

Application Case of ALPHA6210 Frequency Converter for Air Jet Loom

I. Description

The ALPHA6210 frequency converter is a new-type product developed to meet the special demands of air jet loom users. Adopting special control algorithm, it not only can satisfy the special requirement of air jet loom on acceleration time but also features convenient speed regulation, stable operation, and high reliability.

Unlike conventional speed regulation by replacing belt, the frequency converter achieves stepless speed regulation with high control precision and easy adjustment, which greatly improves the efficiency of air jet loom and avoids the damage caused to equipment by belt replacement.

II. Working Principle

The air jet loom is a kind of shuttleless loom that jets air flow to draw weft across the shed. Details are described below.

Air is used as weft insertion medium. The ejected compressed airflow pulls the weft and brings it across the shed. This weft insertion mode enables the loom to achieve high speed and high output.

Among several common shuttleless looms, air jet loom has the highest speed. It also features reasonable weft insertion mode, high insertion rate, easy operation, safe running, strong adaptability, low material consumption, and low noise. Hence, the air jet loom has become one of the most promising weaving machines.



III. Existing Problems

Since spinning different fabrics requires different running speed, the running of air jet loom often needs to change the rotation speed of the spindle. Spindle drive is completed through the belt.



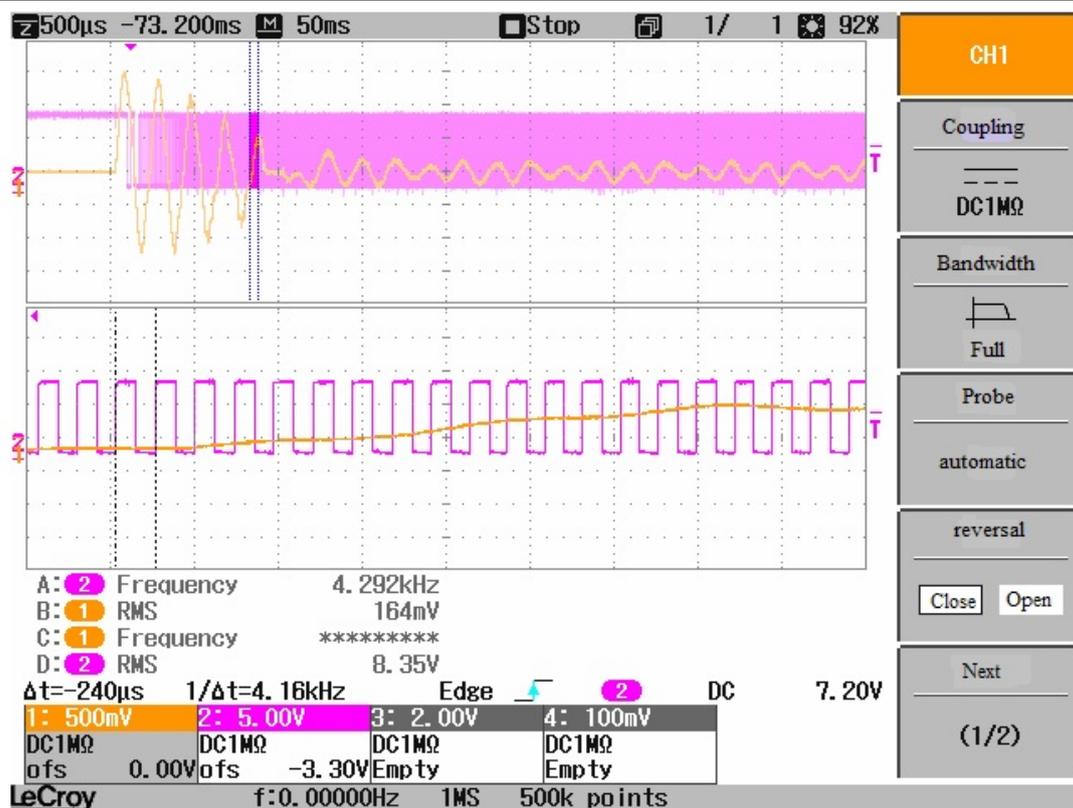
Therefore, current air jet loom requires belt replacement and drive ratio change to achieve the purpose of changing rotation speed. However, this speed changing mode brings many problems.

