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TAMILNADU INVFLUENCE (Road to TNGIM 2024) – 14th December 2023

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From the **President's Desk**

Dear SIEMA Members,

 ${f A}^{
m s}$ we step into a new year, I extend my warm wishes for a Happy and Prosperous New Year.

The implementation of the Aluminium Quality Control Order (QCO), originally scheduled for December 1, 2023, has been postponed until June 1, 2024. I would like to thank the Central Government for heeding our request for the postponement of the QCO.

The Indian Engineering Sourcing Show (IESS), organized by EEPC, will take place from March 4th to 6th, 2024, right here in Coimbatore. This event is expected to attract numerous international buyers. It's a remarkable opportunity for our members to showcase their products to a global audience. I encourage you to participate and make the most of this platform.

It has come to our attention that some of our members have been receiving fraudulent calls from individuals posing as BIS Officers. These impostors claim that market samples of their pumps have failed BIS testing and demand a monetary deposit to avoid the issuance of a "Stop" mark for their products. I want to emphasize that this is a SCAM. The BIS Coimbatore office has confirmed this. If you receive such a call, please contact the BIS Coimbatore office directly. Your vigilance is essential to protect our industry.

In this New Year, let's move forward with enthusiasm and dedication, working together to overcome challenges and embrace opportunities.

Thank you for your continued support and commitment to SIEMA.

Warm regards,

D. Vignesh

January 2024

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Editor Sri D. Vignesh

The opinions and views expressed in this magazine are those of the respective authors.

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TECHNICAL CALENDAR OF EVENTS (BIS/ BEE)

Technical committee meeting is held on 30th Nov, 2023 at Siema Board Room to discuss about:

- a. IS 9079 monoset pump Standard revision,
- b. IS 9283 submersible motor Standard revision,
- c. *R&D project in ETD and MED Standards.*

It is also decided to form a team of technical committee members to give a proposal regarding BEE, BIS application integration.

Online Technical meeting

Online Technical Meeting was conducted on Dec 6, 2023 through ZOOM to brief about MED 20 R & D Project on Submersible Waste Water Pump sets.

Online Technical meeting

Online Technical meeting was conducted on Dec 13, 2023 through ZOOM to brief about MED 20 R & D Project on Submersible Waste Water Pump sets. Technical committee chairman Dr. C. Murugesan explained the SSPMA-USA (SUMP & SEWAGE PUMP MANUFACTURERS ASSOCIATION) standard. This is the only standard available on submersible waste water pumps

MSME TFC Meeting for the Month of November 2023 : On 22nd Nov,2023

MSME TFC Meeting for the Month of November 2023 was held on 22nd November, 2023. President Sri. D. Vignesh attended the meeting. The PPT of the day's meeting, was circulated to all our Members.

Representation was given to Thiru Nirmal Raj IAS on 18th Nov, 2023

Representation was given to Thiru Nirmal Raj IAS on 18th Nov, 2023 Requesting to include Domestic, Agricultural & Industrial Pumps in the priority sector for availing subsidy in TIIC Financial schemes.

Stakeholders meeting regarding the upcoming Technology Centre On 27th Nov, 2023, 4th Dec 2023 & 11th Dec 2023.

The Stakeholders meetings were held at CODISSIA City Office to discuss on the upcoming Technology Centre @ Coimbatore. Our Office Bearers and Past Presidents attended the meeting.

Boat (SR) Meeting on 1st Dec 2023

The Board of Apprenticeship Training, Ministry of Education, Government of India (SR), Chennai conducted a meeting at Coimbatore. Discussions were held about National Apprenticeship Training Scheme (NATS), Establishment enrollment procedure, Rules & Regulations, Financial benefits etc. to the Industrial Associations for better understanding. President Sri. D. Vignesh attended the meeting, at Titan Company Limited, Sulur, Coimbatore.

TAMILNADU INVFLUENCE (Road to TNGIM 2024): On 14th Dec, 2023.

The Event Invfluence was organized by FICCI. Honorable Minister Thiru. T.R.B. Rajaa was the Chief Guest. Various sessions by Key speakers were arranged. Our Vice President Sri. R. Arun gave a special address at the meeting.

The COSIDICI 9th National Award Function organized by TIIC: On 15th Dec, 2023.

The function was arranged by TIIC at SITRA Auditorium. The concept of the program was: The Mission of "Embedding Sustainability in MSMEs through Capacity Building and Facilitation". Our Vice President Sri. Ma. Sendhilkumar gave a Presentation in the Technical Session on "Strengths of Coimbatore".

