ENERGY CONSUMPTION OF THE GRIFFES DURING WEAVING PROCESS OF JACQUARD LOOM

by

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Original scientific paper
DOI: 10.2298/TSCI1405583Z

In this paper, energy consumption of the griffes during their serving life is reported. Griffes of the Jacquard loom with reciprocating motion and high speed are the main suffering components during the weaving process. Under the condition of high reciprocating velocity, the mechanical damage is an unavoidable issue that will lead to a fatal collapse on the mechanical parts and even operators. Therefore, finite element analysis is adopted and conducted in present research to intuitively demonstrate the energy consumption on the griffes. This will be benefit for the design and local reinforcement of the Jacquard griffes.

Key words: *finite element analysis, Jacquard loom, griffe, energy consumption*

Introduction

Jacquard fabrics is luxurious, elegant, and popular textile products with high added-value. Compared with traditional dyed and plaid clothes, the jacquard fabrics have more opportunities to manufacture durable, delicate, and complex patterns on the garments or home textiles. Therefore, the market orientation of the jacquard fabric is always at high-end market. This is not only because of its excellent appearance, but also because of its complicated preparing and operating processes.

Jacquard loom is a traditional way to fabricate and weave the jacquard fabric. It is comprised of a set of mechanical parts co-operating with each other to accomplish the weaving task. Nowadays, the running process of jacquard loom can be mostly automated without much human help while the preparation step still need pure manual operation. Dealing with the possible problems and improving the automation level during the jacquard weaving, a wide array of researchers have proposed and published a series of literatures.

Lee, *et al.* [1, 3] and Seyam, *et al.* [2, 4] have published several papers to introduce a new device using micro-electro-mechanical systems (MEMS). This device can be equipped on the harness cords of jacquard to detect and identify warp break locations during weaving process. The success of this device make it possible to develop an automated warp break repair system. Many other investigators [5, 6] focus on the pattern design of the jacquard which is not the main point of this papers.

The authors of the papers [7-9] have done similar theoretical work using finite element analysis (FEA) technique to investigate the stress and strain behaviors of the textile structures. In present research, the FEA technique will be applied to the mechanical analysis of the griffes of jacquard during weaving process.

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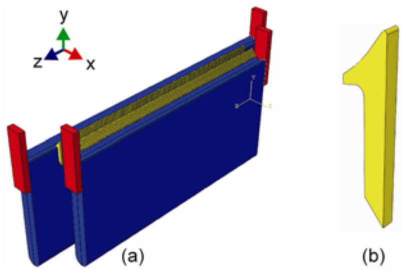

Figure 1. (a) the assembly sketch of the whole model, (b) the needle on the griffe

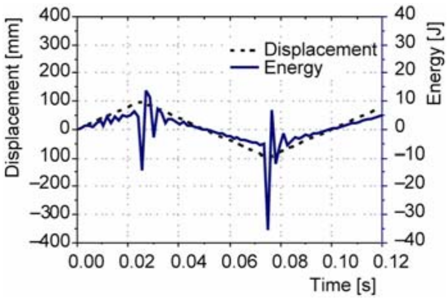

Figure 2. The energy of selected node on the griffe lift

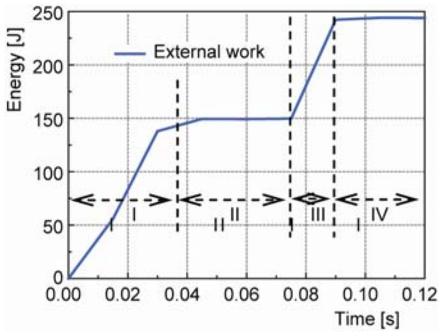

Figure 3. External work on the whole model

Three dimensional griffe model

The 3-D model of two-set griffes is shown in fig. 1. The griffe can be divided into long griffe and short griffe which are making relative movement with each other. The needle of the jacquard, fig. 1(b), that is connected to warps yarns with various colors is set on the edges of the griffes. The movement of the needle depends on the pattern of the desired product. During the whole weaving process, some needles will be attached to magnetic valve and hung up the griffe while the others will move with the griffes.

Theoretical analysis

Figure 2 shows the energy of a selected node which is located on the top surface of the griffe lift. The black dotted line stands for the displacement of the node. The energy line (solid line) is calculated by multiplying the displacement and force on the node at every moment. It can be seen from fig. 2 that the energy vibration centralizes on the moment when the moving direction of the griffe is changed. The change of the velocity direction consumes much more energy compared with the ascending or descending period.

Figure 3 is the external work applied to the whole model. In the initial period, the lifting load needs to overcome the inertia of the griffes which makes the external work increases (period I). During the stable lifting period, the external work is stabilized to a steady level (period II). When one of the griffe reaches the top point, the reverse movement is followed which consumes much more external work (period III). Then, the external work go back to a new steady level after overcoming the energy of velocity change (period IV).

Conclusions

This paper reports the energy consumption during the weaving process of Jacquard loom with FEA technology. The results show that the moment when the velocity is changed to the opposite direction is most likely to be a critical moment for the fatal damage of the components. Therefore, the reinforcement design of the griffes should also focus on the critical loading ability at this moment.

Acknowledgment

The work is supported by Priority Academic Program Development of Jiangsu Higher Education Institutions (PAPD) National Natural Science Foundation of China under grant No. 11372205 and No. 11402155, Jiangsu Planned Projects for Postdoctoral Research Funds (Grant No. 1302061C and 1302112B), Opening Project of National Engineering Laboratory for Modern Silk (Grant No. KJS1315), China Postdoctoral Science Foundation (Grant No. 2014M551656) and Natural Science Foundation of Jiangsu Province (Grant No. BK20140396 and BK20140399).

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Paper submitted: January 10, 2014
Paper revised: May 5, 2014
Paper accepted: July 12, 2014