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Araştırma Makalesi Research Article

EVALUATION OF NOISE ON RING SPINNING MACHINES

Murat KODALOGLU[1*], Feyza AKARSLAN KODALOGLU[2]

[1] Isparta University of Applied Sciences, Vocational School of Technical Sciences, Occupational Health and Safety Program, Isparta, Turkey
[2] Suleyman Demirel University Engineering Faculty, Textile Engineering, Isparta, Turkey

Keywords
Spinning, Noise, Fuzzy, Safety, Ring Machine.

Abstract
The ring spinning system is a system that continuously spins yarn and winds bobbins. This yarn, after leaving the delivery rollers, takes the twist of the rotating spindle and traveler, and is wound onto the bobbin, which goes as overlapping on the spindle. The degree of weight in the spinning mills increases. On top of that, one of the reasons is working at its higher speeds to improve the production rates in the production process in a competitive environment of development. The evaluation and evaluation of speed balance almost as a whole is increasing, and in the evaluation of more energy in sound. assessment does not qualify as a problem of poor human health and condition in many countries. It is at a level to serve people. "Production rather than production consists of elements freed from the emergence of high-level indicators. Fuzzy logic can be developed by tool from tool pilots with predictive and general applicability to the planning of aircraft by human being difficult to craft. In this model, the appropriate gear wheel on the appropriate type gear wheels.

RİNG İPLİK MAKİNALARINDAKİ GÜRÜLTÜNÜN DEĞERLENDİRİLMESİ

Anahtar Kelimeler
Büküm, Gürültü, Bulanık, Güvenlik, Ring makinası.

Öz
Ring iplik eğirme sistemi kontinü olarak ipliği eğiren ve masuralara saran bir sistemdir. Bu sistemde iplik, çıkış silindirlerini terk ettikten sonra dönen iğ ve kopçanın içinden geçerek büküm almakta, iğ üzerine takılı olarak dönmekte olan masuraya sarılmaktadır. İplik fabrikalarındaki gürültü miktarı artmaktadır. Bunun temel nedenlerinden biri, yoğun rekabet karşısında ring iplik makinelerin üretim oranlarını artırmak için her zamankinden daha yüksek hızlarda çalıştırılıyor olmasıdır. Hız artışının doğrudan bir sonucu olarak denge dışı kuvvetler ve titreşim artmakta ve ses olarak daha fazla enerji açığa çıkmaktadır. Gürültü, sanayileşme ve kentleşmenin yoğun olarak yaşandığı pek çok ülkede insan sağlığını ve yaşam kalitesini daha fazla etkileyen önemli bir sorun olma özelliği taşımaktadır. İnsanlar, yaşamın değişik ortamlarda gürültülü alanlarda bulunmaktadır. Bununla birlikte gürültüden en çok etkilenen kesimi, yüksek düzeyde gürültülerin ortaya çıktığı sanayi kuruluşlarında çalışanlar oluşturmaktadır. Bulanık mantık, insan akıl yürütmesinin bilgisayarlaştırılmasını sağladığı için tahmin doğruluğu ve genel olarak başarı uygulanabilirliği ile olağanüstü tahmin doğruluğu ile toplanması zor olan veriler bulanık mantık tabanlı modeller deneyimlerinden yararlanılarak geliştirilebilir. Bu çalışmada, bulanık mantık tabanlı yaklaşım ile ring iplik makinasında farklı devirlerdeki gürültü düzeyi incelenmiştir.

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Yazar Kimliği / Author ID (ORCID Number)
M.Kodaloglu, 0000-0001-6644-8068
F.Kodaloglu, 0000-0002-7855-8616

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[*] İlgili yazar / Corresponding author: muratkodaloglu@isparta.edu.tr, +90-246-214-6911

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[2] Suleyman Demirel University Engineering Faculty, Textile Enginering, Isparta, Turkey

Highlights

- Noise generation in spindles of ring spinning machines.
- Simplicity and applicability of the fuzzy logic system.
- Excitation forces increase as speeds increase

