

# Exploration and Practice of Engineering Training Line Cutting Training

Liang Zhou<sup>a</sup>, Yang Yang<sup>b</sup> and Li Jinliang<sup>c,\*</sup>

School of Engineering Training Centre Changchun, Jilin University, Jilin 130025, China

<sup>a</sup> zhouliang2011@jlu.edu.cn, <sup>b</sup> yyljl@jlu.edu.cn, <sup>c</sup> ljlyy@jlu.edu.cn

**Keywords:** Engineering training, line cutting, practice teaching, advanced manufacturing technology

**Abstract:** The practice curriculum system of engineering training in colleges is constantly reforming and innovating. It has gradually expanded from traditional manufacturing technology such as turning, milling and fitter to modern advanced manufacturing technology such as wire cutting, CNC turning, CNC milling, laser processing, robots. The line cutting training is designed to enable students to understand the basic theories and processing techniques of modern manufacturing technology, to familiarize themselves with the operational skills of modern manufacturing techniques, and to initially establish the concept of modern manufacturing engineering.

## 1. Introduction

The line cutting machine is a modern advanced manufacturing technology, which is a high precision and high efficiency automatic machine tool [1]. Line cutting training is designed to allow students to understand the basic theories and processing techniques of modern manufacturing technology, become familiar with the basic operational skills of modern manufacturing techniques, and initially establish the concept of manufacturing engineering.

The curriculum system of practice of engineering training in universities is in constant reform and innovation. It has been gradually expanding from traditional manufacturing techniques such as turning, milling and in shape to wire cutting, CNC, CNC milling, laser processing, robots and other advanced modern ones [2,3]. Manufacturing technology strengthens the content of the practical teaching of new technologies, new materials and new processes, pays attention to the integral application of multidisciplinary knowledge and pays attention to the cultivation of the capacity of engineering practice and the awareness of innovation. To this end, the Engineering Training Center of Jilin University has opened a training module for the practice of line cutting.

## 2. Teaching objectives

Understand the structure, processing characteristics and range of application of wire cutting machines, familiar with the layout of the wire cutting process, step division, path calculation, programming and part processing, familiar with the methods basic programming of wire cutting, manual programming, computer-assisted programming, line Training in the operation of cutting machines; mastery of the basic operative skills of wire cutting machines, capable of independently completing the programming and processing of simple parts according to the requirements of the drawings. Through the basic training of wire cutting machine tools, students can understand the general process and basic knowledge of advanced manufacturing technology, and establish a good foundation for related follow-up courses.

### 3. Teaching construction

#### 3.1 Construction of teaching documents

##### 3.1.1 Teaching programme

Practical training syllabus is a programmatic document guiding practical training teaching. The practical training module of linear cutting provides 12 teaching hours for students majoring in machinery, automobile, materials, agricultural machinery, management and other mechanical and near-mechanical majors. As shown in table 1.

Table 1 Practical training syllabus of linear cutting

sequence number	content	time
1	Machine structure, processing characteristics and application scope	1 hour
2	Machine tool	1 hour
3	Computer aided programming	2 hours
4	Practical process	2 hours
5	Innovation Training	4 hours
6	Operation test	1.5 hours
7	Brief summary	0.5 hours

##### 3.1.2 Teaching material

In order to cooperate with the engineering training center to strengthen the practical training teaching content of modern advanced manufacturing technology<sup>[2]</sup>, combining with the actual needs of the teaching reform of mechanical engineering training system in colleges and universities of engineering, the "modern engineering training" teaching material series of engineering training was compiled to improve students' engineering practice ability. The thinking that compiles this teaching material is teaching content makes every effort to select, pay attention to practical training, stress practical, picture and text are illustrated, facilitate self-study. In the process of compiling, the author strives to keep the text simple and pays attention to the systematicness and scientificity of knowledge, which plays an important role in the practical teaching of linear cutting.

##### 3.1.3 Training lecture

In accordance with the requirements of the syllabus for basic knowledge related to linear cutting, we have prepared the "practical training notes for linear cutting"<sup>[3]</sup>. The application of this speech script standardizes the explanation of the practical training content of linear cutting, avoids the omission of knowledge points in the practical training teaching process caused by the personal factors of the practical training instructors, thus ensuring the standardization of the practical training teaching of linear cutting, and meeting the requirements of the practical training syllabus of linear cutting.

