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Review Article

Spinning Technology in the Physical Design of Music Strings and the Mechanics of Sounds in Balloon Guitars

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Abstract

Design strings may be "plain", consisting only of a single material, like steel, nylon, or gut, or wound, having a "core" of one material and an over winding of another. This is to make the string vibrate at the desired pitch, while maintaining a low profile and sufficient flexibility for playability. Spinning technology in the physical design of music Design strings and the mechanics of sounds in balloon (Oud) guitars as a core-spun yarn containing an ultrafine copper wire for design of music Design strings -oriented applications is successfully manufactured using a modified vortex spinning system. The copper wire is located in the core region and is tightly wrapped by the helical short-staple fibers of the outer layer in the vortex core-spun yarn. The staple fibers are expected to provide an effective protection to the copper and nylon wire core and to prevent the potential occurrence of short circuits resulting from the contact between the adjacent conductive tracks for design of music Design strings -oriented , The friendliness of the interaction between the human and the conductive track is also expected to be improved due to the improved surface structure of design of music Design strings -oriented , and appearance provided by the short staple fibers. The vortex core-spun yarn containing a copper wire has strength higher by 88.6% and a breaking extension lower by 78.2% compared to the design of music Design strings -oriented wire. The strain sensitivity of the vortex core-spun yarn in the workable strain range is not affected by either the design of music Design strings -oriented production process [1,2].

Keywords: Spinning of Music; Mechanics of Sounds; Balloon (Oud) Guitars

Mini Review

The problems:

a) The subject of Design strings in musical instruments are interdisciplinary topics that are not found in scientific research to improve the development of instruments. They are interdisciplinary.

b) Not including these applications and teaching them in the faculties of specialization (science "Department of Physics" - Applied Arts "Department of Spinning and Weaving" - Applied Arts "Department of Spinning and Weaving" - Departments of Music in different faculties). .?

c) These Design strings were produced from various raw materials. And the user of the instruments does not know the content of the instruments he plays on?

d) These Design strings have been produced since the era of the Pharaohs from various materials, the user of the instruments does not know the historical development of the instruments he plays on?

e) Spinning technology for string production is simple and available in Egypt.

Music in Ancient Egypt

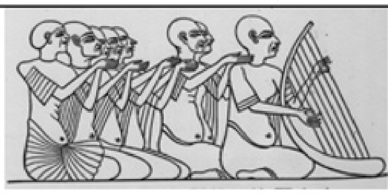
the physical design of music Design strings throw Spinning technology in the physical design of music Design strings and the mechanics of sounds in balloon (Oud) guitars, although music existed in prehistoric Egypt, the evidence for it becomes secure only in the historical (or "dynastic" or "pharaonic") period--after 3100 BCE. Music formed an important part of Egyptian life, and musicians occupied a variety of positions in Egyptian society. Music found its way into many contexts in Egypt [3]: temples, palaces, workshops, farms, battlefields and the tomb. Music was an integral part of religious worship in ancient Egypt, so it is not surprising that there were gods specifically associated with music, such as Hathor and Bes (both were also associated with dance, fertility and childbirth) [4,5] (Figure 1).

Ancient Egyptian tomb painting depicting lute players, 18th Dynasty (c. 1350 BC) [34]

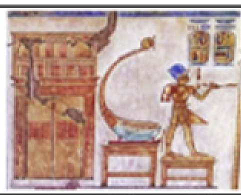
Balloon (Oud) guitars of Machine" Oud " for the artist " Sayyid Darwish " was born in Alexandria, Egypt, on March 17, 1892, and died on September 10, 1923. [32]