Representation to Thiru Hans Raj Verma: On 15th Dec, 2023

Representation was given to Thiru Hans Raj Verma IAS, requesting for Advocacy in Including Pumps in Priority Sector for TIIC Subsidy.

SIEMA conducted a Round Table Discussion on Opportunities for Pumps and Motor Manufacturers to Export to USA with INXEPTION, on 4th Dec, 2023.

Office Bearers and a few Members attended the discussion. From Inxeption Corporation, USA Mr. Farzad Dibachi, CEO, Ms. Rhonda Dibachi, Chair-Inxeption Board of Directors, Mr. Sunil Gandhe, MD- Inxeption India their Vice President Ramnivas. R., were present in the Discussion.



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Fault-tolerant Switched Reluctance Motor Propulsion System for eVTOLs

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Abstract

eVTOLs are receiving a lot of attention as a potential solution to urban air mobility challenges. Many configurations are multirotors, which are open loop unstable, therefore very susceptible to actuator failures. Due to their usually short mission duration (20-30 min), fault-tolerance of the propulsion system is of greater importance then reliability. Thus, novel approaches to enhance this capability are required. This study proposes a new fault-tolerant propulsion system using 4-phase switched reluctance motors. It is designed for an 8-10 kg scale multirotor eVTOL, to replace redundant coaxial brushless DC motors with a single fault-tolerant drive. Acknowledging the role of fault-tolerant control algorithms, the propulsion system is validated in terms of the loss of effectiveness metric, typically used in the evaluation of control solutions. The switched reluctance motor propulsion system was found to be highly resilient to open phase and current sensor faults, but susceptible to position sensor faults. This can, however, be mitigated with sensorless control solution. Extending the findings to full-scale eVTOLs is also discussed.

1. Introduction

EASA [1] has published the results of a study on societal concerns for Urban Air Mobility (UAM). In regard to air taxis, the three main concerns are environmental, noise and vibration, and safety. The environmental issues encompass (negative) impact on animals, noise pollution, impact from production, and climate impact from operation. Noise annoyance comes not only from magnitude, but also the unfamiliarity of the sound. This creates a requirement for precise vibration control around the 3 kHz frequency, to which humans are especially sensitive^[1]. Safety, though, is of paramount importance, because multirotor vehicles are open loop unstable, thus require constant control to be able to fly. This is why they are especially vulnerable to actuating system faults. However, for this specific application, and for the short mission duration, the ability to continue working in the faulty conditions - faulttolerance - seems to be of a higher importance than reliability (time worked without fault) ^[2, 3].

The current solution of using Brushless DC (BLDC) motor-based actuating system has multiple possible points of failure, some of them related to rare-earth magnets used (demagnetization, cogging, voltage induction in unpowered phases, etc.). There are, of course, ways of mitigating these issues, such as winding or motor redundancy, but these may not be suitable for every environment. Therefore, this work proposes an alternative multirotor actuating system using Switched Reluctance (SR) motors, details its design and control and analyzes the influence of three common types of faults (open phase, current sensor and position sensor).

The paper is organized as follows: Section 2 describes the main ideas of the proposed actuating system, specifically focusing on SR motor design; Section 3 covers software implementation of the system, motor control and fault models; Section 4 shows and discuses healthy and faulty behavior; Section 5 addresses the usage of SR technology in eVTOL vehicles; and Section 6 summarizes the findings.

2. Proposed solution

SR motor actuating systems for multirotor applications are a novel approach, thus there are no commercial system of this kind available on the market. Therefore, this study considers a custom-designed system including a propeller, electric motor, converter and a motor controller. A sizing methodology based on ^[4] was used to obtain a design of a system using an 18 inch propeller and intended for a 8-10 kg vehicle.

In this study, the focus is directed towards obtaining a system that is a good representation of the SR technology, rather than optimizing the performance. Therefore, the motor and converter topologies chosen are conventional and typical for general applications.

The main element of the actuating system is the SR motor. For increased fault-tolerance, the motor is a 4-phase 8/6 conventional design with 71 mm outer diameter. The main parameters are presented in Table 1. The design was obtained and prepared for manufacture using an approach described in ^[5]. Figure 1 shows the completed, manufactured rotor and shaft assembly, placed in the stator.

Table 1:	Summary	of SR	motor	parameters
----------	---------	-------	-------	------------

• •
4
6
71.0 mm
40.4 mm
0.2 mm
22.2 - 25.2 V (6S LiPo)
640 W
5500 rpm
1.1 Nm
32 A _{r.m.s.}
/ 73%



Figure 1: Manufactured SR motor - wound stator, rotor and shaft

3. Actuating system simulation

The designed actuating system is implemented using Simcenter Amesim 17 software. The simulation allows for healthy and faulty operation mode analysis, with typical faults injected into the system at different stages of operation. In addition, parameter uncertainties and sensor output errors can also be simulated.