##### 3.1.4 Practical training instruction

In order to help students comprehensively and completely grasp the safe operation rules and basic operation steps of the practical teaching of linear cutting in a limited time, improve the accuracy and safety of the operation of students in the practical training of CNC turning, and ensure the smooth development of the practical teaching of linear cutting, the practical training instruction of linear cutting was compiled.

##### 3.1.5 Training report

In order to test whether the theoretical basic knowledge and operational skills learned by students

in the practical training of linear cutting can meet the requirements of the practical training syllabus, the training content of linear cutting was studied, and the training report of linear cutting was prepared by using flexible questions such as selection, blank filling and short answer.

### 3.1.6 Practical training theory examination question bank

In order to test the students' understanding and mastery of the basic knowledge related to engineering training, the practical training theory examination questions were prepared for the practical training teaching content of line cutting. Various types of questions were adopted to closely follow each link of the practical training of line cutting, and the basic knowledge of line cutting that students should know and know was assessed.

### 3.2 Teaching hardware construction

According to the requirements of the line cutting syllabus, the hardware construction details of the wire cutting training module are shown in Table 2.

Table 2: Wire cutting training module hardware construction

No.	Equipment Name	Quantity
1	Wire cutting machine	8
2	EDM piercing machine tool	1
3	EDM shaping machine	2
4	Computer	30
5	CAXA Wire-cutting software	30

### 3.3 Construction of teaching staff

In order to carry out the line cutting training teaching in a smooth and orderly manner, the engineering training center is equipped with a relatively stable and multi-level training teaching instructor to accept the master's degree personnel with strong new technology and new craft ability as the line cutting practice teaching. The professional leader is a senior teaching technician with deep teaching experience, rich experience and high level. Each of the trained training personnel will be tested and evaluated, and the competition will be carried out. The training and guidance of the training will be carried out in an orderly manner with practical knowledge, strong ability and high comprehensive quality.

## 4. Implementation of teaching process

Under the guidance of the practical teaching syllabus of linear cutting, the teaching process follows the cognitive rules of students, designs the practical teaching content of linear cutting step by step, and carries out the practical teaching of linear cutting step by step.

The instructor first demonstrated the processing process of typical parts by using linear cutting, introduced the composition and working principle of linear cutting machine tool, compared with laser processing, introduced the processing characteristics of linear cutting machine tool; Understand the function and function of switches and buttons on the operation panel of linear cutting machine; The instructor used multimedia to explain the modeling method of typical caxa linear cutting software parts, the generation of tool path and the basic method of automatically generating numerical control machining program. Under the guidance of the practical instructor, the students conducted caxa linear cutting software programming exercises. Students carry out process analysis and tool track calculation on the part drawings designed by themselves, and use the linear cutting machine tool to process after generating the program. Guide students to summarize the skills, knowledge, experience, consciousness and methods that should be acquired in linear cutting training in the form of discussion, and finally determine the score; After the practical training, students independently completed the training report of linear cutting [4].

## **5. Assessment and performance assessment**

Combined with the process-based management of practical training, the final score of engineering training is composed of two parts: 80% of engineering training practical training score and 20% of basic knowledge assessment. The results of engineering training and practical training shall be weighted and determined by the results of all practical training links. The weight of each practical training link shall be determined according to the proportion of teaching hours of each practical training link, among which the practical training report accounts for 20%, the operation training accounts for 70%, and the internship attitude accounts for 10%.

## **6. Conclusion**

This paper introduces in detail the construction ideas, construction contents and implementation process of the wire cutting training module. This module allows students to understand the cutting-edge modern advanced manufacturing technology, narrow the gap with modern advanced manufacturing technology, and improve the quality of training. This module allows students to understand the cutting-edge modern advanced manufacturing technology, narrow the gap with modern advanced manufacturing technology, and improve the quality of training.

## **References**

- [1] Yang Y , Jinliang L , Dongni G , et al. Exploration and Practice of the 3D Printing Practical Teachingon Engineering Training[J]. China Modern Educational Equipment, 2016(09):88-89..
- [2] Hai-Yan J , Yan LI , Dong P . Discussion on Teaching Model of WEDM Practical Training[J]. Experiment Science & Technology, 2010(03):126-128.
- [3] Tie F,Hongsheng D. Exploration On Teachers team construction in university engineering training center in new period [J]. Experiment Technology and Management,2017(12):242-244.
- [4] Leggett D J. Identifying hazards in the chemical research laboratory [J].Process Safety Progress, 2013(31);393-397.