Figure 1

A musical instrument is a device created or adapted to make musical sounds. In principle, any object that produces sound can be considered a musical instrument, the history of musical instruments dates to the beginnings of human culture of Ancient Egyptian [6]. Early musical instruments may have been used for rituals, Musical instruments evolved in step with changing applications and technologies [7-9]. The Physical Design of Music Design strings of all the major categories of musical instruments (percussion, wind, stringed) were represented in pharaonic Egypt [6,7]. Percussion instruments included hand-held drums, rattles, castanets, bells, and the sistrum, a highly important rattle used in religious worship. Hand clapping too was used as a rhythmic accompaniment. Wind instruments included flutes (double and single, with reeds and without) and trumpets. Stringed instruments included harps, lyres, and lutes--plucked rather than bowed. Instruments were frequently inscribed with the name of the owner and decorated with representations of the goddess (Hathor) or god (Bes) of music. Both male and female voices were also frequently used in Egyptian music (Figure 2).



pharaonic Egypt[15]



Harp of Ramses III

Figure 2

The ladle-shaped harp, which was for a long time seen in banqueting scenes, was also the instrument of solo harpist. It was also offered as a special gift to a deity, as seen on a portico of Tuthmosis IV, where the harp, along with other valuables, was presented to Amun-Ra. In the temples of Ramses III at Medinet Habu, harp was offered to Amun-Ra and Mut, with two such musical instruments are presented by Sty I at Abydos. The crescent-shaped harp is a late development of the aeched harp that appeared in the Greco-Roman period. The instrument with a shallower sound-box, placed on a stand, had decorated nech with a form of a women`s head, surmounted by the sun disc, feathers and goddess Merit as showen in the temples of Mut, Hathor and Isis [1]. The physical design of music Design strings as A string is the vibrating element that produces sound in string instruments such as the guitar, harp, piano (piano wire), and members of the violin family. Design strings are lengths of a flexible material that a musical instrument holds under tension so that they can vibrate freely, but controllably. Design strings may be "plain", consisting only of a single material, like steel, nylon, or gut, or wound, having a "core" of one material and an over winding of another. This is to make the string vibrate at the desired pitch, while maintaining a low profile and sufficient flexibility for playability [10]. The invention of wound Design strings , such as nylon covered in wound metal, was a crucial step in string instrument technology, because a metal-wound string can produce a lower pitch than a catgut string of similar thickness of the physical design of music Design strings . This enabled stringed instruments to be made with less thick bass Design strings. On string instruments that the player plucks or bows directly (e.g., double bass), this enabled instrument makers to use thinner Design strings for the lowest-pitched Design strings , which made the lower-pitch Design strings easier to play. On stringed instruments in which the player presses a keyboard, causing a mechanism to strike the Design strings , such as a piano, this enabled piano builders to use shorter, thicker Design strings to produce the lowest-pitched bass notes, enabling the building of smaller upright pianos designed for small rooms and practice rooms. [10,11].

String construction

The end of the string that mounts to the instrument's tuning mechanism (the part of the instrument that turns to tighten or loosen string tension) of the physical design of music Design strings is usually plain. Depending on the instrument, the string's other, fixed end may have either a plain, loop, or ball end (a short brass cylinder) that attaches the string at the end opposite the tuning mechanism. When a ball or loop is used with a guitar, this ensures that the string stays fixed in the bridge of the guitar. When a ball or loop is used with a violin-family instrument, this keeps the string end fixed in the tailpiece. Fender Bullet Design strings have a larger cylinder for more stable tuning on guitars equipped with synchronized tremolo systems. Design strings for some instruments may be wrapped with silk at the ends to protect the string. The color and pattern of the silk often identifies attributes of the string, such as manufacturer, size, intended pitch, etc. (Figure 3).