The control system chosen for the study is based on a cascade PI loops - four inner loops for phase current control and one outer loop for speed control. The control structure is shown in Figure 2. This arrangement allows to retain the phase separation of the SR motor and its fault- tolerance capabilities. The PI controller parameters were selected manually trying to minimize the 5% response settling time.

3.1. Fault definitions

This study makes a distinction between two types of faults: uncertainties and failures. The difference comes from the way these are implemented in the simulation.

Uncertainty is defined as a change of parameter from the baseline (design). It is assumed to be pre-existing at the start of the simulation. The error magnitude (positive or negative) is expressed as a percentage, so that 0% means the baseline value. This allows to find the ranges of acceptable deviation that result in a specific performance degradation, specifically ranges for no performance decrease and 5% decrease.

Failure state is binary, either fully occurring or not at all. However, it can be injected into the simulation at specified times (0.0, 1/0 and 2.5 s), therefore allowing to analyze the behavior at various output levels. This also makes it possible to analyze multiple faults occurring simultaneously, whether in the same or different components. A specific set of failures was used for sensors: zero signal, maximum signal and random signal, which is supposed to model any other type of failure.

In multirotor vehicles, a major source of faulttolerance is the vehicle control system ^[6,7]. Studies on this topic typically simplify actuating system faults with a simple percentage metric called Loss of Effectiveness (LOE):

$$LOE = \frac{T - T^*}{T^*} \times 100\%$$

where T and T* are the thrust and thrust demand.



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Figure 2: Block diagram of SR motor actuating system

This number, expressed in percent, describes how much thrust (collective or per rotor) is lost after a fault. Specifically, failures are described by the LOE measured 0.49 s after the fault is injected. While in Table 2 the uncertainties are presented using LOE at the end of 1.0 s simulation with WOT thrust demand, in Figures 4 and 6 the effectiveness ($T/T^* \times 100\%$) and the 95% response time metrics are used. This gives a better view into the dynamics of the response and allows to discern if the steady state was reached.

4. Results and discussion

This study focuses on three kinds of faults: winding open phase faults, position sensor faults and current sensor faults. The first is of interest, as high fault-tolerance in this area would offer a major benefit over BLDC motor drives. There is only a single position sensor in the SR motor actuating system (due to weight constraint) and it is crucial for efficient motor control, so the system's behavior during such faults needs to be known. Similarly, although there are four current sensors (one in each phase), they are also crucial for motor control and need to be analyzed.

The results are presented through Tables 2 and 3, as described in the previous section. The term "n/a" is used to denote that the negative error values were not investigated while "-" means that no loss of effectiveness was observed in the analyzed domain. The term "fail" is used where the simulation did not complete.

4.1. Open phase faults

There is only a slight difference in LOE between an open circuit failure (Figure 3a) on the high or low side of the converter, so this distinction is not kept for other simulations. The recovery from the fault is very quick when injected at tfault = 0.0 s(<0.1 s) and almost instantaneous when injected at tfault = 1.0 s (improvement over ^[8]). It seems that

Component	Uncortainty type	negative e	error value	positive error value		
component	Uncertainty type	5% bound 0% bound		0% bound	5% bound	
Phase A curr. sensor	delay	n/a	n/a	8×10 ⁻⁵ s	8×10 ⁻⁵ s	
	delay	n/a	n/a	8×10 ⁻⁵ s	8×10 ⁻⁵ s	
All phases curr. sensors	offset	-10 A	-6 A	2 A	5 A	
,	noise	n/a	n/a	20%	36%	
	gain	-0.010	-0.004	0.004	0.010	
	noise	n/a	n/a	3%	5%	
Position sensor	initial pos. offset	-2°	-1 °	-1 °	3∘	
	sampling period	n/a	n/a	10 ^{0.8} s	10 ^{1.1} s	
	resolution	-	-	-	-	

