

# Switched Reluctance Motor Drive Systems

## Overview

Switched reluctance motors (hereafter referred to as SRMs): (i) have salient poles with concentric windings in the stator and rotor with only laminations having no windings or permanent magnets on it, (ii) are least expensive to manufacture compared to all other motors (iii) having no magnets or windings in the rotors make them not only light but also capable of very high speed operation because of mechanical robustness, (iv) provide high efficiency operation, comparable to permanent magnet synchronous and brushless dc motors while surpassing the induction motor efficiency, (v) require dc currents in their windings and hence work directly with dc voltage and hence batteries making them ideal for automotive, EV and solar applications, (vi) are most robust from the points of view of fault tolerance from failures in partial winding(s), (vii) due to dc current requirement, SRMs have a number of unique power converter topologies starting from n transistor and n diode for a n phase machine and up to 2n transistors and 2n diodes devices for a n phase machine endowing low cost, and (viii) the converters are shoot through fault proof assuring high reliability. These features are ideal in motor drives where minimal cost and maximum performance are absolute requirements particularly in high volume applications of refrigerators, washing machines, dryers, hand tools, air conditioners, fans and pumps, automotive accessory motor and drives, electric scooters, e- rickshaws, EVs, and industrial applications. These market applications are opening up very fast in India in recent times. Given the cost, price fluctuation, source location concern (China) and availability of permanent magnets, SRM drive system is an attractive alternative for variable speed applications. Though the SRM technology is not widely used at this time but many large companies abroad have the technology to enter the market at any time.

The primary objectives of the course are as follows:

- i. Familiarize the basics of rotating and linear SRMs, their various forms and their distinct advantages over other machines to the participants.
- ii. Basic design of SRMs and the process of design.
- iii. Introduce briefly the basics of power electronics and the plethora of power converter topologies suitable to operate these motors.
- iv. Control of the SRM drive system including high performance control with very low ripple torque, position sensor-less control and high efficiency control.
- v. Theory, operation, modelling, simulation, analysis and design of the SRM motor drives are systematically developed step by step in full that will enable the participants to become highly familiar with these motor drives and to use that knowledge in their day to day design, development and testing of their drive systems.
- vi. Audible noise is a major concern in SRM drives operation and that issue and its mitigation are presented.

<b>Course</b>	<b>Switched Reluctance Motor Drive Systems</b>	November <u>20 –24, 2023</u>
<b>Who can attend</b>	<ul style="list-style-type: none"> <li>▪ Executives, engineers and researchers from manufacturing, service and government organizations including R&amp;D laboratories</li> <li>▪ Faculty members from reputed academic and technical institutions</li> <li>▪ Students at different levels (B.Tech/M.Tech/Ph.D)</li> </ul>	
<b>Fees</b>	<p>The participation fees for the course is as follows:  <b>Foreign Participants: US\$ 500</b>  <b>Persons from Industry: Rs. 5,000/-</b>  <b>Faculties from academic institutions/Govt. research organizations: Rs. 3,000/-</b>  <b>Ph.D scholars: Rs. 2000/-</b>  <b>Students (B.Tech/M.Tech/M.Sc): Rs. 1000/-</b>                      The above fee includes all instructional materials, laboratory equipment usage charges, and internet facility.                      The participants will be provided accommodation on payment basis.</p>	

## Course Instructor



R. Krishnan is Professor Emeritus of electrical and computer engineering at Virginia Polytechnic Institute and State University. His research interests are in electric motor drives. He has published more than 170 technical papers and he has 27+ patents and 6+ pending. He founded two electric drives companies namely *Panaphase Technologies* and *Ramu Inc.*

He has authored:

- i. *Electric Motor Drives (Prentice Hall)*,
- ii. *Switched Reluctance Motor Drives (CRC Press)*,
- iii. *Permanent Magnet Synchronous and BLDC Motor Drives (CRC Press)*,
- iv. Co-editor, co-author of *Control in Power Electronics (Academic Press)*.

Prof. Krishnan is a recipient of best paper awards from IEEE Industry Applications Society's Industrial Drives committee (5 awards) and Electric Machines committee (1 award). In addition, he received the first prize from IEEE Transactions on Industry Applications for his paper and the 2007 Best Paper Award from IEEE Industrial Electronics Magazine. He was awarded IEEE Industrial Electronics Society's Dr. Eugene-Mittelmann Achievement Award for Outstanding Technical Contributions to the field of Industrial Electronics in 2003. Krishnan is a *Life Fellow, IEEE* and a Distinguished Lecturer of IEEE Industrial Electronics Society. He is an elected Senior AdCom Member of IEEE IE Society and served as its Vice President (Publications) from 2002 to 2005.



Dr. Chandrasekaran is an Assistant Professor in the Department of Electrical Engineering at National Institute of Technology Hamirpur. He obtained his Ph.D. degree from Indian Institute of Technology Gandhinagar. His current research interests include Grid Synchronization Techniques and Cyber Security of Power Systems.



Dr. R. K. Jarial is an Associate Professor in the Department of Electrical Engineering at National Institute of Technology Hamirpur. Presently, he is also the coordinator of TIFAC Centre of Relevance & Excellence (CORE) on Power Transformer Diagnostics at NIT Hamirpur. His current research interests include power electronics and drives, condition monitoring of electrical apparatus and high voltage engineering. He has authored/co-authored more than 100 technical papers in international journals and conferences.

## Course Coordinators

Dr. Chandrasekaran S,  
Assistant Professor  
Department of Electrical Engineering  
National Institute of Technology Hamirpur  
Himachal Pradesh – 177005.  
Phone: 9882299190  
E-mail: chandru@nith.ac.in

Dr. R. K. Jarial,  
Associate Professor  
Department of Electrical Engineering  
National Institute of Technology Hamirpur  
Himachal Pradesh – 177005.  
Phone: 01972-254882,  
E-mail: jarial0@gmail.com

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