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Installation of Stroboscopic Free Fluorescent Lamps for Electrical Machines Laboratory

Madhvaraja[1], A Sai Divya[2], Sahana K[3], Hemanth Kumara N H[4], Krishna Chaitanya T E[5]
[1]*Assistant Professor,* [2, 3, 4, 5]*UG Students, Dept. of Electrical & Electronics Engg, PDIT, Hosapete, India*

Abstract: ***Stroboscopic effects can alter human visual perception of the moving object in normal fluorescent lamps. To eliminate this effect, stroboscopic free fluorescent lamps are to be used in electrical machines laboratory to avoid accidents caused by moving object. A capacitor is placed in series with choke between two set of parallel connection of florescent lamp at 90^0 out of phase, thereby avoiding flickering of lamps at same time period. Hence one of the lamps will be glow during one half cycle. The aim of this paper is to install the stroboscopic free florescent lamps in Electric Machines laboratory to eliminate stroboscopic visual effect.***

Keywords: Stroboscopic, florescent, capacitor, visual phenomenon, Electric Machines laboratory.

I. INTRODUCTION

The stroboscopic effect is a visual phenomenon caused by aliasing that occurs when continuous rotational or other cyclic motion is represented by a series of short or instantaneous samples (as opposed to a continuous view) at a sampling rate close to the period of the motion.

At the usual alternating current supply frequency of 50 Hz, A discharge will be extinguished 100 times per sec. Although effect is seldom noticeable in normal conditions [1]. It is possible that this may, in some instance, give rise to stroboscopic effect that is moving object such as rotating parts of machinery, illuminated by this light, may appear to be rotating more slowly than their actual speed.

Stroboscopic effect can alter human perception of the surrounding environment hazardous condition may arise due to the presence of stroboscopic effect, which can increase the occurrence of potential accidents. Stroboscopic effect can alter human visual perceptions of the moving object will appear stationary or moving in different speeds. When the frequency of the moving machine coincides with the multiple of frequency of the light modulation can potentially cause harmful situation to workers [3].

With the achievement of technological aspect, the present inventions are relative to stroboscopic effects. These effects can be minimized by two methods.

II. PROBLEM STATEMENT

Stroboscopic effect causes accidents to a worker in a factory while operating with running machine. Say a flywheel under the illumination of fluorescent light, the flywheel may appear to be stationary or to be operating at reduced speed. This can result in accidents and highly dangerous [2].

A sewing machine whose needle moves up and down may appear to be stationary and the operator can prick the fingers. These are some examples where the stroboscopic effect in the florescent lamps can prove to be dangerous.

Stroboscopic effect caused by flickering of fluorescent lamp, this is harmful to the vision, causing discomfort, visual fatigue and headache.

Creating the healthy environment by eliminating stroboscopic effect by reducing the flickering of fluorescent lamp is to be achieved.

Method to avoid stroboscopic effect:

If the industry is supplied with a three-phase supply, the three lamps are feed with a different phases, so that the zero instants of the three lamps will not be the same. Fluorescent lamps are installed around the rotating or moving machinery, three lamps powered by three different phases should be used. This ensures that all the three lamps do not flicker due to the zero-crossing at the same time due to 120^0 phase angle between the three phases.

If single-phase supply is only available, then the connection of two adjacent lamps is made such that the two lamps are connected in parallel with the supply. In one lamp connection, a capacitor or condenser is kept in series with the choke. This makes a phase shift thereby eliminating the stroboscopic effect.

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III. APPLICATION OF STROBOSCOPIC EFFECT

A. Measurement Of Slip Using Stroboscopic Effect

In this method, a circular metallic disc is taken and painted with alternatively black and white segments. The number of segment (both black and white) is equal to the number of poles of the motor. For a 8-pole motor, there will be eight segments, four black and four white. The painted disc is mounted on the end of the shaft and illuminated by means of a neon-filled stroboscopic lamp which may be supplied preferably with a combined dc and ac supply although only ac supply will do. The connections for combined supply.

Fig.1 shows the connection for ac supply only. It must be noted that with combined dc and ac. supply, The lamp will flash once per cycle. But with ac supply, it will flash twice per cycle. Consider the case when the revolving disc is seen in the flash light oof the blub which is fed by the combined dc and ac supply.

If the disc were to rotate at synchronous speed, it would appear to be stationary. Since, in actual practice, its speed is slightly less than the synchronous speed, it appears to rotate slowly backwards. The slip can be found from the relation N_S-N/N_S.

