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Implementing Finite State Machine Simulation – A Review

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ABSTRACT –

Objective - we have been using sine wave functions from our high school calculus. Simulation is a integral part of anyone's life now. We will program in simulink to see how can we simulate a sine wave and obtain a optimized wave. Also we will see how can we change the initial conditions of our parameters in simulation on the run. Secondly we will build a finite state machine that will show a tradeoff between position and velocity using sine wave. It is encountered with many usual problems. We will fix those problems using simulation in simulink at small intervals of time.

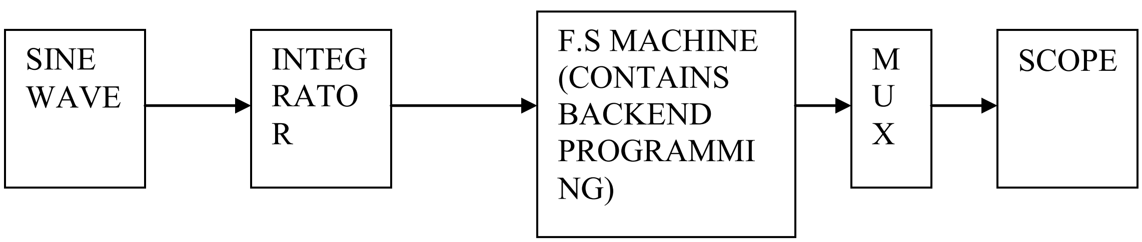

Fig 1 - FINITE STATE MACHINE WITH SINE WAVE SIMULATOR

INTODUCTION

1. Finite state machines

Finite state machines are autonomous systems, which are evolving at a time, automatically, depending on the signals applied at that moment and the state in which the system is. The finite state machines are inspired from reality, where everything has a limited life cycle. This life cycle means an initial state, an intermediary state and a final one. Also it is considered that a finite state machine is a system with a finite number of states, having a model of behavior composed by states, transitions and actions. A state stores information about the past, meaning that reflect the changes from the system initialization to the present. A transition involves a change of state and is described by a condition that must be satisfied in order to start the transition. An action is a description of an activity, which must be performed at a given time. A finite state machine is represented with the state diagram, given by the transition table from one state to another. (Ivan et. al. 2011).

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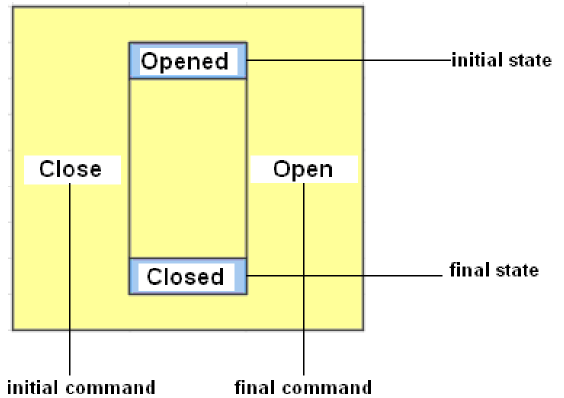

Fig. 1. Finite state machine

In a Finite State Machine the circuit's output is defined in a different set of states i.e. each output is a state. A State Register to hold the state of the machine and a next state logic to decode the next state. An output register defines the output of the machine. .(Monga et. al., 2012. The FSM is used to model the communication channel of proposed protocol between the Client *Ci* and the Server *Si*.(Aljeaid et. al., 2014)

Finite State Machine (FSM) with different encoding algorithm constraints like gray, one-hot, sequential, Johnson, speed1 and auto. Finite state machine is a restricted class of sequential circuits called synchronous circuits which assumes the existence of a common global clock. An FSM is a discrete dynamic system that translates the sequence of input vectors into sequence of output vectors. (Uma et.al., 2012)

LITERATURE REVIEW –

AUTHERS	OBJECTIVE	METHODOLOGY	RESULT
Malik et al., (1995)	Studies the concept of the Cartesian composition of fuzzy finite state machines. Shows that fuzzy finite state machines and their Cartesian composition share many structural properties.	Case study	uzzy finite state machines which is a Cartesian composition of submachines can be studied in terms of smaller machines.
Erich Schmidt, (2011)	to discuss the state of the art of finite element analysis of electrical machines and transformers. Electrical machines and transformers are prime examples of multi-physical systems involving electromagnetics, thermal issues, fluid dynamics, structural mechanics as well as acoustic phenomena.	numerical analysis	Various methods of coupling the different physical domains of multi-field finite element analyses are described. Thereby, weakly coupled cascade algorithms can be used with most problems in the field of electrical machines and transformers
König et al., (2009)	to utilize a control system representation based on	A new recombination operator for	The framework is capable of robustly