Table 2: Summary of uncertainty analysis study

Component	Failuro	0% thrust I OE	50% thrust	100% thrust
Component	Fallure	0 % thrust LOE	LOE	LOE
	zero value	fail	fail	fail
Phase A curr. sensor	max. value	0.48%	43%	15%
	random signal	fail	0.48%	0.58%
	zero value	fail	fail	fail
All phases curr.	maximum value	100%	78%	87%
	random signal	fail	fail	11%
Dhase A	open circuit (high side)	0.33%	0.40%	15%
Phase A	open circuit (low side)	0.47%	0.42%	15%
Phases A&B	open circuit	3%	0.56%	39%
Phases A&C	open circuit	3%	0.43%	39%
Phases A&B&C	open circuit	56%	18%	63%
	zero value	101%	82%	89%
Position sensor	max. value	101%	82%	90%
	random signal	100%	99%	99%

Table 3: Summary of failure simulation studies at start-up and stableconditions



Figure 3: Analysis of multiple phase failures

the only adverse effect of a loss of a single phase is limiting the maximum thrust value to a certain level. However, in the case of open circuit faults in multiple phases, not only does the maximum torque drop, but the response time also increases, which is clearly shown in Figures 3b and 3c. However, the resulting LOE in case of a loss of phase does not correspond to 25% the number of lost phases, but is considerably lower, as shown by ^[9]. This shows that the other phases can easily share part of the load. This is a great benefit in terms of fault-tolerance, especially considering that thrust produced with only two phases conducting is around the value of 2.5 kg.f, so it allows for safe hover of the vehicle.

4.2. Current sensor faults

The base signal delay of the phase current sensor is 5 10–6 s. As shown in Figure 4a, this can be increased by a further 8 10–5 s (equal to about 3° mech. at 6300 RPM) without any change in output parameters. Phase current sensor noise also does



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Figure 5: Analysis of phase A current sensor failures

not seem to affect performance much, as shown in Figure 4c. However, in this case it is high frequency (100 kHz), thus outside the system bandwidth.

For positive offset values Figure 4b is predictable - due to the sensor offset (or constant bias), the demand value is reached for lower real current, therefore storing less energy in the field and resulting in close-to-linear drop in effectiveness and system response time. Although mathematically it would make sense for the negative part of the domain to be symmetrical to the positive part (current never reaching zero, reducing energy conversion area), it is more nonlinear. This is most likely due to the small energy conversion area increase due to current higher than demanded, but limited by non-linear saturation. In addition, for high magnitude negative error values the simulation does not complete, for the same reasons as for high delay. The edge cases of 50 A and -50 A represent the edge cases of always conducting or not conducting at all and can be ignored, as these are also modeled as faults.

Zero output of a single current sensor causes the simulation to stop due to the current value being too high, as shown in Figure 5a. However, the maximum current sensor signal (Figure 5b) forces the controller into outputting current reducing signal. This makes that phase behave exactly like an open circuit fault (Figure 3a). This is important, as it shows that no other currents are induced in this phase, eliminating the risk to other components. Therefore, it is recommended to set up the current sensing system so that loss of power (or other similar faults) results in sending maximum value of a signal, to protect against overcurrent. Unfortunately, random signal failure (Figure 5b) results in an unexpected behavior with two of the simulations failing and one completing only with slight noise in the thrust.

When applying current sensor failures to all phases, results for zero and random signals are repeated. However, fault-tolerance in case of maximum signal is lost, as now all phases behave like an open circuit fault, thus the motor is not supplied with any current and cannot operate.

4.3. Position sensor faults

The position sensor signal is very sensitive to gaintype uncertainties, as shown in Figure 6a. This is due to the multiplicative nature of the uncertainty, therefore the longer the motor operates, the higher the error value gets. This can be (partially) solved with an additional method of obtaining position data or resetting the position with every evolution. This is a feature of the Heidenhain ERN 1020 used for the test-bench, but has not been modeled in the simulator. In addition, Figure 6b shows the periodical nature of the sensor output signal characteristic.

Some degree of tolerance is found in terms of the sampling period, in the form of a gradual decrease of effectiveness, as shown in Figure 6c. The decrease in response time is due to lower steady state thrust value, therefore being quicker to reach. However, what is surprising, is the fact that neither effectiveness nor response time is affected by changes in the encoder resolution (with default being 2048).

As has already been established above, a position sensor is very vulnerable to uncertainties or other disruptions to its signal. This is confirmed in Figure 7, where each type of fault results in complete loss of effectiveness. Interesting is the fact that in case of zero and max signal faults, a tiny periodic response is produced, most likely caused by the rotor teeth oscillating at the aligned position.



Figure 6: Analysis of uncertainties in incremental encoder





The dependence on a single position sensor for motor control makes the actuating system vulnerabletosensorfaultsoritsincorrect calibration. Even tiny deviations of measurements from the actual position lead to significant performance degradation. That is why it is crucial to introduce redundancy, whether in the form of multiple physical sensors or a single sensor augmented with a sensorless method. Unfortunately, Hall arrays, which are common in brushless DC drives, cannot be used due to the lack of permanent magnets, thus the lack of a permanent magnetic field. Purely sensorless method is also possible (due to its higher reliability), but the potential quality of the measurement is unknown.

