博士论坛

针织物悬垂屈曲的数值模拟

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摘要　　开发虚拟服装试衣系统需模拟织物的悬垂和屈曲，而采用正交异性力学模型不适合织物。为此，笔者基于针织物的细观力学模型，用有限元方法模拟方形针织物片铺在圆桌面上的悬垂和屈曲，该细观模型描述了织物由于其细观针织结构而特有的力学性质。织物片用8结点壳单元离散，这种壳单元被特别设计，能描述织物片在悬垂中发生的大转动。对织物片的屈曲模态进行了分析，对其后屈曲变形进行了计算，最后进行了方形织物片的悬垂和屈曲实验。模拟的结果和实验的观测结果很一致。研究成果为虚拟服装试衣系统的开发奠定了基础。

关键词　　针织物　悬垂　屈曲　有限元方法　细观力学本构模型

分类号

Numerical simulation of draping and buckling of knitted fabric

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Abstract

In order to develop a virtual trial system of garments many researches have been devoted to simulations of draping and buckling of knitted fabric，but most of them are failed that because the adopted orthotropic mechanical model is not suitable for knitted fabric.With the aid of the micro-mechanical model of knitted fabric that characterizes the special properties of knitted fabric due to its micro-knitting structures，the draping and buckling of a square knitted fabric sheet covering on a circular table are simulated by finite element method.The fabric sheet is discretized with 8-node shell elements which are specially designed to describe the large rotation of fabric sheet during draping.The buckling modes of the fabric sheet are analyzed，its post-buckling deformations are evaluated，and experiments on draping and buckling of a square knitted fabric sheet are also carried out.The simulated results are in good agreement with the experimental observations.The works in this paper pave the way for developing the virtual trial system of garments.

Key words　knitted fabric　draping　buckling　finite element method　micro-mechanical constitutive model

DOI:

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