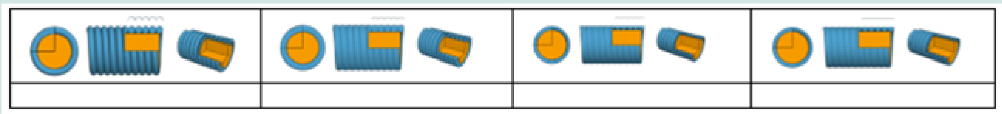


Figure 3

Flat Wound

Flat wound Design strings also have either a round or hex core. However, the winding wire has a rounded square cross-section that has a shallower profile (in cross-section) when tightly wound. This makes for more comfortable playing, and decreased wear for frets and fretboards (this makes them a popular choice for fretless instruments). Squeaking sounds due to fingers sliding along the Design strings have also decreased significantly. Flat wound Design strings also have a longer playable life because of smaller grooves for dirt and oil to build up in. On the other hand, flat wound Design strings sound less bright than round wounds and tend to be harder to bend. Flat wounds also usually cost more than round wounds because of less demand, less production, and higher overhead costs. Manufacturing is also more difficult, as precise alignment of the flat sides of the winding must be maintained (some rotation of the winding on round wound Design strings is acceptable) [12,13] .Modern bowed strings are plain (typically the higher-pitched, thinner Design strings) or flat wound, to allow smooth playing and reduce bow hair breakage. There is a niche market for round wound fiddle Design strings.

Weir Core Types

The physical design of music Design strings, there are two types, or shapes, of core wire typically used in wound Design strings.

Hex Core: Design of Design strings is composed of hexagonal core wire and a tight (usually round) winding. Hex core string design prevents the wind from slipping around the core – which can occur with round core Design strings. This may improve tuning stability, flexibility, and reduce string breakage, compared to round core Design strings [14].

Round core: Design of Round core Design strings are composed of regular round core and a tight (usually round) winding. Round core is the traditional "vintage" way of manufacturing and results in a greater contact between the winding and the core of the string in Gauge systems (Figure 4). A wound acoustic guitar string design (phosphor bronze wound around steel) with a ball end, 0.044" gauge , Bowed instrument design strings, such as for the violin or cello, are usually described by tension rather than gauge. Fretted instruments (guitar, banjo, etc.) strings are usually described by gauge the diameter of design string. The tone of a string depends partly on weight, and, therefore, on its diameter and its gauge. Usually, string manufacturers that don't describe strings by tension list string diameter in thousandths of an inch (0.001 in = 0.0254 mm). The larger the diameter, the heavier the design of string. Heavier strings require more tension for the same pitch and are, as a consequence, harder to press down to the fingerboard. a fretted instrument that is restrung with different string gauges may require adjustment to the string height above the frets (the "action") to maintain playing ease or keep the design of strings from buzzing against the frets. The action height of fretless instruments is also adjusted to suit the string gauge or material, as well as the intended playing style.

Guitar: Design of Steel strings for six-string guitar usually come in sets of matched strings. Sets are usually referenced either by the gauge of the first string (e.g., 9), or by pair of first and last (e.g.,); measurements in thousands of an inch are the de facto standard, regardless of whether Imperial units are used in a country. Some manufacturers may have slightly different gauge sequences; the sample data below comes from D'Addario string charts for regular, round-wound, nickel-plated strings.

Electric guitar: The following table displays the Design of gauges in inches: (Note: strings in dark gray boxes are wound. All others are plain.)

Acoustic guitar: Design of String gauge is subject to the personal preferences of the musician, but acoustic guitars are typically strung with a heavier gauge than electric guitars. The need for projection due to lack of amplification is one of the main reasons for this.[30] (Note: strings in dark gray boxes are bronze wound. All others are plain. These are for steel-string guitars, not classical nylon/gut strings. The gauge values are in inches.)