5. Application to full scale eVTOL vehicles

Using a SR motor actuating system at the eVTOL scale can have impact on their introduction into public airspace and the societal acceptance. As shown in the introduction, the three main concerns are environmental, vibration and safety. The simple structure of SR motors is highly sustainable, as it consists only of easily available electrical steel and copper windings, thus making it easy to source and recycle.

When scaling up the presented actuating system - to the eVTOL level, the fault-tolerance capabilities are retained, as these are a derivative of the drive topology - separation of phases and the lack of permanent magnets. Performance wise, a quadratic increase in torque with size and a cubical increase in weight can be expected ^[10]. However, at higher vehicle sizes the weight constraints are more flexible and the end-winding influence (that had to be counteracted at the scale presented) is diminished, thus allowing for thinner stator teeth and yoke.

A major concern in SR drives is the high level of torque ripple. In multirotor air vehicles applications, where the motor is connected to a propeller and the system's output is measured as thrust. It is clear from Figure 8 that the typical thrust ripple (per arm) is only about 3 g, due to high propeller inertia. Considering the vehicle's weight (8-10 kg depending on configuration) and inertia, the influence should be minimal. However, the vibration from motor operation is within the human hearing range, but should be much quieter than the accompanying propeller noise.



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The Event Invfluence was organized by FICCI. Honorable Minister Thiru. T.R.B. Rajaa was the Chief Guest. Various sessions by Key speakers were arranged. Our Vice President Sri. R. Arun gave a special address at the meeting.



The COSIDICI 9th National Award Function organized by TIIC: on 15th December 2023

The function was arranged by TIIC at SITRA Auditorium. The concept of the program was: The Mission of "Embedding Sustainability in MSMEs through Capacity Building and Facilitation". Our Vice President Sri. Ma. Sendhilkumar gave a Presentation in the Technical Session on "Strengths of Coimbatore."







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Figure 8: Thrust ripple at high motor speed and the FFT of the acceleration from stall to WOT

6. Conclusion

There are multiple concerns regarding the of multirotor eVTOLs introduction into public airspace. Three main societal concerns are environmental, noise and vibration, and safety. To address those concerns, especially safety (understood here as fault-tolerance), an alternative actuating system based on switched reluctance motors is developed for an 8-10 kg scale demonstrator multirotor vehicle. This work presents design, control and operation in healthy and faulty conditions. Out of the three kinds of faults analyzed, SR actuating systems are highly resilient against open circuit and current sensor faults. This is a major improvement over brushless DC motors^[11, 12]. However, these systems are vulnerable towards position sensor faults, thus require additional redundancy - either as a physical sensor or by using a sensorless control method. The work also addresses the issue of scaling up the system to the eVTOL level and comments on the SR actuating system in regard to the societal issues. Finally, this work highlights the potential of reluctance torque machines and phase separation in the safety critical aerospace applications.

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வெற்றிகள் தொடரட்டும்

சிந்தனைக் கவிஞர் டாக்டர் கவிதாசன் இயக்குனர் மற்றும் தலைவர், மனிதவள மேம்பாட்டுத் துறை ரூட்ஸ் நிறுவனங்கள், கோவை



முயற்சிகளை

-ழ்க்கையின் முற்பகுதியில் வெற்றிபெற சுறுசுறுப்பும் <u>ஊ</u>க்க(ழம் தேவை. பிற்பகுதியில் வெற்றிபெற பொறுமையும் தன்னடக்கமும் தேவை' என்றார் அரிஸ்டாட்டில். இளமையில் வியர்வை சிந்தாவிட்டால் முதுமையில் கண்ணீர் சிந்தவேண்டும் என்பது நமது பழமொழி. ஆகவே நீங்கள், இளைஞராக சுறுசுறுப்பாகவும் இருந்தால் வேகமாகவும் உழைக்க வேண்டும். அதே நேரத்தில் பிற்பகுதியில் வாழ்க்கையில் இருந்தால் பொறுமையாகவும் தன்னடக்கத்துடனும் இயங்க வேண்டும்.

