

# Simulation and result of scalar control engineering essay

[Profession](#)



**ASSIGN  
BUSTER**

## **Introduction**

This chapter focuses on scalar control in three stage initiation motor public presentation, trying to happen the intrinsic advantages and disadvantages of the method. An probe is conducted, via instance survey, into the public presentation of initiation motor thrust using the scalar control method. As package bundle, Matlab Simulink has been used and the simulation consequences are presented to turn out the dynamic behaviour of this type of control method.

## **Matlab and simulink**

In the simulation of initiation machines utilizing Matlab and Simulink are first-class for numerical computation and informations visual image ; control applied scientists use them extensively for analysis design are many different tool chests available which extend the basic map of Matlab into different application countries ; for illustration, the Matlab tool chests, `` control system `` model prognostic control `` and `` Robust control `` supply methods for computing machine -aided control system design.

The simulation bundle allows a broad scope of different constellations and theoretical accounts to be investigated quickly. The Simulink Matlab application is adopted because of its intrinsic integrating of vectorized system representation in block diagram signifier. Therefore, in this bundle, the package is used as an analytical for the graphical portraiture of the clip developments of signals combined with the simple realisation of the functionality of control and power electronic excitements.

## The initiation motor theoretical account

The initiation motor theoretical account has to be taken into consideration, It is of import because it is related to the control of the initiation motor. The initiation motor is used because it has perfected of features of theoretically and by experimentation. It is driven in a figure of different mentions frame, so the purpose of the theoretical account is frequently expressed in an arbitrary two-axis go arounding mention frame. This makes it easy to command ; the interior decorator can mend the mention frame to a peculiar motor measure and adjust the theoretical account consequently. All electrical parts of the machine, the variables and parametric quantities, are viewed from the stator. This is all indicated by the major marks in the machine equations given below. All rotor and stator measures are in the arbitrary two-axis rotor mention frame ( dq frame ) . The inferiors used are defined as follows:

vitamin D: A vitamin D axis measure

Q: A A Q axis measure

R: A A rotor measure

s: A stator measure

cubic decimeter: A A escape induction

m: A common induction

## Reference frame

The mention frame is used to change over input electromotive force ( abc mention frame ) to the dq mention frame and besides used for change overing the end product currents dq mention frame to ( abc mention frame ) . A pick has to be made between the following mention frame transmutations:

Synchronous.

Stationary ( Clarke or itransmutation ) .

Rotor ( park transmutation ) .

The pick of the mention frame wave forms affects all dq variables. It besides affects the velocity of the simulation and, in some instances, the truth of the consequences. The undermentioned guidelines are suggested:

If the stator electromotive forces are non balanced or non connected and the rotor electromotive forces are balanced ( or 0 ) a stationary mention frame can be used.

If the rotor electromotive forces are non balanced or non connected and the stator electromotive forces ; are balanced rotor mention frame can be used.

If all the electromotive forces are connexions and balanced the stationary or synchronal mention frame can be used.

The undermentioned relationships explain the rudiment to dq mention frame transmutations which apply to the initiation machine block 's input electromotive forces.

In the old equations,  $\theta$  is the angular place of the mention frame, while  $i_s = i_s^* - i_s^* r$ , and the difference between the place of the mention frame and the place ( electrical ) of the rotor. Because the machines twists are connected in a three-wire Y constellation. There is no sequence ( 0 ) constituent. It besides justifies the usage of two input electromotive force lines to the line in the signifier alternatively of three electromotive force lines to impersonal. The relationships that follow depict the dq-to rudiment mention frame transmutations applied to Asynchronous machine stage currents.

In the tabular array below are shown values represented by and . In each mention frame ( vitamin E is the location of the synchronously revolving mention frame.

## **Induction Motor Drives with Scalar Control**

One manner of understanding scalar control method is by utilizing instances survey with Matlab simulation. This portion of this chapter will concentrate and discuss how this method performs. The simulation consequences will be analysed and compared subsequently on with vector control.

### **Case survey**

The circuit shown below as the instance survey, an unfastened cringle scalar control method with PWM inverter is used to feed the stator through the

control electromotive force supply. This inverter uses sinusoidal pulse-width transition ; hence, the base of frequency of the moving ridge 's frequency is set at 60 Hz and the triangular bearer wave 's frequency is set at 1980Hz. This corresponds to a frequency transition factor medium frequency of 33 (  $60 * 33 = 1980 \text{ Hz}$  ) . A three-phase initiation motor is connected to a changeless burden of nominal value 11. 9Nm. In this circuit, a three stage initiation motor is built. Blocks of the machines and power electronic Matlab libraries have been used and besides in this circuit all the parametric quantities are the same circuit of vector control because the research worker wished to do a comparing between this circuit diagram of scalar control and vector control. Furthermore, the machine is used it has the same parametric quantities of vector control and scalar control.

### **Simulation parametric quantities**

Choosing the ode23tb incorporating algorithm, set the comparative tolerance to  $1e-3$ , the absolute tolerance and maximal measure size to car and the stop clip to 4s. So the scalar method simulation was carried out utilizing the motor parametric quantities as shown in the tabular array below.