Bowed strings: Design strings since the 20th century, with the advent of steel and synthetic core strings, most bowed instrument string makers market their strings by tension rather than by diameter. They typically make Design strings sets in three tension levels: heavy, medium, and light (German stark, mittel, and weich). These tension levels are not standardized between manufacturers, and do not correlate to specific diameters. One brand's medium strings may have quite a different tension from another brand's medium. Based on available historical records, gut Design strings were sold before 1900 in a similar way. On the other hand, modern gut core strings with metal winding, typically have been sold either ungauged for less expensive brands, or by specific gauge. The Gustav Pirazzi Company in Germany introduced the Pirazzi meter (PM) measurement early in the 20th century. One PM equals .05 mm. For example, a 14 1/2 PM gauge string has is .725 mm in diameter. Pirazzi (now known as Pirastro) continues to sell its Oliv, Eudoxa, and Passione brand premium gut core Design strings by PM gauge. Each string is available in 5 or more discrete gauges. Manufacturers of traditional plain gut strings, often used in historically informed performance, sell their products by light/medium/heavy, by PM, by mm or some combination [15].

Core Spinning Materials

Core-spun yarns are two-component structures with Core and sheath. Generally continuous filament yarn is used as core and the staple fibers used as sheath covering. The core-spun yarn is used to enhance functional properties of the fabrics such as strength, durability and stretch comfort.

Steel: Steel forms the core of most metal Design strings Steel is an alloy of iron and carbon with improved strength and fracture resistance compared to other forms of iron. Certain keyboard instruments (e.g., harpsichord) and the Gaelic harp use brass. Other natural materials Stainless steels that are corrosion- and oxidation-resistant typically need an additional 11% chromium., such as silk or gut or synthetics such as nylon and kevlar are also used for string cores. (Steel used for strings, called music wire, is hardened and tempered.) Some violin E Design strings are gold-plated to improve tone quality. Steel or metal strings have become the foundation of Design strings for the electric guitar and bass. They have a pleasingly bright tone when compared to nylon strung guitars. Their metal composition varies greatly, sometimes using many different alloys as plating. Much of the history of metal Design strings evolved through innovations with the piano. In fact, the first wound metal Design strings ever used were used in a piano. However, when it came to getting super small diameter Design strings with good elastic properties, the electric guitar took the metal string to the next level adapting it for the use of pickups [11]. Because of the higher tension of steel Design strings, steel-strung guitars are more robustly made than 'classical' guitars, which use synthetic Design strings. Most jazz and folk string players prefer steel-core Design strings for their faster response, low cost, and tuning stability [16].

Nylon: Nylon string, [17] traditionally used for classical music, has a more mellow tone, and the responsiveness of it can be enjoyed typically for folk but other styles of music use it as well (for example, Willie Nelson performs on a nylon strung guitar). Nylon Design strings are made of a softer, less dense material and are under less tension than steel Design strings (about 50% less). This means they can be used on older guitars that can't support the tension of modern steel Design strings. Nylon Design strings do not work with magnetic pickups, which require ferrous Design strings that can interact with the magnetic field of the pickups to produce a signal. Currently, stranded nylon is one of the most popular materials for the cores of violin, viola, cello, and double bass Design strings. It is often sold under the trade name of Perlon. Nylon guitar Design strings were first developed by Albert Augustine Strings in 1947 [18].

Gut: The intestine, or gut, of sheep, cattle, and other animals (sometimes called catgut, though cats were never used as a source for this material) is one of the first materials used to make musical Design strings [19]. In fact, the Ancient Greek word for string, "khordḗ," has "gut" as its original meaning. Animal intestines are composed largely of elastomers, making them very flexible. But they are also extremely hygroscopic, which makes them susceptible to pitch fluctuation as a result of changing humidity. Exposure to moisture from the sweat of a musician's hands can cause plain (unwound) gut Design strings to fray and eventually break. This is not as much of a problem with wound gut Design strings , in which the gut core, being protected from contact with perspiration by the metal winding (and underlayer, if there is one), lasts a much longer time. Nonetheless, as such a gut string ages and continually responds to cyclic changes in temperature and humidity, the core becomes weak and brittle, and eventually breaks [11]. Furthermore, all gut Design strings are vulnerable to going out of tune due to changes in atmospheric humidity. However, even after the introduction of metal and synthetic core materials, many musicians still prefer to use gut

Design strings, believing that they provide a superior tone. Players associated with the period performance movement use wound and unwound gut Design strings as part of an effort to recreate the sound of music of the Classical, Baroque, and Renaissance periods, as listeners would have heard it at the time of composition. For players of plucked instruments, Nylgut Design strings are a recently developed alternative to gut Design strings. They are made from specialty nylon and purport to offer the same acoustic properties as gut Design strings without the tuning problems [20].