வாழ்க்கையின் ஒவ்வொரு நிலைக்குத் தக்கவாறு நமது மனோபாவத்தை (Attitude) யும்

அணுகுமுறையையும் (Approach)அமைத்துக்கொண்டு செயல்படும் போதுதான் நமது வெற்றிகள் தொடரும் என்பதை உணர்ந்து கொள்ள வேண்டும். வெற்றி என்பது விபத்தல்ல; ஒரு முடிவில்லாத முயற்சி களுக்கு கிடைக்கும் பரிசு ஆகும். ஆகவே எப்பொழுதும் முயற்சி முற்றுப் புள்ளி களுக்கு வைக்காமல் தொடர்ந்து

முதன்மையாக இருப்பதல்ல வெற்றி; முன்னேறிக் கொண்டே இருப்பதுதான் வெற்றி. தொடர் முயற்சி இருந்தால் தோல்வியும் ஒருநாள் வெற்றியாகும். சோதனையும் ஒருநாள் சாதனையாகும்.

முயன்று கொண்டிருப்பவர்கள் மட்டுமே தொடர்ந்து வெற்றிக்கனிகளைப் பறிக்கின்றார்கள். திறமைகளை வளர்த்துக் கொள்ள வேண்டும் எனச் சிந்திக்கும் போது, பல்வேறு திறமைகளை வளர்த்துக் கொள்வது மிகவும் அவசியம் என்றாலும், அவற்றில் மிக முக்கியமான ஐந்து திறமைகள் என்னென்ன என்பதைப் பார்ப்போம். அவை:

- 1. தொடர்ந்து கற்றுக் கொள்ளுதல் (Continuous Learning)
- புதிய கோணத்தில் சிந்தித்தல் (Thinking in New Dimension)
- 3. புதிய முயற்சிகளை மேற்கொள்ளுதல்

இருந்தாலும்

4. பொறுமையும் நிதானமும்

எந்த நிலையில்

நிறுத்தக் கூடாது. ஏனென்றால் முதன்மையாக இருப்பதல்ல வெற்றி; முன்னேறிக் கொண்டே இருப்பதுதான் வெற்றி. தொடர் முயற்சி தோல்வியும் இருந்தால் வெற்றியாகும். ஒருநாள் சோதனையும் ஒருநாள் சாதனையாகும். ஒவ்வொரு தோல்வியையும் ஆய்வுக்கு எடுத்துக் கொண்டு, நிறை ஆராய்ந்து குறைகளை

அதிலிருந்து அனுபவ அறிவை வளர்த்துக் கொண்டு தொடர்ந்து முயல்வதுதான் வெற்றியின் ரகசியமாகும்.

தொடர்ந்து

வெல்வதற்கு என்னென்ன

வாழ்க்கையில்

உச்சியில் இருப்பவர்கள் SIEMA Magazine

வானத்தில் வீழ்ந்தவர்கள் அல்ல. இருந்து தரையில் இருந்து படிப்படியாக அவர்களும் உயர்ந்தவர்கள்தான் என்பதை புரிந்து கொள்ள வேண்டும். ஒவ்வொரு மரமும் செடியாக இருந்து வளர்ந்து உயர்ந்தவைதான் என்ற உண்மையைப் புரிந்து கொள்ள வேண்டும். உழைப்பின்றி வருகின்ற செல்வமும் பதவியும் நிலைத்து நிற்பதுமில்லை, நிம்மதியைக் கொடுப்பதுமில்லை என்பதுதான் வாழ்வியல் ഉ ഞ്ഞ്ഞം.

ஏணியின் உச்சிப் படியை அடைய வேண்டுமென்றால் அதன் கீழ்ப்படியிலிருந்துதான் தொடங்க வேண்டும். வாழ்க்கையும் அப்படித்தான் என்பதை உணர்ந்து கொண்டு முயற்சிப்பவர்களே முதன்மை பெறுகிறார்கள்.

தொடர்ந்து கற்றல் அவசியம்

தொடர்ந்து கற்பதையும் கற்றதை வாழ்க்கையால் கடைப்பிடிப்பதையும் ஒருபோதும் நிறுத்தி விடக்கூடாது. ஏனென்றால் வாழ்க்கை முடிவது மூச்சு நிற்பதால் மட்டுமல்ல; முயற்சி நிற்பதாலும் தான் என்பார்கள். ஆகவே ஒவ்வொரு நாளும் கற்றுக் கொண்டே இருக்க வேண்டும். ஆம்! புது வெள்ளம் வரவில்லை என்றால் கடல் கூட வற்றிவிடும்.