Graphical Abstract

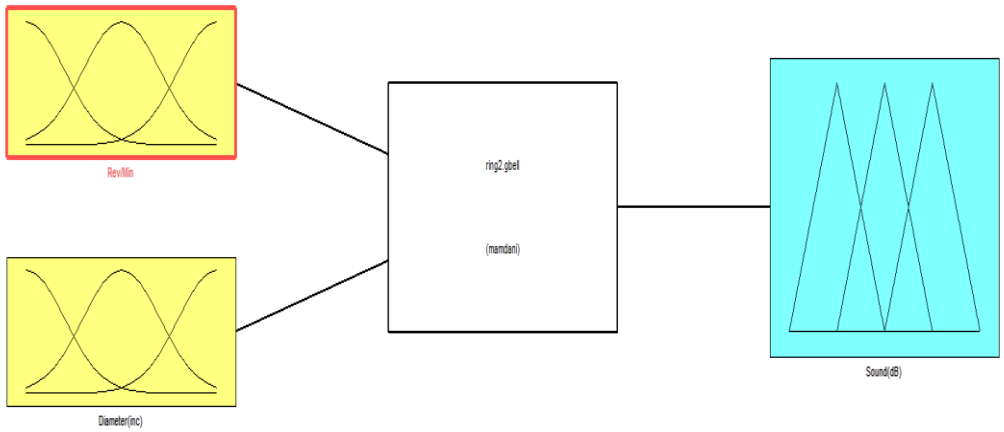

Figure 1. Fuzzy Logic model

Purpose and Scope

It is aimed to reduce the noise by examining the working principles of the mechanisms used in ring spinning machines.

Design/methodology/approach

Aim; In particular, a basic research support infrastructure will be formed, the stresses of which in yarn production can be minimized and the noise level can be determined.

Findings

The formation of moving cam levers and blades inside the spinning machine body has been designed in a unique way by examining the relevant studies. A unique system has been developed that can control the noise level of yarn manufacturing processes with the desired quality and precision.

Originality

With the fuzzy logic method, the noise level of the imported machines with a high price was determined in much wider ranges, and it was possible to evaluate the employee health issues. The design of the system belongs to Murat Kodaloğlu et al.

Corresponding author: muratkodaloglu@isparta.edu.tr, +90-246-211-6911

1. Introduction

The twist given to the yarn in ring spinning machines is provided with the help of the spindle-ring-traveller trio. After the roving comes out of the delivery cylinder, it passes through the thread guide and the eyelet attached to the collar and is wound on the bobbin as thread. The bobbin rotates on the spindle together with the spindle. As a result of the thread being dragged by the rotation of the bobbin, the traveler starts to rotate on the ring. Thanks to this rotational movement, the fiber bundle starts to twist by twisting around itself as soon as it comes out of the front roller. In order to perform the twisting operation, the thinned roving must be grasped and rotated from the lower end. This process; It is carried out by the spindle, ring and traveler trio. The clasp holds the lower end of the thinned wick; On the other hand, the spindle twists the roving around itself with the help of the ring and traveler. If the friction of the traveler with the ring is not taken into account, it is assumed that each revolution of the spindle or each turn of the traveler around the ring gives a twist to the yarn. As long as the fiber bundle continues to be delivered from the front roller, the yarn both receives twist and continues to be wound on the bobbin. Winding process; It is made with a device consisting of a ring, traveler and spindle trio. The traveler, which rotates freely on the ring, will lose some of its speed due to friction. Since the spindle and thread will force it to rotate continuously, there will be a revolution difference between the spindle and the traveler, and as a result, the winding of the thread on the bobbin will take place. During the winding, there is a ring rail that acts as a way to the yarn, regulates the winding and constantly goes up and down from the top to the bottom. Planga, going up heavier, wraps the main layer of the yarn, descending faster, wraps the intermediate layer on the bobbin. The formation of cones in the bobbin is provided by the device on the machine. This device; consists of latch, fork and chain. The chain shortens a little with each movement of the ring rail, delaying the movement of the ring ring and creating a taper (Usta, 2001 and Atherly, 1964 and Burns, 1965).

