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A New Automatic Drawing Language

Un nouveau langage automatique pour le dessin

Eine neue automatische Zeichnungssprache

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1. Abstract

Lately labour cost has enormously risen and managers of factories are obliged to adopt automatic production system in which N/C machines play an important part.

We also have an attempt to fabricate steel bridges and frame works automatically with N/C gus-cutters drills and so on. But it is not so easy to supply paper tapes or magnetic tapes in which N/C instructions are packed. These tapes can never produce quickly and infalliably without a computer with large memories and its software.

After thorough investigation we got such conclusion that all informations about each material of which a structure is composed, should be packed into a magnetic tape and that it should be send to the factory.

In the factory they will pick up suitable informations as occasion demands.

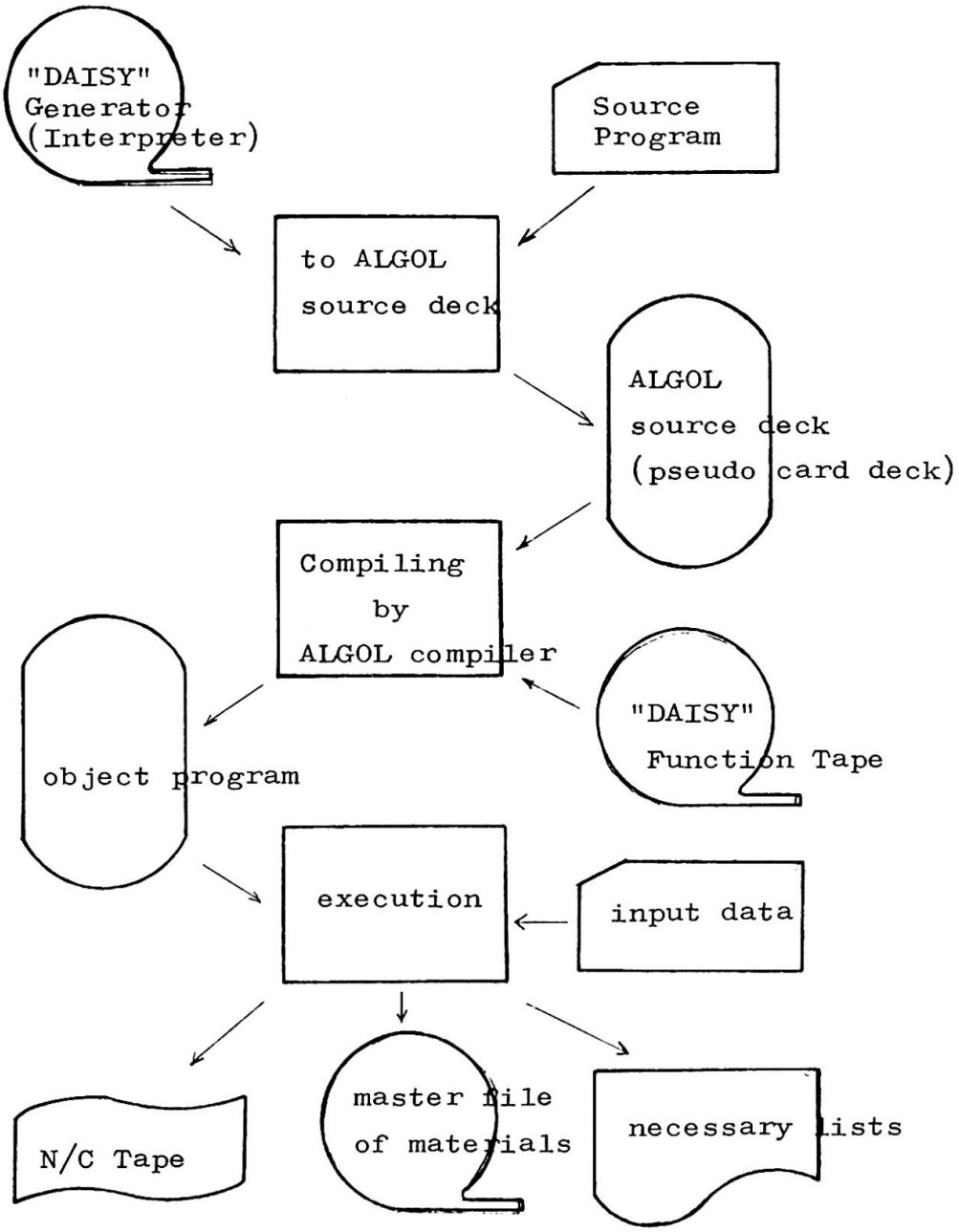
We searched for such a software in vain. At last we decided to make a new language with which we can get not only a automatically drawn plan but also a magnetic tape mentioned above. We began on it in the spring of 1970 and as we brought to completion with difficulty, we now report this paper to you.