வெற்றிகரமாகத் வாழ்க்கைப் பயணம் தொடர்வதற்கு தொடர்ந்து கற்பது மிகமிக அவசியம். ஏற்கனவே கற்றதும் பெற்றதும் தான் நம்முடைய நிகழ்கால வாழ்க்கைக்கும் அடித்தளம். ஆகவே மென்மேலும் உயர்வதற்கு புதிய கருத்துக்களும் புதிய புதிய முயற்சிகளும் அவசியம். புத்தகங்களை வாசிப்பதன் மூலமாக புதிய புத்தாக்கம் பெறமுடியும். களிர்கள் தான் ஒரு செடியை வளர்க்கிறது. அதுபோல புதிய கருத்துக்கள் தான் ஒரு மனிதனையும் சமுதாயத்தையும் உயிர்ப்புடன் வைக்கிறது. ஒரு நாளைக்கு குறைந்தது பத்துப் பக்கங்களையாவது வழக்கமாக்கிக் வாசிப்பதை கொள்ளுங்கள். வாழ்க்கையின் வசந்தம் தொடர்வதை உணர்வீர்கள்.

புதிய கோணத்தில் சிந்தித்தல்

வழக்கமான வாழ்க்கையை புதுமையாக மாற்றுவதற்கு புதிய கோணத்தில் சிந்திப்பது அவசியம். நீங்கள் செய்கின்ற ஒவ்வொரு செயலும் உங்களுடைய பழக்கத்தின் (Habit) அடிப்படையில்தான் அமைந்திருக்கும். அவ்வாறான வழக்கமான முறைகளை மாற்றியமைப்பதற்கும் அதை புதிய கோணத் வழக்கமான வேலைகளில் சி தில் சிந்தித்து, முன்னேற்றங்கள் ஏற்படுத்துவதற்கு றுசிறு முயற்சிக்க வேண்டும். உலகத்தின் வளர்ச்சி க்கும் முன்னேற்றத்திற்கும் புதிய சிந்தனைகளே அடித்தளமாக அமைந்துள்ளன.

ஜப்பான் நாட்டில், தொடர் முன்னேற்றத்தை கைசன் (Kaizen) என்கிறார்கள். அதாவது சிறுசிறு முன்னேற்றங்களை ஒவ்வொரு செயலிலும் ஏற்படுத்துவதன் மூலமாக பெரிய மாற்றங்களை உருவாக்கமுடியும் நிரூபித்துள்ளார்கள். என்பதை அவ்வாறான தொடர் முன்னேற்ற யுத்திகளை செயல்களில் கடைப்பிடிக்க வேண்டும். அவ்வாறான சிறுசிறு முன்னேற்றத்தை ஏற்படுத்துவதற்கு புதிய கோணத்தில் சிந்திப்பது மிகவும் அவசியம்.

புதிய முயற்சிகள் வேண்டும்

எதையும் புதிய கோணத்தில் சிந்திப்பதுடன், அவ்வாறுசிந்தித்தவற்றைசெயல்படுத்துவதற்கான முயற்சியும் முனைப்பும் வேண்டும். ஏற்கனவே அடைந்த வெற்றிகளையோ தோல்விகளையோ எண்ணி எண்ணி காலத்தை வீணடிப்பதைவிட நடந்தது நடந்ததுதான், இனி நடக்கப் போவதில் கவனம் செலுத்துவோம் என்ற ஆக்க மனதுடன் புதிய முயற்சியில் இறங்க வேண்டும்.

புதிய முயற்சிகளை மேற்கொள்ளும்போது, மிகவும் கவனமாகவும் தன்னம்பிக்கையுடனும் செயல்பட வேண்டும். தோல்விகள் நிகழாமல் முன்கூட்டியே இருப்பதற்கு ஏதுவாக அவசியம். சிந்தித்துத் திட்டமிடுதல் திட்டமிட்டுச் செயல்படும்போது, காலம் வீணாவதைத் தவிர்க்கமுடியும் என்பதுடன் ஆற்றல் வீணாவதையும் குறைக்கமுடியும். திட்டமிடுதலில் வெற்றி பெறுவதென்பது இலக்கை அடைவதில் பாதி வென்றுவிட்டதற்கு ஒப்பாகும்.

பொறுமையும் நிதானமும்

தொடர்ந்து வெற்றிகளை குவிப்பதற்கு பொறுமையும் நிதானமும் மிகவும் அவசியம். விமர்சனங்களை ஏற்றுக் கொள்வதிலும்





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விமர்சனங்களில் உண்மை இருந்தால் திருத்திக் கொள்ளவும், உண்மையில்லை என்றால் அவற்றை உதறித்தள்ளிவிட்டு மிகவும் கவனமாக செயல்படுகின்ற துணிவும் வேண்டும்.