1. This mode belongs to step speed change, so only fixed speed can be switched to. Fine tuning according to actual working condition is impossible to achieve under this mode.
2. Belt replacement requires professionals and the replacement takes a long period of time, which affects production efficiency.
3. After belt replacement is completed, professionals are required for calibration. This also reduces production efficiency and increases costs.
4. Belt is a wearing part and frequent replacement causes damage more easily. Also, belts of different specifications are required. This significantly increases costs.

IV. Frequency Converter Solution

We equip the air jet loom with a 6210 frequency converter. Then, the rotation speed of spindle is changed by controlling the motor speed. Hence, stepless speed regulation is realized by just changing frequency on the control panel without replacing belt or modifying the loom. This greatly facilitates speed regulation and improves production efficiency.

As air jet loom is demanding on spindle starting time, conventional starting mode adopts the method of triangle start to star running to realize fast start-up. For the spindle accelerating to 750rpm, the starting time can reach 74ms.

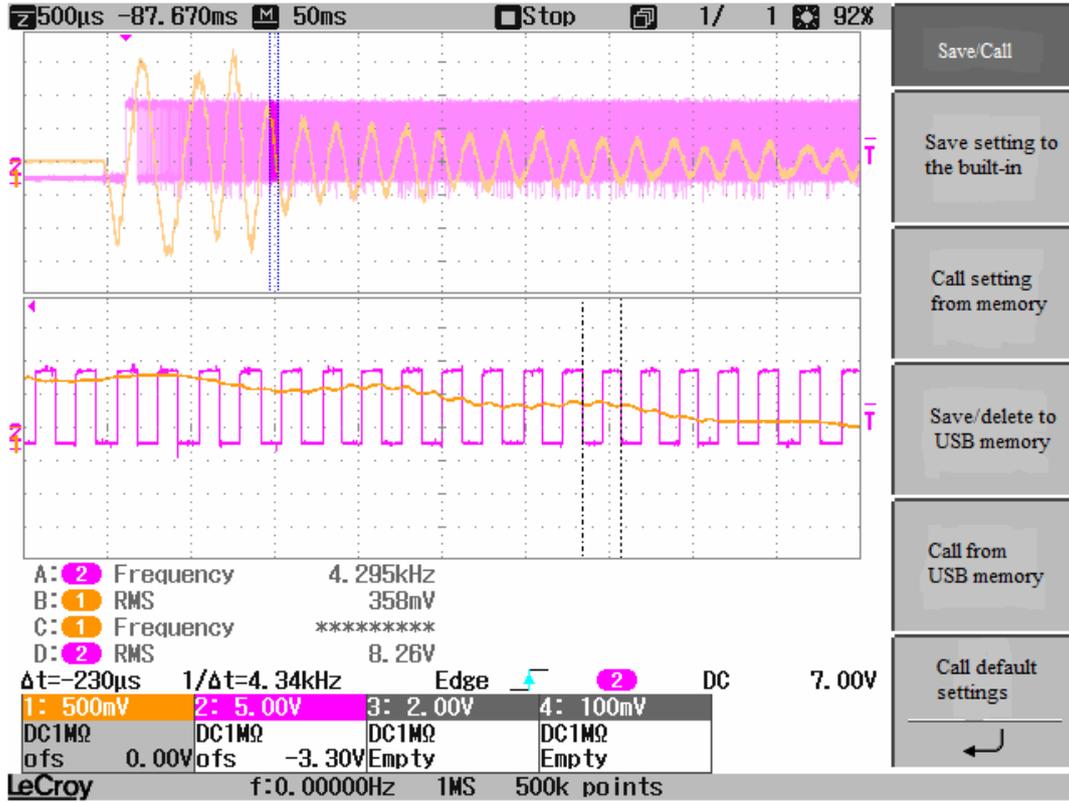


Spindle accelerates to 750rpm
 Required time: 73.2+1=74.2 ms

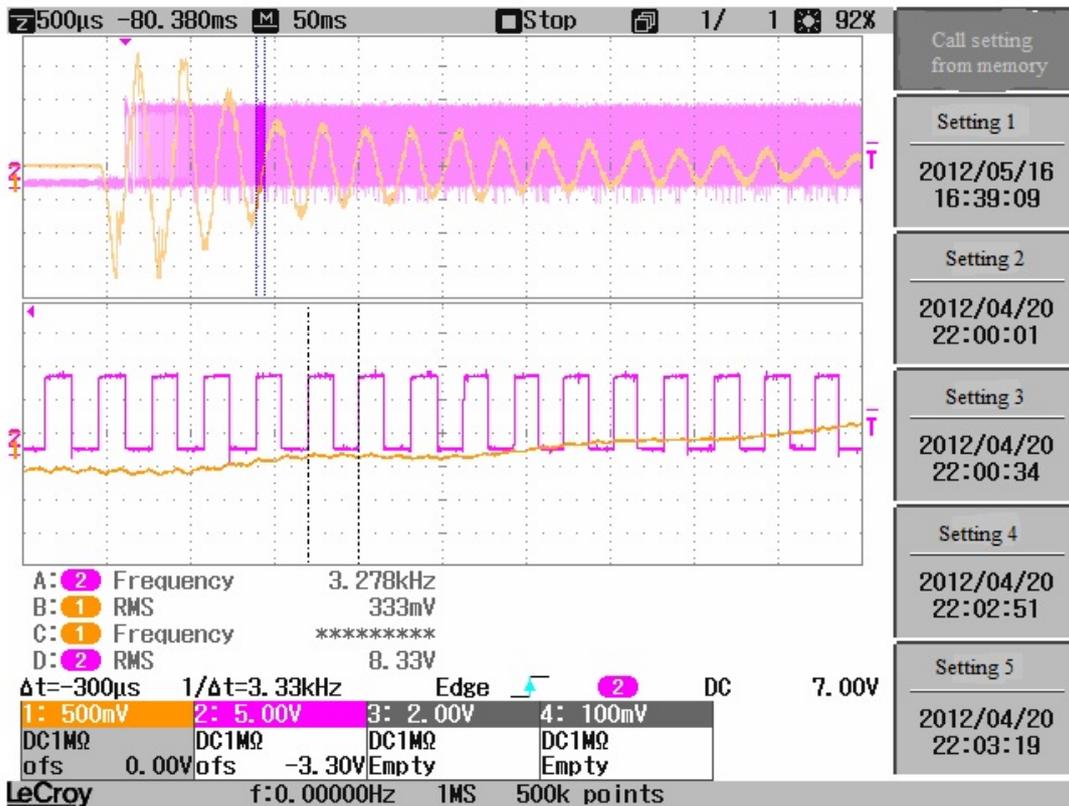
After a frequency converter is installed in the air jet loom, the traditional startup mode of triangle converting to star is abandoned. The motor is directly started by the frequency converter, so the starting time of the converter must meet corresponding production process requirement.

The 6210 frequency converter independently developed by our company adopts a special start method which controls the starting time of accelerating spindle to 750rpm within 91ms. This fully meets the needs of customers and differs little from that of traditional start mode.

