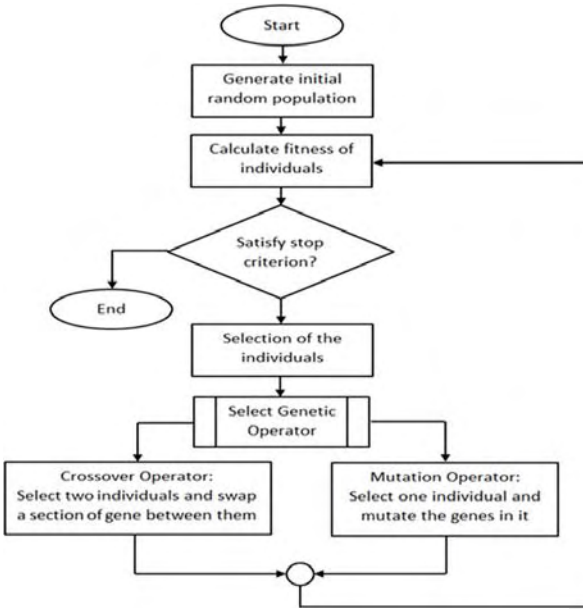


Fig. 1. Flow chart of the genetic programming approach

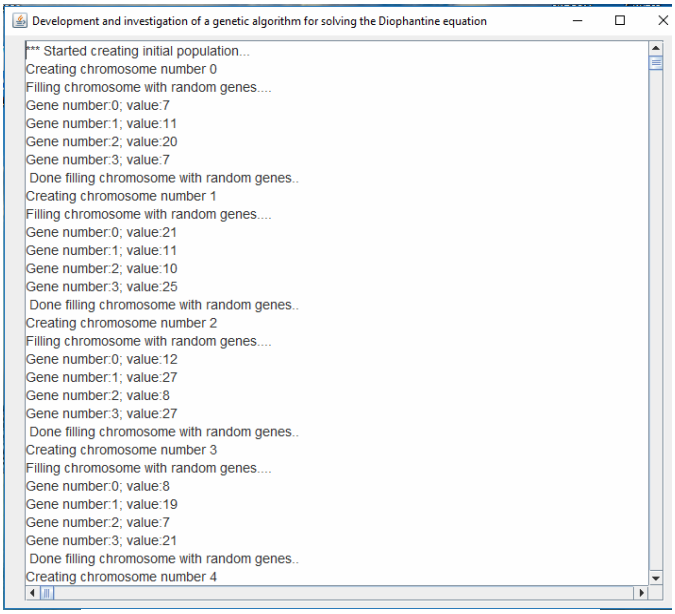


Fig. 2. Window of the developed program

The offspring of each of these parents contains the genetic information of both father and mother. How this can be determined is very arbitrary. However for this case, we could use something called a "cross-over". Let us say a mother has the solution set $a_1,b_1,c_1,d_1$, and a father has the solution set $a_2,b_2,c_2,d_2$, then there can be six possible cross overs (| = dividing line).

There are many other ways in which parents can trade genetic information to create an offspring, crossing over is just one way. Where the dividing line would be located is completely arbitrary, and so is whether or not the father or mother will contribute to the left or right of the dividing line.

**Conclusion**

The average fitness value for the offspring chromosomes were 38.8, while the average fitness value for the parent chromosomes were 59.4. Of course, the next generation (the offspring) are supposed to mutate, that is, for example we can change one of the values in the ordered quadruple of each chromosome to some random integer between 1 and 30. Progressing at this rate, one chromosome should eventually reach a fitness level of 0 eventually, that is when a solution is found. For systems where the population is larger (say 50, instead of 5), the fitness levels should more steadily and stabily approach the desired level (0).

Literary sources:

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## INVESTIGATION OF THE INFLUENCE OF ELECTRO-IMPULSE CURRENT ON MANGANIFEROUS LIQUID-ALLOY

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The authors carried out a large volume of experimental studies on the influence of electro-impulse current in the process of crystallization of the casting during the study of steel grade 35GL.

Table 1 – Routines of electro-impulse current influence

| Current parameters | Routine 1 | Routine 2 | Routine 3 | Routine 4 |
|---|---|---|---|---|
| Current strength | 20, 40, 60, 80 | | | |
| Squelching | 2 | 5 | 15 | 24 |
| Frequency | 5 | 10 | 33 | 33 |

The treatment of the melt with an electro-impulse current was carried out from the beginning of the casting of the metal in the form to the end of the encryption, with the parameters of the current strength varying from 20 to 80 A, squelching from 1 to 24, and also the frequency from 5 to 33 Hz. To conduct research, 4 modifications were selected (Table 1).

All four routines of modification have an effect on the morphology of crystallite of the metal base (Fig. 1).


Fig. 1. Influence on the size of the crystallite of the metal base of different routines of electro-impulse processing of manganiferous steel 35GL

Modification routines 3 and 4 are the most appropriate since the smaller the austenitic crystallite the larger the total area between the crystallites and consequently the less specific content of harmful impurities located on the boundaries of the crystallites.

With a current of 40 A (routine 3) in 35GL steel samples, the crystallite size of manganese carbides is the smallest: crystallites are 10 times smaller than unmodified specimens and 2 times smaller than when treated under routine 4. Thus, the smallest structure is obtained in samples at modulating the electro-impulse current of variable polarity with the following parameters: duration of impulses more than 10…3 s, frequency 5…33 Hz, strength 30…40 A, squareness 5…24, with voltage in the power line 180…240 V (routine 3).

The electro-impulse current passing through liquid steel run away of formation of critical nucleus. This leads to active volumetric crystallization. The dendritical crys-tallization is discontinued much earlier than the unmodified casting. Metal in the volumetric crystallization zone has a finer structure and a higher density. In the modified casting the internal shrinkage is insignificant.

Electric discharge machining of a liquid-alloy steel 35GL with a current of variable polarity with an impulse time of more than 10…3 s, a frequency of 5…33 Hz, a strength of 30…40 A, a squareness of 5…24, at a voltage in the power line 180…240 V during crys-tallization in the casting-form contributes reduction of physical discontinuity: reduction of structural discontinuity: the size of the crystallite of the metal base decreases from 280 to 82…85 microns, and the size of manganese carbides – from 6,7 to 0,3…0,5 microns; significant increase in the basic mechanical properties of cast structural steel 35GL: the strength is increased by 9%, the impact hardness – by 21%, the hardness (HB) – by 6%.