Fluoropolymers (aka "Carbon"): Fluoropolymer Design strings are available for classical guitar, harp, and ukulele. These Design strings are usually traded under descriptions like fluorocarbon, carbon fiber, or carbon, which is scientifically incorrect. The so-called Carbon material has a higher density than nylon, so that a nylon string can be replaced by a carbon string of smaller diameter. This improves the precision of higher fretted notes, and the resulting vibrational behaviour leads to a more brilliant sound with improved harmonics. In particular, classical guitarists who feel that a nylon G string sounds too dull can use Design strings that include a carbon G string [20,21].

Other polymers: Other polymers, including polyetheretherketone and polybutylene terephthalate, have also been used [22,23].

Silk: Silk was extensively used in China for traditional Chinese musical instruments until replaced by metal and nylon Design strings in the 1950s. Only purely silk Design strings used for the guqin are still produced, while some silver-wound silk Design strings are still available for classical guitars and ukuleles. The quality in ancient times was high enough that one brand was praised as 'ice Design strings ' for their smoothness and translucent appearance [24].

Winding materials: Aluminum, silver, and chrome steel are common windings for bowed instruments like violin and viola, whereas acoustic guitar Design strings are usually wound with bronze and piano Design strings are usually wound with copper. To resist corrosion from sweat, aluminium may be used as a resistant alloy such as hydronalium. Classical guitar Design strings are typically nylon, with the basses being wound with either silver or bronze. Electric guitar Design strings are usually wound with nickel-plated steel; pure nickel and stainless steel are also used. Bass guitar Design strings are most commonly wound with stainless steel or nickel. Copper, gold, silver, and tungsten are used for some instruments. Silver and gold are more expensive and are used for their resistance to corrosion and hypoallergenicity. Some "historically-informed" Design strings use an open metal winding with a "barber pole" appearance. This practice improves the acoustic performance of heavier gauge gut Design strings by adding mass and making the string thinner for its tension. Specimens of such open wound Design strings are known from the early 18th century, in a collection of artifacts from Antonio Stradivari. "Silk and steel" guitar Design strings are overwound steel Design strings with silk filaments under the winding. Phosphor bronze: Phosphor bronze was introduced by D'Addario in the early 1970s. Phosphor bronze is said to keep its "new" sound longer than other Design strings. Small amounts of phosphorus and zinc are added to the bronze mixture. This makes the phosphor bronze slightly more corrosion resistant than 80/20 bronze. 80/20 Bronze: 80/20 bronze Design strings are 80 percent copper and 20 percent zinc [23]. The zinc also gives it a brighter tone, additional hardness and slows down the aging process. With additional string coating, they are preserved even more. Although, if some of the coating is applied poorly, the Design strings can lose their tone in just a matter of hours and if left in high humidity can turn a hint of green because of the copper and corrode with time. The name "80/20 Bronze" is a misnomer since bronze is by definition an alloy of copper and tin. "80/20 bronze" Design strings would be more correctly referred to as brass [25].

Nickel-plated steel: Some acoustic players use Design strings, wound with nickel-plated-steel, meant for electric guitar. The properties of the nickel-plated Design strings make it a good choice for flattop guitars with sound hole-mounted magnetic pickups (Figure 5).