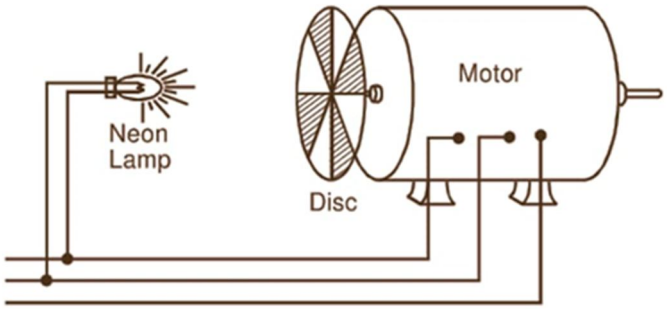

Fig: 1.Measurement of the slip using the stroboscopic effect.

B. Measurement Of Rotational Speed Using Stroboscopic Effect

A typical test setup for stroboscopic effect testing is shown in Figure 2. The stroboscopic effect visibility meter can be applied for different purposes.

1) Measurement of the intrinsic stroboscopic-effect performance of lighting equipment when supplied with a stable mains voltage;
2) Testing the effect of light regulation of lighting equipment or the effect of an external dimmer.

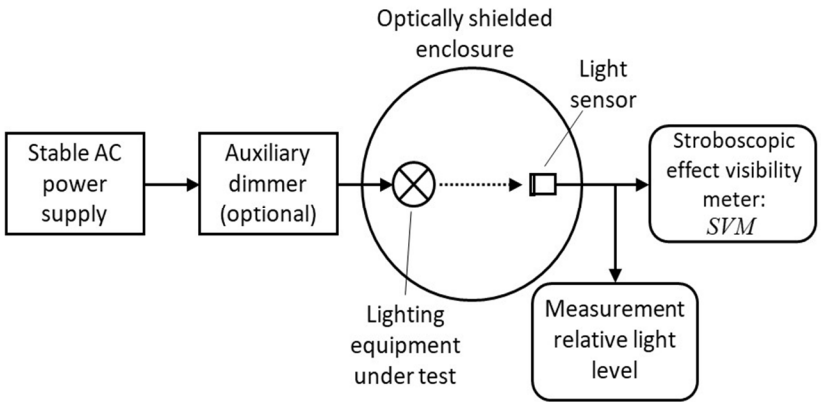

Figure 2: Setup to test lighting equipment for its stroboscopic effect performance.

A stroboscope or stroboscopic tachometer is also called a flashlight stroboscope used for the measurement of angular velocity or rotational speed by the stroboscopic method. It consists of a flashing light of variable frequency in which the flashing frequency of the stroboscope light can be adjusted. A variable frequency oscillator is employed to control the flashing frequency of the light. By adjusting the oscillator frequency the angular speed can be measured.

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IV. METHEDOLOGY

In actual applications, however, where this effect might cause annoyance, it can be practically eliminated in a three-lamp unit by connecting each lamp on a separate phase of a 3-phase system and it can be greatly reduced in a two lamp unit by the use of a 2-lamp control unit, which employs a condenser in the ballast of one of the lamps.

Fig.3 shows the circuit diagram of two fluorescent lamps arrangement. A capacitor is placed in series with choke between two set of parallel connection of florescent lamp at 90^0 out of phase, thereby avoiding flickering of lamps at same time Period. Hence one of the lamps will be glow during one half cycle. The current through the lamps is almost 90^0 out of phase and under these conditions light output of one of the lamps is at a maximum.

This method has an additional advantage of giving an overall power factor of nearly unity for the unity of two lamps. In this arrangement one circuit remains at a low power factor at about 0.5 lagging, while the other circuit incorporating a series capacitor C remains at a power factor of about 0.5 leading.

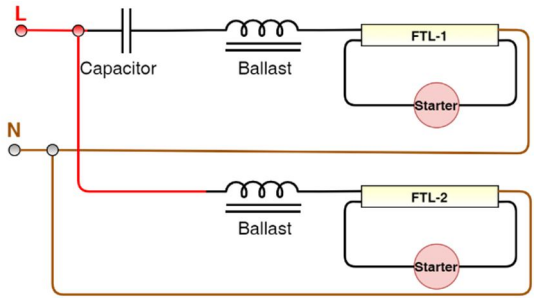

Fig: 3. Circuit diagram of two fluorescent lamps in series with the capacitor.

The 8 sets of stroboscopic free fluorescent lamps are installed in Electrical Machines laboratory-1 and 2 in Department of Electrical and Electronics Engineering, Proudhadevaraya Institute of Technology, Hosapete. India.