The tabular array shows the simulation parametric quantities for constellation of the circuit Fig ( 6. 2 )

### **Simulation consequences**

The thrust started from deadlock by stipulating 0 for all initial conditions of province variables in the Powergui interface. In this instance, the mention velocity was stepped from 120 to 160 rad / s at  $t = 1 \text{ s}$  and thrust variables velocity, torsion and current observed. Transeunt responses to get down the <https://assignbuster.com/simulation-and-result-of-scalar-control-engineering-essay/>

initiation motor thrust are shown below ; the first figure shows motor steady province torsion and velocity. Figure ( 6. 6 ) the motor started and reached its steady province velocity of 120 rad/s ( 1800rpm ) at 1s ; at get downing, the magnitude of the 60 Hz current reached approximately 180 A, its peak current ( 127 rms ) .

Therefore, there was a high initiation motor get downing current, as was expected, because the motor has high power, whereas its steady province value was ( 20A ) and the  $I_{rms}$  value about ( 14, 14 rms ) . Besides, strong oscillations of the electromagnetic torsion at get downing were observed. On the torsion in steady province observation noisy signal with a average value of 11. 9 Nm. In the three motor currents there was observed all the harmonics [ multiples of the 1980 Hz exchanging frequency ] which were filtered by the stator induction, so that the 60 Hz constituents were dominant. Sing the curves of the three stage initiation motor ( squirrel Cage ) , on get downing the motor without burden, the motor get downing currents, torsion and velocity can be observed on the range. At the terminal of simulation clip at ( 4s ) . , when the motor was reached steady province that is the torsion and velocity are changeless, So,  $T_e - T_L = 0$ , it was observed that the stator and rotor currents were rather ( noisy ) and the torsion and velocity had truly changeless value because the motor was non yet loaded so that is why the motor was on steady province.

## **Get downing with burden**

In the following simulation end product different simulations were used to happen out the result when the velocity is set-up at steady province at a

certain clip. In this figure ( 6. 7 ) , the rotor velocity started increasing from 0 to 120 rad/s, after this, the lessening velocity for short clip between 2 2nd and 2. 5 second, so velocity decreased until steady province ( 100 rad/s ) , for the falling value of the velocity is 20 rad/s. Suddenly, alteration in the magnitude of the stator current resulted in transient before the torsion reached the steady province and besides alteration in the linkage of the rotor flux. The research worker could detect the motor currents were high and largely noisy get downing current and besides that the torsion starts additions from 2 seconds to 2. 5 seconds and to increase until changeless value was reached ; at the same clip as cut downing velocity, the current, nevertheless, was increased because the relationship between torsion and velocity are reciprocally related. Finally and clearly either the dynamic torsion control is really hapless and besides it has jobs with the transeunt response of the torsion or it is really hapless and can non be controlled by the torsion in the transient province.

Figure ( 6. 7 ) measure up torque response at 11. 9N. m

The undermentioned simulation of torsion 50N. m applied at least two seconds and a changeless velocity of 120 rad / s to see how this theoretical account of scalar controls responded to these alterations. This simulation shows the end product velocity started increasing from 0 to 120 rad / s, than at 2 seconds the velocity will be reduced to 90 rad / s, so that the torsion is applied to two seconds, so get down to cut down velocity ( a little ) at the same clip, torsion is increased until making a changeless value.



The starting currents were high, up to 1.5 seconds, and so reduced until the steady province was reached at the same clip the torsion applied. Internist provinces torque and current were noisy and did non discontinue. However, the dynamic behavior of scalar control was non perfect, so in this it instance affected the public presentation of the initiation motor. Scalar control should be used at low velocity and variable velocity, for illustration as fans or pumps.

Figure ( 6. 9 ) shows simulation end product difference simulation status was used to happen out the result when the velocity is step up at the steady province at certain clip. At the one second the velocity starts to increase and the torsion besides increased but for short clip so the torsion starts to decreased until reached changeless value, besides this clip the velocity invariable. This means altering the velocity with the scalar control under the steady province status will be sensible.

The dynamic public presentation of thrust ( public presentation relation to the velocity control mention alteration and burden torsion ) as Fig ( 6. 10 ) can be studied by using two alterations in operating conditions of the thrust ; a measure alteration in velocity mention and measure alteration of the burden torsion. The torsion 50Nm was applied for 2 seconds and velocity of measure 140rad / s for 1 2nd, to see how these model scalar controls would react to these alterations. In this instance, it was observed the velocity dropped aggressively to one second, shortly, and so went up to 140 rad / s to 3.5 seconds.

The electromagnetic torsion of the initiation motor was foremost variable in 0.6 seconds. After the torsion is little bead of one second when the rate was applied the torsion continuously went up to 90Nm in 3.5 seconds. In this instance, the increased velocity and torque addition were non the same as earlier. The chief job of current and torsion in 1 second is if the torsion all of a sudden drops and the current addition is more than the starting current, In this instance, the value of the burden and velocity control should be increased.

### **Scalar control dissection**

The electromotive force applied to the motor must alter with frequency. The control method is really simple and easy to implement. Improves inactive public presentation of control system, but its transient capableness is non satisfactory. Accurate place control is non possible.

Open cringle scalar control will be able to provide speed fluctuation ; it is non able to supply reliable control under transeunt conditions. Therefore, the scalar control is suited merely if the motor operates in steady province without velocity ordinance. Scalar control is used chiefly in applications where changeless torsion is required. Scalar control ever has hapless kinetics. Scalar control methods are used merely the magnitude and frequency ( V/Hz ) .