axis Inductances at various levels of current in a delta wound PMSM motor?**

Question 9 answers

Asked 27th Aug, 2015

 Naresh Kakani

In the following attached files, you can find the method for calculating the direct axis inductance ( $L_d$ ) and quadrature axis inductance ( $L_q$ ) with respect to a star wound rotor. To explain briefly, in order to measure  $L_d$ , I would block my rotor in a position where the direct axis of the permanent magnet is in line with the A-Phase of the rotor. At this point, I can conduct a DC Decay Test (pls refer attached document - ACTA-2013-1-07.pdf). In case of a star winding, I would multiply the obtained value by (2/3) and thus get my  $L_d$  value. Same goes for  $L_q$ , but I would block it in a position which is  $90^\circ$  electrically ahead. But in my case, I have a PMSM with a delta wound rotor. Can anyone suggest, how to calculate the  $L_d$  and  $L_q$  incase of a delta winding.

[View](#)**How to determine PM flux linkage,  $L_d$ ,  $L_q$  corresponding to rotor position?**

Question 2 answers

Asked 14th Dec, 2018

 Duc-Kien Ngo

In these attached papers, the authors said that it can be used frozen permeability (FP) to determine **PM flux linkage,  $L_d$  and  $L_q$  corresponding to rotor position**, Fig. 11 and 12 of the first paper, and Fig. 2 of the second paper. But in my knowledge, the FP usually used to separate average PM and reluctance parameters.

Does anyone can suggest the method to determine above parameters in **the variation with rotor position, not the average ones** like some existed questions in this website? And how to do these in **FEA softwares** like JMAG, Ansys Maxwell, etc?

Thank you.

[View](#)**How to solve this error in MATLAB?**

Question 6 answers

Asked 3rd Dec, 2021

 Tufail Ahmad Bhat

I am getting this error while running the simulation.

"Error in port widths or dimensions. Output port 1 of 'modifiedSTRIPS/Subsystem/Mux' is a one dimensional vector with 5 elements."

Please can anybody solve it?

[View](#)**How to determine the value of rotor flux constant from Back EMF for PMSM?**

Question 4 answers

Asked 8th Dec, 2013

 Nurul ain mohd said

If my value of back EMF=115V/krpm, how could I convert this to get the value of rotor flux constant?

[View](#)**Why BLDC motors are not preferred for higher power Electric Vehicles, instead PMSM is used? For how much power they can be a suitable choice?**

Question 2 answers

Asked 20th Mar, 2022

 Sanjit Dutta

I have seen that almost all four-wheeler commercial vehicles or power requirements over 10 kW, PMSM or Induction motors are used. Is the reason behind this is more torque ripple and lower speed range of BLDC motors? What are the other reasons?

But if I want to use a BLDC motor for a power requirement of around 40 kW in an EV, considering better power density, what are the disadvantages that can be faced. What are the other advantages of BLDC that can support its application in this case?

Is there any commercial EV that is using a BLDC motor for the power requirement range of 30-50 kW?

[View](#)**Best book for PMSM ?**

Question 4 answers

Asked 21st Dec, 2021

 Avinash Mehra

Sir please suggest me best book for PMSM for mathematical modelling, control, braking everything.

[View](#)**Relationship between the magnetic flux linkage and back-emf constant?**

Question 3 answers

Asked 29th Sep, 2021

 Kanat Suleimenov

Dear Researchers, can you briefly explain how to obtain the magnetic flux linkage if the back-emf constant is known? Can you suggest any useful links on this topic? My motor under the test is surface mounted PMSM (SPMSM). Thanks for advance!

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#### Can a PMSM operate at higher speeds than the nominal speed?

Question 3 answers

Asked 1st Mar, 2020

 Leandro Ponce Cevallos


Is there any method that allows to operate a PMSM at speeds higher than the nominal speed?

[View](#)

#### I am receiving error in Ansoft Maxwell which is: Adaptive passp, process 3dnms: Insufficient memory.?

Question 1 answer

Asked 3rd Jan, 2019

 Syed Muhammad Ali

No of passes chosen=5. Even if I reduce the number of passes to 3, still I used to get the same error. Please some one can help me as I need to get this resolved as soon as possible.??





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ted Publications

#### Position and speed sensorless control for PMSM drive using direct position error estimation

Conference Paper

Feb 2001

 K. Sakamoto ·  Y. Iwaji ·  T. Endo ·  T. Takakura

A new position and speed sensorless control approach is proposed for permanent magnet synchronous motor (PMSM) drives. The controller directly computes an error for the estimated rotor position and adjusts the speed according to this error. The derivation of the position error equation and an idea for eliminating the differential terms, are present...

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#### Fourier-Based Modeling of Permanent-Magnet Synchronous Machines Operating at High Speed

Thesis

Jan 2017

 Bert Hannon




Een streven naar betere efficiënties enerzijds en een tendens naar meer gespecialiseerde elektrische aandrijvingen anderzijds, domineren momenteel de evolutie van elektrische machines. Het gevolg daarvan is dat het belang van doorgedreven optimalisaties tijdens het ontwerp van elektrische machines sterk stijgt, wat op zijn beurt weer zorgt voor een...

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#### Distribution characteristics analysis of torque ripple in permanent magnet synchronous motors considering the noise factors

Article

Jan 2015

 Z.-Y. Wu ·  H. Guo ·  H. Qian

In mass productions of permanent magnet synchronous motors (PMSM), the torque ripple dispersion is caused by the sizes errors and the material properties variations, which can also be named as noise factors. In order to analyze the distribution of torque ripple in mass productions of PMSM, the sensitive analysis was operated and the most sensitive...

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