To understand the mechanisms of noise generation in the spindles of ring spinning machines, the mechanical properties of the spindles must be known. The bobbin is a metal tube positioned by guide centralizers that sit at the top of the spindle. Noise has two main sources: (a) noise from the surroundings of the coil; (b) noise from bearings

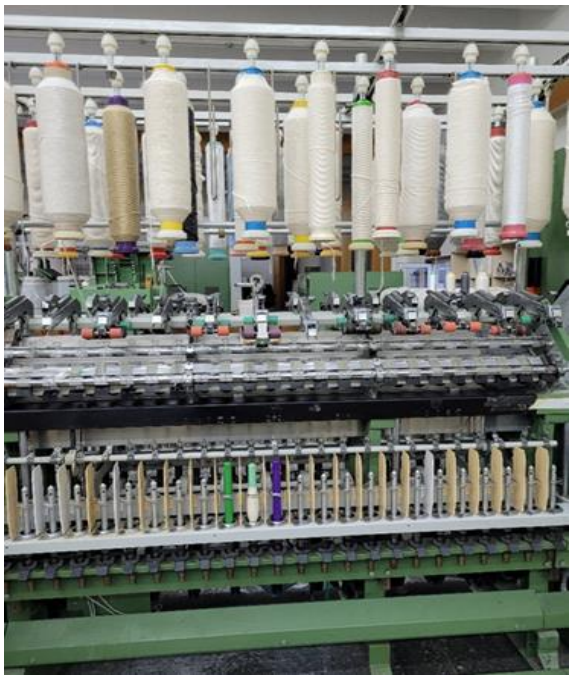

Figure 2. Machine Body

Figure 3. Spindle and Bobbin Assembly

In almost all the areas in the industry the machine operators are exposed to the noise levels throughout the duration of their work period of about 8 h per day. Much work has already been done on the effect of long-term hearing exposure to textile machine noise and other environments with similar noise spectra. Spurred on by the Wilson Committee report attention has been focused on the problem of the reduction of industrial noise in many textile environments in this country. Over-all noise levels through- out the industry where high-speed machinery is operating are in the region of 90 to 105 dB with the main energy peaking around 1000 to 2000 Hz. Recommended deafness risk criteria Burns, Glorig, Ward & Nixon are sometimes exceeded in several octave bands in many processes, supplying the need for a noise- reduction programme.

Spindles; They are the elements that enable the winding to take place by moving the bobbin in the ring spinning

machine. The spindles are mounted on the machine from the neck and base. Friction between the traveler and the ring limits the spindles reaching very high speeds. The spindles have a knee-commanded brake assembly. The bobbins must fit on the spindles evenly and engage tightly. The swinging bobbin causes the spindle to vibrate.

The ring is the ring around the spindle in the ring machine and forms the traveler's rotation path. It is subject to high friction. The bracelet is made of hardened quality steel. The surfaces of the bracelets are made harder than the clasp. In order for the traveler to be efficient, it is very important that it is perfectly round and the surface is smooth. The yarn coming out of the front rollers is wound on the bobbin by sliding the traveler, which is formed by the rotation of the spindle, on the ring.

Buckle; It is the metallic or plastic part that the thread passes through while winding on the bobbin, which gives tension to the thread and also provides twisting with the spindle. The traveler is attached to the collar and rotates by dragging through the thread. It depends on the fiber properties used, the production speed, etc. Depending on the type of traveler used, the type of traveler may also vary.

Balloon breaker; As a result of the great speed of the traveler and the yarn, both are under the influence of a very important central force. This force will press the traveler against the collar, while the force of the thread will want to throw it out. In the meantime, it is seen that the yarn takes a pear-shaped transparent form around the rotating spindle. This is called a balloon. As a result of ballooning in the ring spinning machine, the threads wound on the bobbins can become wrapped around each other and thread breakage may occur. Preventing this is with the help of balloon collars that define the ballooning limit.

Separator plates (separator); The separators are mainly intended to prevent the yarn balloons rotating side to side from hitting each other and the stationary or moving machine parts and getting stuck (MEB, 2011).

