

# The Design Trend of Footwear Based on Biomechanics

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## Preface

With rising awareness of health, more and more people go outdoor and start doing fitness activities. In the meantime, people also slowly recognize the functions, protection and comfort features of fitness equipment or accessories. Therefore, people pay more attention to the effects of functional sporting goods. On the whole, there are two directions of the design trends of functional sporting goods in the future: one direction is the development of functional materials mainly appealing to lightness, high elasticity, mobility, waterproof, wind-proof, humidity proof and also highly breathable products, for example the products made of Goretex material; the other direction is overall functional designs applying the analysis of body movement and based on the principles of biomechanics, sports medicine, ergonomics to design sporting products with protective functions, reducing sport injuries, enhancing sports performances such as professional jogging socks. Over the past development of functional sporting goods mainly focuses on functional materials. Nowadays the direction moves to the whole functional design. Aiming to provide more added values to human body, this study used the functional footwear as example to look into the future product trends.

# Sports Shoes

Shoe among the functional sporting goods is a typical model which applies the functional material and display the functional design. More people start outdoor activities and they will buy a pair of sports leisure shoes with more suitable comfortable features. Generally speaks, the functions of sports leisure shoes lies in decreasing sports injuries. Thus, sports shoes shall be equipped with good shock-absorbing function so as to reduce the impacts of huge shock power upon human body while doing sports. Besides, they shall also display proper gripping ability so as to prevent from slipping and falling down. The plantar pressure shall be also evenly distributed. When the plantar pressure is too much, it might cause partial soft tissue injuries and even worse ulcer. More importantly, the shoes shall provide stability so as to protect ankles and avoid sprain injuries. The shoes shall be suitable and light so that the user feel comfortable without burden. Many leading shoe manufacturers promote new technologies one after another, different from the previous approaches. They apply knitting technologies and develop more suitable, comfortable and lighter sports leisure shoes. For example, the global brands Nike and Puma have promoted similar new products, indicating the future design trends of sports leisure shoes.

A. Nike Flyknit Series was an innovation technology in 2012. Flyknit refers to seamless, single-layer design and upper technology, knitted in diverse density of polyester. The gross weight is simply 160 grams. Nike Flyknit technology applies both fundamental principles of engineering and the advanced knitting technology on upper design. The initiative is to make people forget the existence of shoes, hoping to give runner extreme suitable and skin-like feelings. The end goal is to wears shoes like wearing socks, providing extremely suitable and feather-like light feelings. Nike





Source: Nike's official website

Nike Flyknit Series features knitting with better fitting, lightness and natural features

Flyknite presents itself as a pair of suitable, light and mobile running shoes. In 2013, the second Flyknit-technology shoes came out. Their outlook became much closer to socks' shape; moreover the shape fits better and provides more comfort feelings. Besides, as to the shoe bottom, the design goes towards the bare-foot concept. The famous Nike Free 5.0 completely interprets the bare-foot ideas. Until 2014, Flyknit has far-reaching impacts upon a great number of products, including soccer shoes, basketball shoes whose production mixes with Flyknit technology and gives new definitions of soccer and basketball shoes.

B. Puma Mobium Elite Series features adaptive running technology. In this series of shoes, the most distinctive innovation design is the Mobium Band with the placement of a strong rubber tubing shaped like the number, 8, on the outsole. Its function is similar to plantar fascia of the foot. When the foot bears more pressure, the rebounding power gets stronger and the Mobium Band helps controlling foot pronate and slowing down

foot overpronation speed. Additionally, forefoot, the design of expansion pods resembles both the paw structure of the cat family. This pod, produced also based on the human foot bone structure and muscle distribution, provides cushioning and defending functions. As to the upper, the material is breathable mesh fabric so as to give comfort and breathable feelings during the process of doing sports.



Source: Puma's official website

Puma Mobium Elite Series, the upper material adopts breathable mesh fabric so as not to get humid and hot. The X-shaped rubber tubing helps the foot stretch and tighten.

## Sports Socks

In the past, when people did outdoor sports, they only care about wearing comfortable and suitable sports shoes. People forgot that the closest thing to the feet is a pair of socks. In the recent years, with the rising awareness of health, people start to care about the functions of socks. There are more and more people who like to spend a bit more money to choose a pair of sports socks with more functions. Sports socks help distribute foot pressure evenly. Once the foot pressure gets even which can easily help soft issue to avoid ulcer

while bearing too much pressure or too much rubbing. The rubber tubing can help support the arch of foot and reduce foot-arch fatigue. And the top design of socks, similar to taping, enhance the level of ankle stability and covering feature and further reduce the fatigue resulting from overpronation. The socks also need sweat-absorbing and breathable materials so as to better the comfort feeling while doing sports. The internationally-known brand X Bionic and the recent uprising brand in Taiwan, Titan, just releases its new products. It is obvious to see the design trend of sports leisure socks.