This processing system is so called "generator system."

The merits of this method is as follows. As we can code the system programs with a compiler language, we can complete the system within short time and even if a bug is found unfortunately, we can easily repair it. Besides when we are to entrust its maintenance to our successor, we can transfer it to them smoothly. On the other hand the weak point of this method is that process is so complicated that much process time is required to accept necessary informations, and the operator of the computer are apt to commit misoperation. We examined these merits and demerits carefully before we take up this method.

2. Flow of Data

We named this system "DAISY", and source cards which are coded by a programmer are processed as Fig. 1.



4. Features of "DAISY"

As mentioned in abstract the main aim is to make an information tape for fabrication, the function is designed to meet this desire.

N/C languages in the past aims at the fact that a coder can make a cutter location tape easily, copying the plan by hand. So if you begin coding at your desk where there is no plan, you will find it quite difficult. I dare to say it to be impossible. This reason is as follows.

1. It is inconvenient for numerical and logical operation.
2. Components of vector cannot so easily be derived.
3. The concept of system doesn't take how a drafter make up his plan into consideration.

The third item is very important. When a skillful drafter is goint to code auto-drawing program, he must completely change the way of constructing the plan.

We watched carefully skillful drafters working to know how they will get points and how they draw lines on the tracing papers, etc.

We at last knew that they will not separately draw each line but place a piece which they are going to draw on a tracing paper and rotate it 3-dimensionally so that the piece will expose the designed surface and drop the suitable shadow of it on a paper in their heads, and then they begin to draw it. This process in the drafters' head is thoroughly copied to the new language. When you will make a certain plan, you will arrange all the parts that the plan is composed of, on an imaginary tracing paper and rotate them mentioned formally and then if you write "DRAW ALL" at the last line of the coding sheet, you will get the N/C tape desired. Of course general faculty as a N/C language is furnished.

Another conspicuous faculty is that the placed pieces can freely be processed. For example if you want to cut the piece you can do so. You can bare halls of the piece. If desired you can join two pieces to one.

The piece once placed may change its location to wherever you like. But if you move it 3-dimensionally only the shadow of it to the surface in view will be left.

To complete a plan another important component we must not forget is dimensions and dimension lines. Not a little quantity of labour

is spent to it when a drafter draws a plan by hand. System is also designed so as to code them with a few statements and the distance between two arrow marks signed to the edges of a dimension line can be automatically calculated.

Summing up the faculty of the "DAISY" we exhibit as follows:

1. Vectors (point, line, curved line, figure, pattern, member) can be used.
   Where member has its thickness.
2. Figures, patterns and members can be change their shapes freely and move them anywhere.
3. Various values can be derived from the vectors.
4. All the information of a member can be entried to the master tape of the job.
5. Dimension lines can be easily made.
6. Another N/C command can be generated.
7. "Macro-Drawing" is possible.

5. Version-Up

As mentioned former paragraph, this system has occupied "generator method." 3-step process is desired before we receive a N/C tape. We are carrying a plan that we will improve the "DAISY" to the compiler. If this plan is achieved remarkable quantity of processor time of the computer will be spared.

At present N/C tape format is not universal and is only able to a certain maker's machine. We must improve the post-processor so that any type of format may be allowed.

6. Conclusion

By occupying "DAISY" system, we succeeded to get automatically drawn plans at relatively cheap cost.

The amount of core memory which this system desires is 196 k bytes and the average processor time for one sheet is about 3 minutes.

In other department of industry it might be impossible to handle data 3-dimensionally, but steel structure is mainly composed of plates and rolled shapes. For this reason we managed to succeed to complete the system in relatively short period of time.