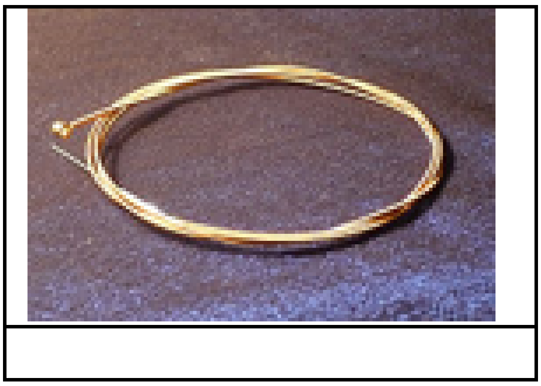


Figure 4

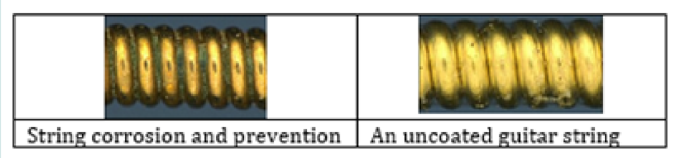


Figure 5

A coated guitar string: [26] All metal Design strings are susceptible to oxidation and corrosion. Wound Design strings commonly use metals such as brass or bronze in their winding. These two metals are very vulnerable to corrosion. The sebaceous gland in the player's skin produces oils that can be acidic. The oils, salts, and moisture from the player's fingers are the largest source of corrosion. The composition of the oil and the oxygen in the air also helps to oxidize and corrode the Design strings. In steel Design strings the oxygen reacts with the iron in the steel, and it creates rust. As a result, the string loses its brilliance over time [27,28]. Water, another by-product of oxidation, increases the potential for acid corrosion in oils. Wound Design strings, such as bronze acoustic Design strings, are very difficult to keep fresh sounding due to the lack of corrosion resistance. To help solve the corrosion problem Design strings are either metal plated or polymer coated. The polymer coating is claimed to reduce finger squeak and fret wear and has better tuning capability. Some companies sell lubricating oils that slow down the oxidation process, increasing the string's life-span. These special lubricating oils are applied to the Design strings as a barrier to the air, to help slow the oxidation process.

Coating and plating: Some common types of metal plating on Design strings include tin, nickel, gold, and silver. Some metals such as gold and silver give the Design strings a different sound. Among Design strings coated with a polymer, (polytetrafluoroethylene) Teflon is the most commonly used. Teflon is resistant to many corrosive agents such as: chlorine, acetic acid, sulfuric acid, and hydrochloric acid. On the microscopic level Teflon has very tightly packed polymeric chains, and these tightly packed chains create a slippery surface that not only helps keep the oil from the player's hands off the Design strings but makes them smooth to play as well. [10] Ethylene tetrafluorothylene (ETFE) is another polymer that is sometimes used to coat Design strings. It is abrasion and cut resistant and has many characteristics similar to Teflon [29].

Boiling Design strings (guitar and bass): Some musicians boil guitar or bass Design strings to rejuvenate them. The high temperature of the boiling water helps free the Design strings of oil, salt, and grime from the player's hands. When a string is played, very small metal shavings from fret wear may break off and lodge between the windings of the Design strings. Heating the Design strings can expand these particles and separate them from the windings. Some players use deionized water to boil Design strings, believing that mineral deposits in tap water may aid corrosion of the string core. After boiling, Design strings may have less elasticity and be more brittle, depending on the quality of the alloys involved. Putting the Design strings through a cycle in the dishwasher has also been known to work [30].

