International Journal of Scientific Research in Engineering & Technology
Volume 1, Issue 6 (November-December 2021), PP: 10-12
www.ijsreat.com

Enactment Analysis of Fault-Tolerant on Five Phase VSI fed IM Applications

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Abstract: *When multi-stage AC drives dealt with fromvoltage source inverters (VSIs) requires a sensible PWM methodofcontrol.Thispaperinvestigatestheperformanceof3-ϕand5-ϕinduction motor drive with various PWM systems. Beginning, a 3-ϕand5-ϕVSImodeliscomparedwithdifferentopenfaultconditions to show the deficiency permissive limit of 5-ϕ inductionmotor drive. Then, PWM trading procedures are arranged for5-ϕ VSI dealt with acknowledgment motor drive for a useful control. Thesuitableswitchingtechniqueisidentifiedbysettingthehighfundamental voltage with lessened %THD in the outcome voltages.Theproposedschemeusesthefull DCbusvoltage,andtheoutputresponsesuperiorwithlowlowerorderharmonicsthantheconventionalsinusoidalpulsewidthmodulation(SPWM)methods. The displays of the 5-ϕ VSI dealt with IM drive testedwith different trading systems, and the results saw intermsofharmoniccontentspresentintheoutputvoltagewaveform. MATLAB/Simulink programming results associated with thispapertoshowandverifythetheoretical thoughts.*

IndexTerms: *SPWM,threephaseVSI,five-phaseVSI,five-phaseinductionmotor, totalharmonicdistortion*

I. INTRODUCTION

A2levelVSIhas32vectorsrepresentedintod1-q1&d3 q3subspaces. All subspaces area source of lower order harmonics exceptthed1-q1subspace.Theswitchingtechniquesproposedin [05] can eliminatetheharmonicspresent in d3-q3. Inaddition,thismethodcangenerate asinusoidal stage voltage waveform. There are very few SVPWMtechniques proposed in [6] to restrict the switchinglossesofa5-ϕinverter.

The comparative assessment of 3-ϕ and 5-ϕ VSI dealt with IM diveis present concerning its inadequacy receptive limit. Then thecarrier based PWM trading plans are arranged in thispaperforthe5-ϕVSIfedIMdrive.TheMATLAB/Simulinkis used to construct the structure. The displays of theproposedtechniquesarecomparedwithconventionalSVPWMtechnique.

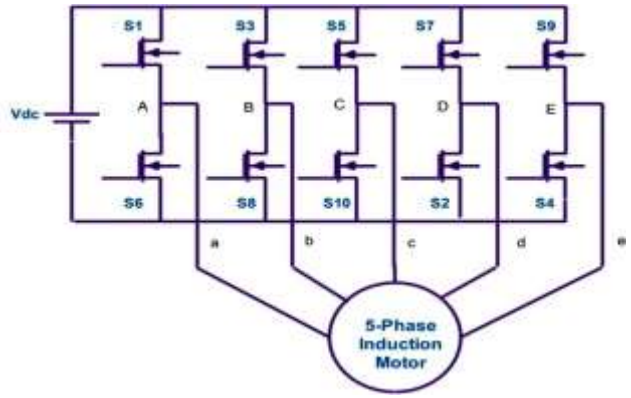
AMathematicalmodelcanberepresentedforaninductionmotor. The 5-ϕ system factors are changed into 2-ϕvariables in d-q plane turning with synchronous speed. The displacement between two phases is72degrees, and the number of stages ought to be something very much like when the transformation. The relationships between5-ϕand2-ϕvariablesare as follows.

Central machine model circumstances for stator sides and rotor sides in fixed reference frame are tended to as follows:

II.TWO-LEVELTHREEPHASEANDFIVE-PHASEVSI

Multi-phase IMdrivesusedforvariablespeedapplications. The conventional multiphase VSIdoesnotsuitable for this application owing to the high aggregate of harmonics presentedinthevoltagewaveforms.Aspacevectorconceptisusedwithamodifiedswitchingsequencetoreducetheharmonicsandalsohelps tomaximizethefundamentalvoltage.

Fig.1 shows the circuit diagram for 3-ϕ VSI dealt with IM drivecomprisessixpowerswitches,twoswitchesperleg.Thepolevoltage is comparable to Vdc when the upper switch is ON and it iszero when it is OFF.Fig.2 shows the circuit chart for 5-ϕVSI dealt with 5-ϕ IM drive incorporates ten power switches, twoswitches per leg. The post voltage is comparable to Vdc when theupperswitchisONanditiszerowhenitisOFF.Toavoidthedirectshortcircuitofsamelegswitches,theyswitchedoppositetoeachother



.Fig.1 5-ϕVSIfed5-ϕIMdrive

III.FAULT-TOLERANTCOMPARISONOF3-ΦAND5-ΦINDUCTIONMOTOR

The presentation assessments of multi-stage voltage source inverter with different PWM strategies are carried out in this paper. A part of the customary PWM techniques such assinusoidalPulseWidthModulation(SPWM),harmonic InjectionPWM and offset addition PWM techniques are discussed forn number of phases. Comparisons between ifferentPWM techniques are presented.