All components on this machine cause various noise levels depending on the machine speed. In this study, a fuzzy logic-based approach has been applied to examine the effect of the number of revolutions on the noise level of the ring spinning machine. The fuzzy-based approach was chosen because fuzzy logic provides the computerization of human reasoning and the ability to handle control problems when there is uncertainty attributable to the complex dynamics of an environment. The advantage of using fuzzy logic lies in the key features that define the simplicity and applicability of the fuzzy logic system. Fuzzy logic is easy to understand and the mathematical concepts behind fuzzy reasoning are simple. It is tolerant of imprecise data and any set of input-output data can be created as a fuzzy system. Fuzzy logic is a method that interprets the values in the input vector and assigns values to the output vector based on a set of rules. It is a rule-based approach that is particularly suitable for a complex system where accurate mathematical models cannot provide satisfactory performance (Yılmaz,2005 and Zadeh,1965).

In almost all areas of industry, machine operators are exposed to noise levels while they work approximately 8 hours a day. many textile mills have focused on the problem of reducing industrial noise.

In twisting areas, machines do not necessarily have to produce the same noise levels. It is produced at different speeds according to the yarn types and the noise levels vary according to the machine speeds. Excitation forces increase as speeds increase and there are slight variations in the vibration response of machine elements, and the resulting noise levels vary from machine to machine (Crawford, 2022 and Dionova ,2020).

Operators of machines operating under different production conditions require close proximity to their machines throughout the working time. The noise spectrum of the ring spinning machine consists of spindle and bobbin set.

2. Material and Method

The fuzzy logic tables created in this study were described by the MATLAB program, and the resulting data were examined. With the fuzzy logic module of the MATLAB program, the Mamdani model with two inputs and one output has been established. In this model, the method of obtaining the results with the center of gravity method is based (Gloring, 1961 and Kodaloğlu, 2022 and Nixon, 1961 and Rice,1966 and Taylor,1965). Input Rev/Min. to the first of the membership function sets. As seen in Figure 4 below, the values are processed into the fuzzy logic module of the MATLAB program.