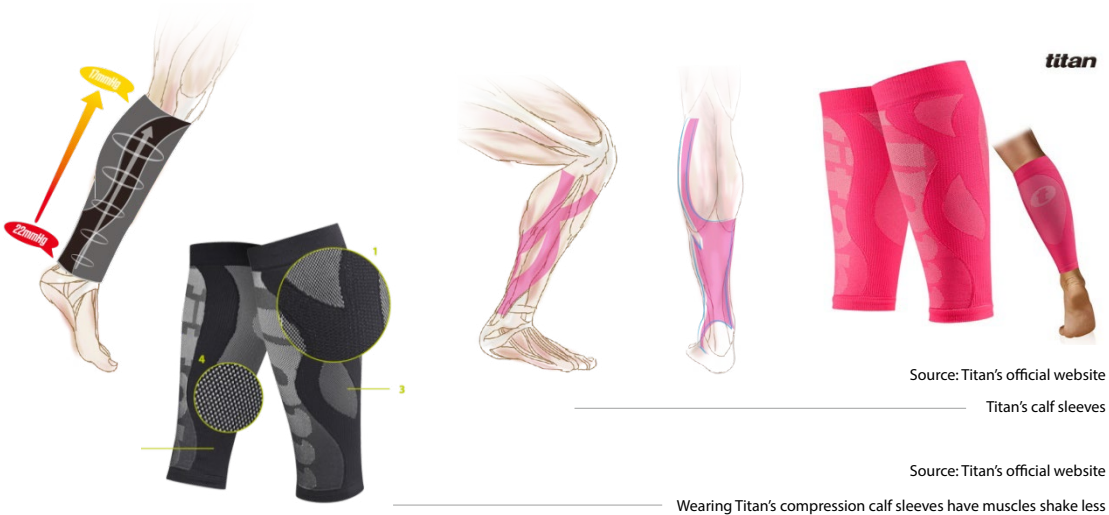
**A** X socks emphasizes the air diverting tunnels so as to improve breathability. Applying the advanced knitting technology to adjust the foot temperature. By guiding the humidity and excessive heat into the air diverting tunnels so that sweat could be absorbed quickly so as to achieve high air breathability and antibacterial effects. The top of socks can fit everyone’s ankle, enhance the covering feature and protect Achilles’ tendon. Some of toes grows thicker layers or callus so that they can protect foot and reduce the chance to get injured or ill.

**B** Titan, a shining nova in Taiwan’s sports industry, known for its outstanding design of functional spots socks, has applied its expertise to sports accessories, e.g. compression calf sleeve. Titan’s compression calf sleeves supporting muscles to prevent from muscle strain while doing sports. In order to effectively support muscles, this compression calf sleeves apply three different knitting approaches including high-intensity knitting to perform high-supporting feature in the parts of muscle and tendon; the two ends of the compression sleeves adopts loose, soft and wide-mouth materials without foot biting and gradual pressure balancing without destroying effects. As to the other parts of sleeves, high-efficient breathable mesh fabric is adopted so that sweat could be evaporated quickly and the uncomfortable feelings, caused by heat and humidity while doing sports, could be reduced and increase the comfort level.



Source: X Bionic's official website

X socks Sports Socks



Source: Titan's official website  
Titan's calf sleeves

Source: Titan's official website  
Wearing Titan's compression calf sleeves have muscles shake less

# Conclusions

1. More and more sports leisure shoes and related sport products adopt knitting technology such as Nike and Puma applies the knitting into designs and lead the trend with flag lash products. The main features of knitting are suitable, comfortable, light, and breathable. The element of knitting in the sports leisure shoes is commonly adopted nowadays.
2. The popularity of sports leisure socks is getting higher and higher. Many people do not just buy cheap ones. In the contrary, they look for functional, protective and highly adoptive sports socks. These features become what consumers care about.

In the past, the sports shoes only emphasize shock-absorbing functions. Sports socks were considered as ordinary accessory. However, in the recent years, more and more sports socks adopts knitting technology so as to give more comfort and adjustable feelings. Their added values have been highly enhanced. In the present, the design of professional functions based on biomechanics, sports medicine, knitting materials and advanced technology has reached the expected targets. For example, the current sports socks compared with previous ones offers stronger covering feature providing the skin-like comfortable and light feelings; besides, it provides expanding flexibility and make feet more mobile. On the whole design, they become more functional such as muscle supporting, sports fatigue reducing, comfort and breathable strengthening and so on. Sports apparel also goes towards the same direction as sports shoes and socks. They start combining the characteristics of knitting into human body and endorse more functions into apparel. As believed in the near future there will be multifunctional material development and well-designed knitting products coming up on the market.