	finite state machines (FSMs) to build a decentralized online-evolutionary framework for swarms of mobile robots.	multi-parental generation of offspring is presented and a known mutation operator is extended to harden parts of genotypes involved in good behavior, thus narrowing down the dimensions of the search space.	evolving the benchmark behaviors. The memory genome and the number of parents for reproduction highly influence the quality of the results; the recombination operator leads to an improvement in certain parameter combinations only.
Rajagopal et al., (1999)	Accurate prediction of temperature distribution in an electrical machine at the design stage is becoming increasingly important. It is essential to know the locations and magnitudes of hot spot temperatures for optimum design of electrical machine.	A methodology based on axi-symmetric finite element formulation has been developed to solve the conduction-convection problem in radial cooled machine using a new eight noded solid-fluid coupled element.	Steady state temperatures have been determined for 102 kW radial cooled motor at 100 percent and 75 percent loads and are validated with experimental results obtained from heat run tests. Parametric studies have been carried out to study the effect of critical parameters on temperature distribution and for optimising the design.
Tadeusz Sobczyk, (2010)	to reduce issues arising when computing steady state solutions for AC machine models using the harmonic balance method.	LU decomposition of an infinite matrix	An algorithm for the LU decomposition of an infinite matrix representing the inductance matrix of an AC machine and an iterative algorithm for determining AC machine steady

			state currents in a recursive manner.
Kala Chand Seal, (1995)	Demonstrates the application of spreadsheets in simulating queuing systems with arrivals from a finite population. The problem is referred to as the machine repair problem where the members of the queue are machine that are breaking down and the servers are the technicians repairing the broken machine	The total number of machine are finite and pre-specified.	Describes the approach for developing a generalized simulation model with any number of machine
S. Rainer O. Bíró,, (2009)	Different solution methods, using finite element method in continuous and discrete frequency domain, are compared with each other in order to find the most appropriate method for the estimation of steady state vibrations in linear structural and mechanical problems. purpose is to describe the procedures.	analytical investigation	the steady state computation using the continuous frequency domain system description delivers the exact solution for a given system.

TABLE 2 – WORK DONE BY DIFFERENT RESEARCHERS ON FINITE STATE MACHINE AND SIMULATION IN PREVIOUS YEARS

SIMULATION - It is well known that stochasticity populations can generate dynamics profoundly different from the predictions of the corresponding deterministic model. For example, demographic stochasticity can give rise to regular and persistent population cycles in models that are deterministically stable and can give rise to molecular noise and noisy gene expression in genetic and chemical systems where key molecules are present in small numbers or where key reactions occur at a low rate. Because analytical solutions to stochastic time-evolution equations for all but the simplest systems are intractable, while numerical solutions are often prohibitively di_cult, stochastic simulations have become an invaluable tool for studying the dynamics of _nite biological, chemical, and physical systems. In the 1970s, scientists developed an exact stochastic simulation approach for chemical kinetics, the Gillespie stochastic simulation algorithm (SSA). The SSA is a procedure for generating time-evolution trajectories of _nite populations in continuous time and has since its introduction become the standard algorithm for these types of models. The development of the SSA was also the _rst e_ort to accelerate stochastic simulations

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beyond what is possible using the basic algorithm by Gillespie. Although the SSA and its various exact and accelerated Monte Carlo implementations have largely been developed for models of chemical kinetics and molecular dynamics, the procedures are applicable to any continuous time system that can be described using coupled _rst-order ordinary di_erential equations. The examples used in this paper are selected to illustrate how to implement the SSA for di_erent types of ecological models. Automotive air-conditioning (AAC) is a necessity for thermal comfort in the cabin of a passenger vehicle especially for people who are living in countries with hot and humid climate [2]. Simulations have been performed to investigate the impact of radial variation of neutral atoms (neutral puff) on the edge plasma of small size divertor tokamak. It was demonstrated that, the variation of neutral atoms (neutral puff) in edge plasma of small size divertor tokamak generates additional large radial electric field and large radial electric field shear near separatrix which can significantly influence global confinement by affecting the transition from low (L) to high (H) confinement. This simulation was performed by using B2SOLPS0.5.2D fluid transport code based on a reduced form of the transport form of transport equations.

SCOPE OF THE PAPER–

Implementation of finite state machine with sine wave and simulating the working by using step wise simulation using Simulink and Matlab.

Problems are encountered during finite state machine simulation. These problems are also overcome by use of step wise simulation and Simulink.

METHODOLOGY USED IN THE PAPER –

1. Designing a sine wave simulator using appropriate multiplexer and integrator in simulink.
2. Plotting the curve for sine wave corresponding to random values.
3. Changing the initial values of the simulation parameters on the run.
4. Adding a chart as output of the integrator
5. Designing a velocity - position state flow structure in the chart using 3 different states.
6. Setting the tradeoff between values and position.
7. Observing the output of finite state machine
8. Output showed when position symbol becomes positive output does not go to 1.
9. This is called simulation overstepping the critical time instant.
10. Fixing this problem using simulink
11. Plotting the output curve again at different small intervals of time. Problem is fixed, Output goes to 1 as soon as position becomes positive

TOOLS USED –

1. MATLAB
2. SIMULINK

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