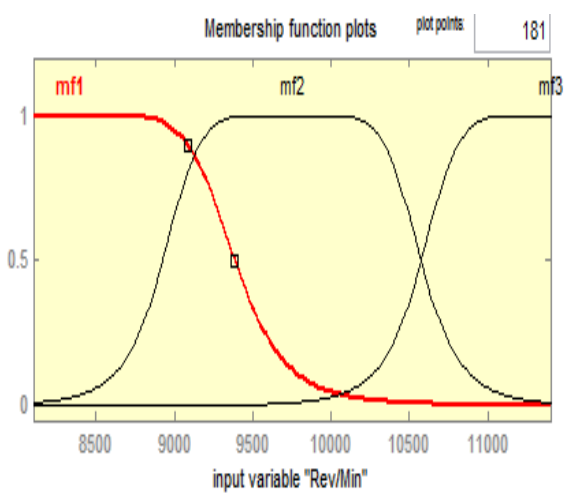

Figure 4. The First Set of İnputs, Rev/Min. Membership Functions

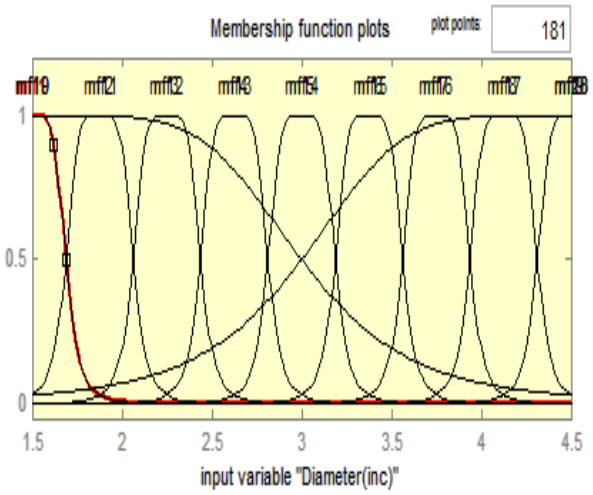

Figure 5. Diameter Membership Functions, The Second Set of Inputs

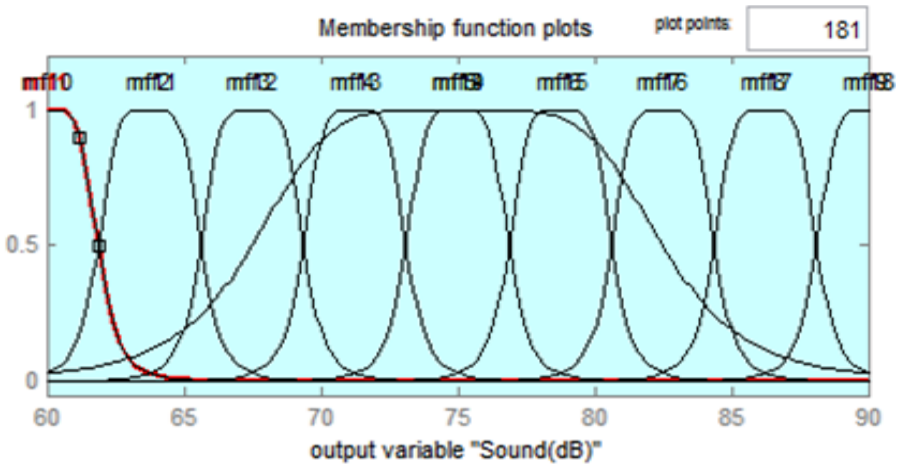

Figure 6. Sound Membership Functions with Output Set

The second of the Input Membership function sets is diameter. As seen in Figure 5 below, the values are processed into the fuzzy logic module of the MATLAB program. Output Sound is given as a set of membership functions. As seen in Figure 6 below, the values are processed into the fuzzy logic module of the MATLAB program.

In the study, the gbellmf method was chosen in the type of membership functions used in the input and output sets. Thus, a trapezoidal shape, which is a geometric shape, was obtained. In this way, approximate values are obtained within the framework of fuzzy logic rules. A total of sixty fuzzy rules were created and these were used for output graphics.

After the membership functions are entered in the MATLAB fuzzy logic editor, the values of the membership function are also entered in the rule editor. After the rule entries were completed, the results were monitored with the rule viewer. During the creation of the results, the center of gravity method was chosen as the clarification method. After processing all the data, the system described with the MATLAB program gave the following results.