The 5-stage structure is differentiated and the 3-ϕ system interms of its voltage and power levels as shown in Table 1.Fromthistable,itisinferredthatthenon-adjacentlinevoltage for the 5-ϕ system is more than the 3-ϕ system andalso the power level is more imperative in the 5-ϕ system. Accordingly the5-ϕ acknowledgment motor is an elective response for the 3-ϕinduction motor inindustrial applications.

conditions in both the 3-ϕ and 5-ϕ enrollment motor system as shown in Table 2.When an issue in any of the stage leads toan extension in the current of various stages and diminished output power of the machine. When the faultinanytwophasesleadstoinoperativeconditionsofa3-ϕinductionmotorsystem.
However the 5-ϕ structure canabletoproducethealmost 85%oftheratedpoweroutput.

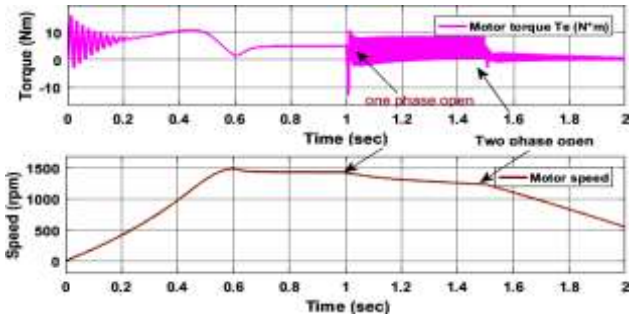


Fig.2Speedandtorqueresponseunderonephaseandtwophaseopenconditionof3-ϕ IM drive

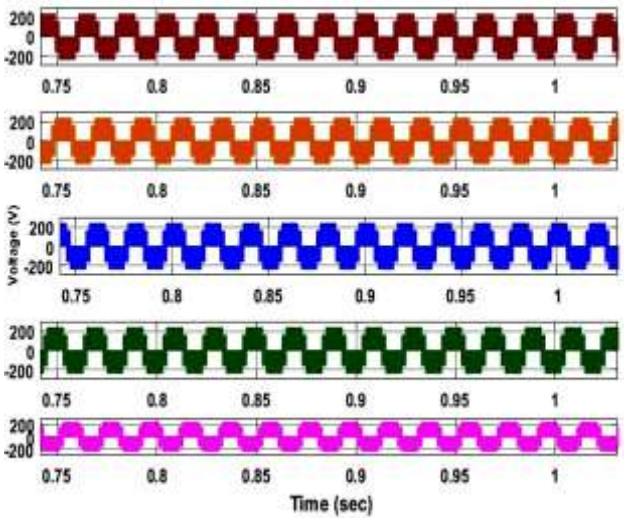
IV. PWMSWITCHINGSCHEMESFOR5-ΦVSI

4.1.Sinusoidal Pulse Width Modulation Technique(SPWM)

TheanalogganddigitalrealizationofcarrierbasedSPWMtechniques is the most popular procedure for the voltage sourceinverters.Thehighfrequencycarriersignaliscomparedwiththe sinusoidal sign to deliver the ending beats for the VSIswitching contraptions. In 5-ϕ VSI, there are 5 reference signalsdisplaced by 2π/5 are differentiated and the three-sided signal togenerategatepulsesfor5-phaseVSIasshowninFig.5.Theamplitude of the reference signal picks the outcome voltageof the VSI. The reference voltages for the multi-stage VSIaregiveninequation(10).

V.SIMULATIONRESULTS

AMATLAB programming multiplication is used to determine the effect of different trading systems and to compare the results of various switching techniques such assintriangle, harmonicinjuctionand offset addition.The simulation limits used for the structure are: Vdc=400V,the chief yield repeat of VSI is 50Hz,



switchingfrequencyfs=5kHzandthedeadtimeofswitchespresentinthesame leghasnotbeenconsidered.

Table3lists the simulation parameters of the system, and the performance ascribes areshowninFig.3.The phase and line voltageof5- ϕVSIisshowninFig.3(a)&(b).The 5 phase induction motor electromagnetic

torqueistrackingthereferencetorquecommandof3Nm,2Nmand4.4 Nmattheinstants0.4sec,0.8and1.3secrespectivelyasshown in Fig. 3 (c). The stator and rotor current variations regarding the load changes have been recorded and shown in Fig.3(d).

VI.CONCLUSION

The overall assessment is made between 3-ϕ and 5-ϕVSI dealt with IM drive to the extent that different weakness conditions. Thefault-liberal limit of 5-ϕ VSI is superior to the 3-ϕdrive.A5-ϕVSIwithvariousPWMtechniquesarepresentedtoimprovethepowerqualityofinputvoltageappliedto5-ϕIMdrive.UseofoffsetadditionPWMtechnique chips away at the utilization of DC transport voltage whencomparedtootherSPWMtechniques.Thiscontroltechniquealso deals with the chief yield voltage by than thesinusoidalpulsewidthmodulationtechniques.ThisinvestigationisperformedintheMATLABSimulinkfor5-ϕVSIfedIMdrive.

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