

Female breasts contain limited anatomical support due to a lack of muscles and bones. During exercise, with the increase of activity intensity, a large force/acceleration will be applied to the breast thereby causing excessive breast movement and inducing extremely high strain within the breast tissues. Such strain not only is the main cause of breast pain but also influence the beauty profile over time. Therefore, research points out that bras, especially functional designed sports bras, are helpful in providing better breast support and preventing injury during intensive activities.

This project has studied factors like breast displacement, strain and stress concentrations, velocity, acceleration and thermal-moisture transfer behaviour within the bra, and developed a methodology for functional sports bra design with the advantages of finite element model (FEM).

女性的胸部欠缺肌肉與骨骼的支撐，所以在運動過程中特別在進行高強度的動作時，要承受巨大的應力，令胸部出現過度的搖晃，拉傷胸部組織。這些損傷不單引致胸部疼痛，如果情況繼續，更會影響胸部外觀，導致乳房下垂。因此，研究指出胸圍，特別是為運動而設計的胸圍有助進行高強度的動作時支撐胸部，防止受傷。

這個項目研究穿上胸圍時胸部晃動、組織內部應力應變集中、移動速度、及熱濕傳遞的情況。並建立女性胸部和運動文胸的有限元模型 (finite element model)，協助設計製作人員更加理解和設計產品。



Application 應用

With the application of dynamic water pumping fabric and flexible material with piecewise deformation modulus and strength, the newly designed sports bra can provide better protection and an improved wearing comfort sensation with adjustable dynamic thermal and liquid sweat transfer behaviours and a supportive capability to meet the various physiological requirements under dynamic changeable activity intensities. FEM of female body and sports bra demonstrates the conditions of breast displacement, pressure, internal stress and strain distributions when wearing a sports bra.

新開發的運動型胸圍使用具有專利技術動態主動排汗織物 (water pumping fabric) 和分段模量柔性織物材料製成，可調節動態熱應力及體液傳送功能，提供較佳的保護，穿著舒適，可滿足女性進行多變的高強度運動時出現的各種生理需求。建立女性胸部和運動胸圍的有限元模型可以顯示穿著運動型胸圍時胸部移位、壓力、組織內部應力應變分佈等的動態變化。

||| Technological Breakthrough 技術突破 |||

- Extra support from lower bra band made by special fabrics;
 - Shaped-adjustable cup by water-pumping fabrics to get rid of sweat, keeping the wearer dry and comfortable;
 - Reduce movement of breast;
 - Improve exercise capacity;
 - FEM demonstrates the conditions of the displacement, internal stress, and strain distributions of female breasts in a sports bra during movement.
- 用特別織物製成的寬底圍可為胸部提供額外的支撐力和保護；
 - 用動態主動排汗織物製成的胸杯可調整形狀以迅速排走汗水，使穿著者保持乾爽舒適；
 - 減少胸部晃動；
 - 改善運動能力；
 - 有限元模型可顯示穿上運動型胸圍運動時胸部所受壓力、運動過程中的移位、以及組織內部應力與應變的分佈及動態變化。

||| Licensing Details 獲取專利 |||

A non-exclusive includes the right of making further R&D and the sale of the functional sports bra based on the filed patent.

非獨家專利授權許可包括根據專利內容進一步開發及銷售功能性運動型胸圍。

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