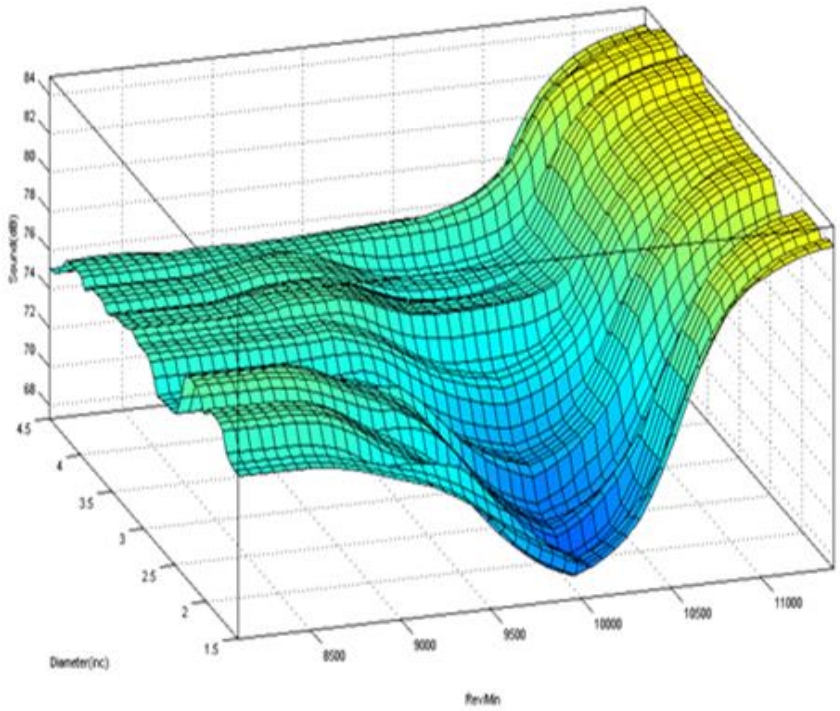

Figure 7. Data Obtained With The MATLAB Program

As shown in Figure 7, a noise reduction of about 9 dB is seen at the initial low speed compared to the high speed. In ring spinning machines, a fairly constant circumferential speed and yarn line tension occur, where the spindle speed is high at the start and as the radius increases when the yarn accumulates, the rotation speed is reduced. Noise levels in the low-frequency octave bands increase very significantly when the coils are full, the spindle harmonic noise. The greater the roundness of the coil, the higher the coil noise will be if the machine has many lobes.

3. Results and Discussion

In this study, the Mamdani method was used to evaluate the change in noise in ring spinning according to machine speed using fuzzy logic method. In the given literature that we have done; effect of long-life machine exposure to textile animals and other environments with similar noise spectra Taylor, Pearson, Ma & Burns I965; Burns, Hinchcliffe & Littler I964; Nixon and Glorig I96I; similar results have been obtained by Atherley I964 in numerous studies. Industries in which high-speed machines are engaged generally have overall noise levels in the 90 to 105 dB range, with a main energy peak of around 1000 to 2000 Hz. The noise level in spinning industry ranges between 8 and 90 dBA, where the blow room is the lowest noise generator and ring frame is the highest. In studies conducted by Talukdar 2001, it has been determined that sound levels exceeding 85 dBA have many negative health effects such as hearing loss, earache. In addition, high noise levels reduce performance, ability to concentrate, lack of sleep, and annoyance to the workers. Unlike the measurements made in the literature with the fuzzy logic method, the noise values occurring at wider engine speeds were determined. As stated in the Noise Control Regulation; choosing other working methods with less exposure to noise selecting suitable work equipment that emits the lowest possible noise level, proper design and arrangement of working places, work equipment correctly and safely providing necessary and training to employees to use should be reduced by.

It has been shown that fuzzy set theory can give more accurate results in terms of determining the noise level. Therefore, the obtained results confirm that fuzzy logic reasoning can be applied especially in controlling the effect of noise parameters. As the analysis and results shown here confirm that the fuzzy-based system can be used for noise level evaluation, the subject needs to be further explored with detailed analyzes of the fuzzy logic rule structure. The results obtained are directly affected by the shape of the chosen membership function, so in the low noise range where the deviations of the results are more emphasized, this membership function should be as narrow as possible. Comparing the spindle-noise spectra of empty spindles and full bobbin spindles shows that bobbin noise is harmonic with the frequency noise corresponding to the spindle rotation speed.

In order to reduce the noise level, the following Maintenances must be Performed on the Machine

- Spindle rotation belts are opened and cleaned with absorber.
- Feet of belts are checked. Spindles are cleaned.
- Gear lubrication pump is checked.
- Main motor bearings are lubricated.
- Prepress rollers are grinded.
- Front thrust roller bearings are lubricated.
- Clips are removed and cleaned with air.
- Lower aprons are dismantled and cleaned.
- Upper aprons are checked.
- The draft rollers are cleaned.
- Guides are checked.
- Balloon control beds are cleaned.
- Separators are cleaned with compressed air.
- Back pressure rollers are grinded
- Pulleys are greased and Ring settings checked.
- Balloon control slot settings are checked and Guide settings are checked.
- The traveler cleaner settings are checked.
- Coil holders are cleaned and checked.
- The drafting roller gauge distance is checked.
- Pressure guns are checked

An overall noise level reduction of 9 dB and a 20 dB reduction in the ringing noise at gears as subjectively, the drawbox is quiet because the reductions have been effected mostly in the sensitive region of the ear. As is often the case in a noise reduction programme, some of the noise reduction may be sacrificed for a speed increase, the speed increase depending on the noise level that can be tolerated.

Conflict of Interest

No conflict of interest was declared by the authors.

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