Fig 4 shows the installation setup of stroboscopic free fluorescent lamps Electrical Machines laboratory.

Fig: 4. Stroboscopic free fluorescent lamps installed in machine laboratory-1&2.

V. CONCLUSION

Stroboscopic effect is a visual perception which affects for human visuals in the rotating machines especially in Electrical Machines laboratories. Hence it is required to eliminate this effect by connecting two set of fluorescent lamps in parallel and a capacitor in series with it, in this project 8MFD capacitor and 36W fluorescent lamps are used, if less than 8 MFD capacitors used, then the intensity of fluorescent lamp will be less. After conducting this experiment the light intensity can be observed and stroboscopic effect is minimized, thereby reducing the accidents caused by rotation machines.

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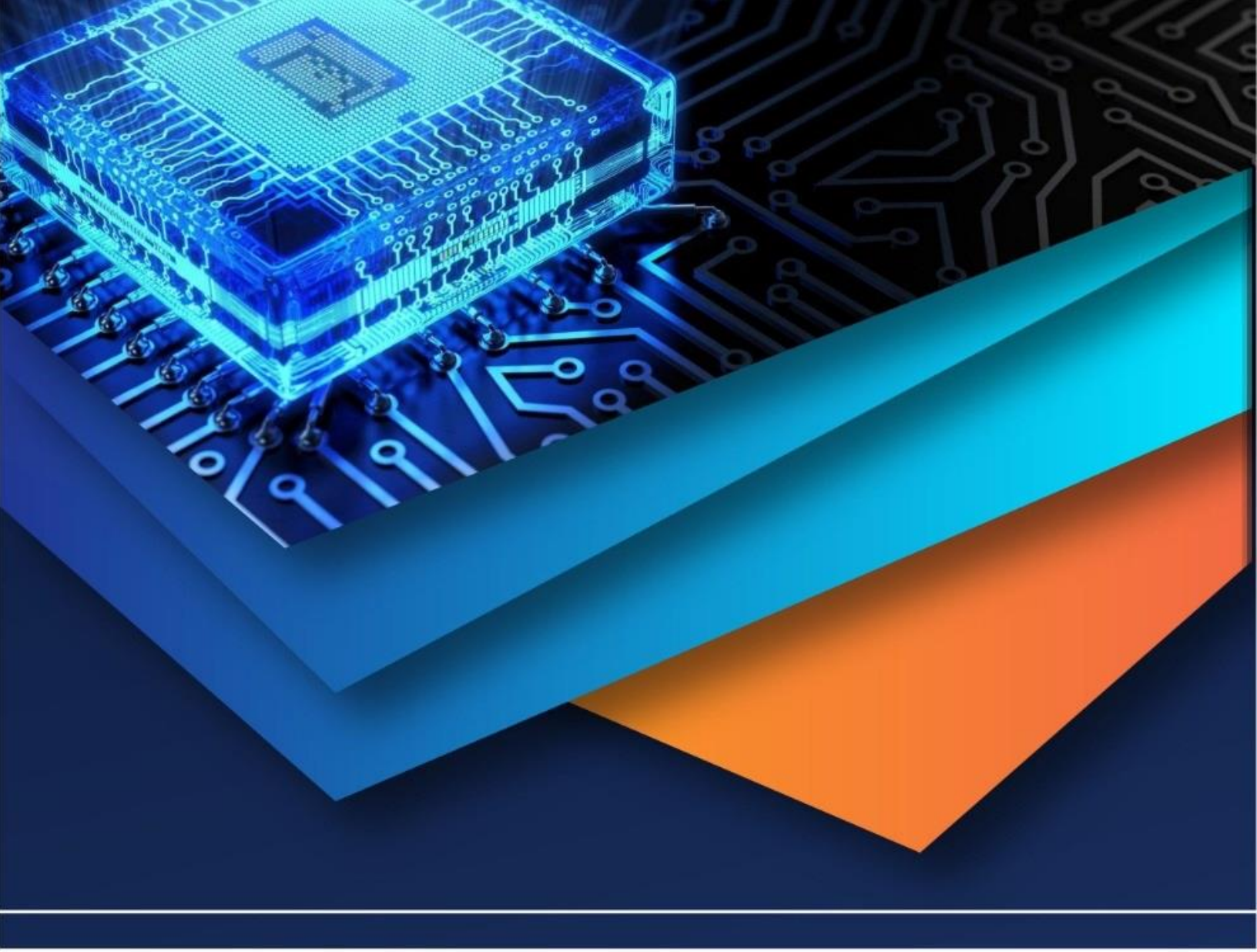

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