In addition, the starting time of 91ms is calculated according to the maximum frequency of 50Hz. If the set frequency is less than 50Hz, the startup is faster. For more details, please refer to the picture below.



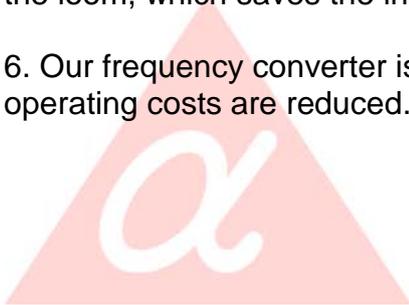
Spindle accelerates to 750rpm, corresponding to 50Hz
 Required time: 87.67+3.5=91.17ms



Spindle accelerates to 560rpm, corresponding to 37.5Hz
 Required time: 80.38+1.5=81.88ms

V. Transformation Optimization

1. By adding a frequency converter, the problem of difficult speed regulation of air jet loom is easily and efficiently solved.
2. Belt replacement and related spare parts are saved. Only the belt corresponding to the maximum rotation speed of spindle is required. The spindle speed is easily regulated by adjusting frequency. Manpower resource required by belt replacement and calibration is saved, thus improving production efficiency.
3. Positive and negative inching of air jet loom can be easily completed by making use of the inching function of the frequency converter. No external inching device is required, which makes inching adjustment faster and more convenient.
4. Our frequency converter supports ModBus. This enables the communication between the frequency converter and the air jet loom control system, thus eliminating the problem of wiring and facilitating control. Also, terminal control mode can be adopted, bringing convenience to existing equipment modification.
5. The addition of frequency converter makes it easier to operate and maintain the air jet loom. Ordinary workers are callable of completing the speed regulation and maintenance of the loom, which saves the investment in professionals.
6. Our frequency converter is energy-efficient, especially at low speeds. Hence, the operating costs are reduced.



ALPHA