String vibration: A string vibrates in a complex harmonic pattern. Every time the player sets a string in motion, a specific set of frequencies resonate based on the harmonic series. The fundamental frequency is the lowest, and it is determined by the density, length and tension of the string. This is the frequency we identify as the pitch of the string. Above that frequency, overtones (or harmonics) are heard, each one getting quieter the higher it is. For example, if the fundamental pitch is 440 Hz (A above middle C), the overtones for an ideal string tuned to that pitch are 880 Hz, 1320 Hz, 1760 Hz, 2200 Hz, etc. The note names for those pitches would be A, A, E, A, C#, etc. Due to the physical nature of the Design strings, however, the higher up the overtones go the more out of tune (or "false" they are to the fundamental. This is an important consideration for piano tuners, who try to stretch the tuning across the piano to keep overtones more in tune as they go up the keyboard. In a phenomenon called sympathetic vibration, a string seems to vibrate by itself. This happens when sound waves strike the string at a frequency close to the string's fundamental pitch or one of its overtones. The string is connected to this similar sound wave through the air, which picks up the vibrations of the sound waves at the same frequency, and in turn causes the string to vibrate on its own. When an outside source applies forced vibration that matches a string's natural frequency, the string vibrates [31]. Resonance can cause audio feedback. For example, in a setup with an acoustic guitar and a PA system, the speaker vibrates at the same natural frequency of a string on the guitar and can force it into vibrational motion. Audio feedback is often seen as an undesirable phenomenon with an acoustic guitar that is plugged into the PA system, because it causes a loud howling sound. However, with electric guitar, some guitarists in heavy metal music and psychedelic rock purposely create feedback by holding an electric guitar close to a powerful, loud guitar amplifier speaker cabinet, with the distortion turned up loud, creating unique high-pitched, sustained sounds. Jimi Hendrix and Brian May were notable users of electric guitar feedback. For a typical high-E nylon string, the maximum transverse force is roughly 40 times greater than the maximum longitudinal force amplitude. However, the longitudinal force increases with the square of the pulse amplitude, so the differences diminish with increasing amplitude. The elastic (Young's) modulus for steel is about 40 times greater than for nylon, and string tensions are about 50% greater, so the longitude and transverse force amplitudes are nearly equal [32].

String vibration: A vibration in a string is a wave. Resonance causes a vibrating string to produce a sound with constant frequency, i.e. constant pitch. If the length or tension of the string is correctly adjusted, the sound produced is a musical tone. Vibrating Design strings are the basis of string instruments such as guitars, cellos, and pianos.

Wave: The velocity of propagation of a wave in a string (v) is proportional to the square root of the force of tension of the string (T) and inversely proportional to the square root of the linear density (μ) of the string

This relationship was discovered by Vincenzo Galilei in the late 1500s.

Tensile properties: Tuning a stringed instrument such as a guitar to pitch puts the Design strings under a large amount of strain, which indicates the amount of stress inside the string. Stress is relative to the stretch or elongation of the Design strings. As the string is tuned to a higher pitch, it gets longer and thinner. The instrument can go out of tune because if it has been stretched past its elastic limit, it will not recover its original tension. On a stress vs. strain curve, there is a linear region where stress and strain are related called Young's modulus. A newer set of Design strings will often be in a region on the stress vs. strain curve past the Young's modulus called the plastic region. In the plastic region, plastic deformation occurs deformation the material cannot recover from. Thus, in the plastic region, the relationship is not linear (Young's modulus is no longer a constant). The elastic region is where elastic deformation is occurring, or deformation from where the string can recover. The linear (i.e. elastic) region is where musicians want to play their instrument [33].

Conclusions

Spinning technology in the physical design of music strings and the mechanics of sounds in balloon (Oud) guitars, the subject of Design strings in musical instruments are interdisciplinary topics that will find in scientific research to improve the development of instruments [34,35]. They are interdisciplinary and must including these applications and teaching them in the faculties of specialization, science "Department of Physics" - Applied Arts "Department of Spinning and Weaving" Applied Arts "Department of Spinning and Weaving" Departments of Music in different faculties. These Design strings were produced from various raw materials. And the user of the instruments does will explore know the content of the instruments he plays on., These Design strings have been produced since the era of the Pharaohs from various materials, the user of the instruments does will know the historical development of the instruments he plays on. Spinning technology for string production is simple and available in Egypt.

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