

Shoe sole design to minimize stress injury at knee for runners

Running has become an activity which is being increasingly performed by a significant portion of the population either for leisure or fitness. The normal daily activity of such people are sedentary and many of them suffer from stress related injury during running. Running shoes not only provide substantial foot cushioning, they also offer arch support, aid in the prevention of injuries and can promote improved athletic performance. However, impact forces experienced by a runner is one of the major factors contributing to stress related injuries such as tendonitis, stress fractures and joint pain.

Among various elements of a shoe, sole of a shoe plays an important and crucial role in providing comfort to a user. High level of customization/personalization eventually increases the time and cost of manufacturing. Moreover, detailed customization would also make the manufacturing process cumbersome. Configurations known in the prior art for reducing impact forces are either too simplistic because of which reduction in forces cannot be quantified or too complicated to achieve and reproduce. Thus, there is a need in the art to provide a simple configuration of a shoe which can effectively reduce the impact forces.

Features of our invention:

- Our invention provides an optimized sole design which can reduce the stress related injury at the knee joint.
- The sole is assumed to be parallel to the foot and has parallel rows of cylindrical shoe sole elements where each row is perpendicular to the base of the foot in a transverse fashion.
- The number of the cylindrical elements on each row can be proportional to the width of the shoe sole at each cross-section perpendicular to the foot along the row of the sole's elements.
- The elements in each row have constant stiffness but the stiffness varies across the parallel rows of elements. The elements of different rows can be made of different material with stiffness varying between the extreme values allowed by those materials.
- The layer above this sole has fillings in such a manner that the pressure distribution on the base sole is uniform along any transverse row.
- The optimization procedure can be adjusted to reduce the impact on any of our body joints. But the knee joint is most prone to injury during running. So, the proposed design minimizes impact force variation on the knee.
- Simulations of running can be performed with this shoe model where the optimization of sole stiffness at each row will give rise to a force transmission profile with the least standard deviation. This will lead to a design which reduces the peak impact force on the body part of our choice.