பொறுமையாகவும் நிதானமாகவும் செயல்படுவதற்குத் துணிவும் தன்னம்பிக்கையும் வேண்டும். ஆம்! பொறுமையாகவும் நிதானமாகவும் செயல்படும்போது துணிவும் தன்னம்பிக்கையும் கூடும்.

வெந்து தனிந்தது...

தேடி அலைந்த சந்தங்களின் சல்லாபத்திலே எவரும் அறியப்படா சந்தமொன்று பிறக்க உட்செவி திறக்க வெந்து தணிந்தது... பிடி சாம்பலும் ஆனது ஜனன... மரணம்...

அண்டம் குலுங்கிட அங்கம் குளிர செம்பவளப் பாதம் சிவக்கவே தக தகிட தத்தாம்...

தத்தகிட தத்தகிட்ட தத்தாம்....

தத் தகிட தாம்ம்... ஆடி முடித்து மெத்தெனவே மௌனத்திலே விழி மூடி அமர்ந்திட்டான்... அடர் பச்சை நிறத்து மங்கை தன் தண் கை தளிர் விரலால் தொட்டிடவே... - வெந்து தணிந்தது... மோனத்துக்கடவுள்! அங்கிருப்பானோ? இங்கிருப்பானோ? மூப்பு கேட்டிடவே செந்தூரக் குஞ்சோ அங்கும்..இங்கும் எங்கும் என்றிடவே ஒடி ஓடிக் களைத்து உள்ளிருக்க,. இங்கேயுமா?! எனத் தூண் பிளக்கவும் சிலிர்த்துச் சிரித்தது



பாரதிச்சுடர் மகேஸ்வரி சற்குரு

செங்கட்சீயம் வெந்து தணிந்தது... மடியிலே பக்திப் பிஞ்சு! ஈரம் உலரா நிலத்திலே கொழுமுகம் நெம்பிடவே சிசு ஒன்று பெருஞ்சிலையுடன் மண் மேலே வந்தது.. வீரன் வெஞ்சிலை ஏந்தினான் கணையில்லாமல்.... மை விழியாளின் மையல் முடியுமுன் ஊரானின் சந்தேகக்கணையைத் தன் கணையாகத் தொடுக்க வெந்து தணிந்தது... பூமி பிளந்திடவே தான் குளிர்ந்திட உள்புகுந்தாள்... ராம பத்தினி! கல்வியுமில்லை கடுக்காயுமில்லை சமையலறை அஞ்சறைப்பெட்டி போதுமென்றார்... குனிந்த தலை நிமிராது பிள்ளை பெறு என்றார்... கட்டியவன் போனால் கட்டுப்பட்டியாய் வீட்டிலிரு என்றார்... எத்தனை நாள் தான் பொறுக்க ? ரௌத்திரக் கனல் எழுந்தது... மூண்டது வெந்து தணிந்தது...

மண்ணாளவும் விண்ணாளவும் வியத்தகு ஏற்றமும் கண்டது... புதுமைப்பெண்!



⁽Prevent, Treat and Defeat Sepsis' **program was organized by Indian Society of Critical Care Medicine on 21st Nov 2023 at The Grand Regend Hotel, Coimbatore.**

President Sri. D. Vignesh, Vice President Sri. R. Arun, Si'Tarc President Sri. K. Mohan Senthil Kumar & Vice President Sri. R. Karthikeyan attended the Program

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	Head	Head	head	Head		current	power		Total	Disch.	Output	Input	O.A.Eff.	suction	
									Head		Power	Power			
(rpm)	m	(m)	(m)	(m)	(lps)	(A)	(K.W)	Hz	(m)	(lps)	(K.W)	(K.W)	(%)		1
2764	5.304	7.0	0.0	12.30	1.50	3.04	0.706	50.00	12.30	1.50	0.18	0.706	25.63	390	7
2765	4.624	10.0	0.0	14.62	1.30	2.99	0.692	50.00	14.62	1.30	0.19	0.692	26.93	340	
2770	3.808	13.0	0.0	16.81	1.04	2.90	0.671	50.00	16.81	1.04	0.17	0.671	25.54	280	
2791	2.992	16.0	0.0	18.99	0.74	2.75	0.634	50.00	18.99	0.74	0.14	0.634	21.73	220	12
2818	2.448	19.0	0.0	21.45	0.39	2.52	0.580	50.00	21.45	0.39	0.08	0.580	14.14	180	1.0
2846	2.176	23.0	0.0	25.18	0.00	2.26	0.518	50.00	25.18	0.00	0.00	0.518	0.00	160	

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