Copyright © 2019 American Scientific Publishers
All rights reserved
Printed in the United States of America

Journal of
Computational and Theoretical Nanoscience
Vol. 16, 2950–2953, 2019

Building Constructions Optimization According to Genetic Algorithm

S. V. Klyuyev[1,*], A. V. Klyuyev[1], A. J. Abakarov[2], V. F. Danilov[3], and E. Ph. Chubenko[4]

[1] *Candidate of Engineering Sciences, Belgorod State Technological University Named After V.G. Shukhov*
[2] *Doctor of Engineering Sciences, Dagestan State University of Technology*
[3] *Candidate of Engineering Sciences, Elabuga Institute of Kazan Federal University*
[4] *Candidate of Engineering Sciences, Vladivostok State University Economics and Service*

The method of ideal plan of bearing structures based on hereditary calculation has been recommended. A structure of steel outline with fluctuating 9 parameters utilizing the strategy for limited components is considered for instance. The volume is limited alongside utilization. The extra conditions associated with pressure and dependability and neighborhood are determined. As a material steel S345 with the accompanying qualities is utilized. To figure the edge the accompanying parameters are utilized: 20 people; 300 ages; 0,1 determination weight; 0,05 change standard; 15 substitution number. Change deviations have direct character and sum 0,001…0,0001 for rib and divider thickness, however for different components 0,01…0,001. The best variation relating to the volume least of the edge material is uncovered.

Keywords: Support, Fortifying, Quality Upgrade.

RESEARCH ARTICLE

1. INTRODUCTION

Over the most recent couple of decades in the circles of building, financial aspects and arranging there is a pattern of change from the permissible specialized and overseeing answers for ideal ones. In any case, the cutting edge improvement hypothesis has not met the prerequisites of a plan engineer due to the way that its severe scientific strategies don't consider genuine states of structure issues. Moreover, present day confounding structure practice needs in proficient numerical methods for taking care of such issues [1–10].

A distinctive component of the new methodology is a perplexing improvement making conceivable to plan an entire framework, yet not its different parts. In this way a standout amongst the most significant logical and connected issues is to create procedure of ideal structure of complex specialized frameworks—the framework plan [11–21].

A development is described by various criteria: cost, unwavering quality, weight, estimate, building time and so forth, that can came in shared logical inconsistency. The trouble of the issue arrangement comprises in the absence of from the earlier data fundamental for scanning for ideal variation of development. Accordingly, the structure system is advantageous to mastermind so that the volume of data on development would increment at each consequent stage. In the meantime it is important to bar deficient variations uncovered throughout plan. In this manner, the two inclinations are to consolidate: age of assortment of changes and truncation of the got assortment [22, 23]. A recommended structure system is reliable with advancement improvement procedure and hereditary calculation (GA) specifically.

2. MATERIALS AND METHODS OF RESEARCH

Hereditary calculations got a wide acknowledgment amidst the 1960's inferable from J. Holland's works. They reproduce developmental procedure with the weight on hereditary instruments, for example quality legacy and recombination. It is made by some number (populace) of counterfeit chromosome (people). Every chromosome contains n qualities that relate to n wanted factors of enhancement issue.

Hereditary calculations like development calculation when all is said in done are connected to scan for the capacity worldwide extremum of numerous factors. The standard of their activity depends on displaying a few

*Author to whom correspondence should be addressed.

 1546-1955/2019/16/2950/004 doi:10.1166/jctn.2019.8200

components of populace hereditary qualities, control of chromosome set at shaping genotype of another natural individual by methods for legacy of guardians' chromosome parts, inadvertent varieties of genotype known as change.

In Figure 1 hereditary calculation is appeared. The primary thought of advancement comprises in improving the individual wellness of the principal populace age until stop criteria are accomplished.

1. Introductory populace. At first it is important to make the underlying populace of people. As nothing is thought about target work, let us take the individual qualities in the previous expressed territory as incidental and consistently disseminated.
2. Singular assessment. It is important to decide readiness for every one of infant people based on target work. At that point one can begin age circle to improve singular wellness.
3. Choice is the initial step to this improvement at which people are chosen by some coincidence or based on their past wellness as indicated by the procedure. This determination fills in as either sort prolongation or tip top status move. Individual with a first class status can be neither rejected from genuine age nor changed.
4. Multiplication implies variety prolongation of people chose for this reason. The least complex method for proliferation is adapting people. Other than it, GA system attempts to produce the best people by quality recombination in chromosome. Standard speaking, for this situation parent people structure couples that trade qualities with one another by some coincidence and structure along these lines two infants.
5. Transformation changes separate qualities of genetic supply. Attributable to it at GA genetic supply ought to be reestablished in light of the fact that at multiplication there would be misfortune genetic supply assortment ordinarily after a couple of number of ages.
6. Singular assessment. In the wake of changing individual chromosomes by recombination and transformation it is vital for each infant to decide the wellness.
7. Singular substitution. Toward the finish of age circle it is important to discover what people ought to be barred from the populace. Generally without substitution the populace would develop longer. GA is normally supplanted with most of guardians by babies.
8. Stop criteria characterize term of streamlining procedure and assume a conclusive job in assessment of results. The two variations of framing stop criteria are utilized: (1) wellness control, because of which the procedure is stopped if the most extreme wellness esteem in populace isn't on a very basic level improved in the scope of indicated age number; (2) assurance of age number.

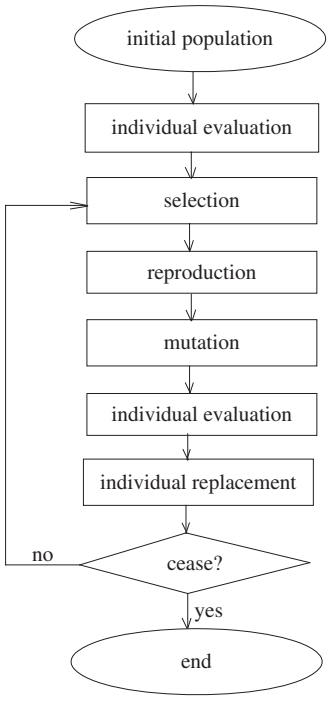

Fig. 1. The genetic algorithm.

The two variations have impediments. In the principal variation it can happen that the most extreme wellness esteem in the populace does not change for quite a while, however at that point, for example because of effective transformation there is an improvement. Subsequently on account of early stop just suboptimum is accomplished.

In the second variation ideal criteria are not the principle one by any stretch of the imagination. Regularly the arrangement keeping up enough the resilience set up for shifted parameters is picked. For this situation it is as yet important to complete improvement forms with various quantities of ages to assess the outcomes.

By methods for choice and prohibition of people with generally poor wellness the populace is additionally revalued. Plainly for this situation the genetic supply can lose some great qualities. GA attempts to decrease these misfortunes however much as could reasonably be expected [1, 2].

3. RESULTS AND DISCUSSION

$\rho = 78,5$ kH/m^3; the module of longitudinal elasticity $E = 2,1 \cdot 10^5$ MPa, lateral deformation coefficient $\nu = 0,3$; yield stress $R_{yn} = 360$ MPa, design resistance $R_y = 300$ MPa.

Give us a chance to think about the structure of steel outline for instance. The volume is limited alongside weight and material utilization. The extra conditions associated with pressure and dependability conditions, general and nearby are determined. As a material steel S345 with the accompanying qualities is utilized: thickness $5 \leq b \leq 15$; $10 \leq h_{p\pi} \leq 30$; $10 \leq h_{p\Pi} \leq 30$; $0,5 \leq t_{p\Pi} \leq 1,5$;

RESEARCH ARTICLE

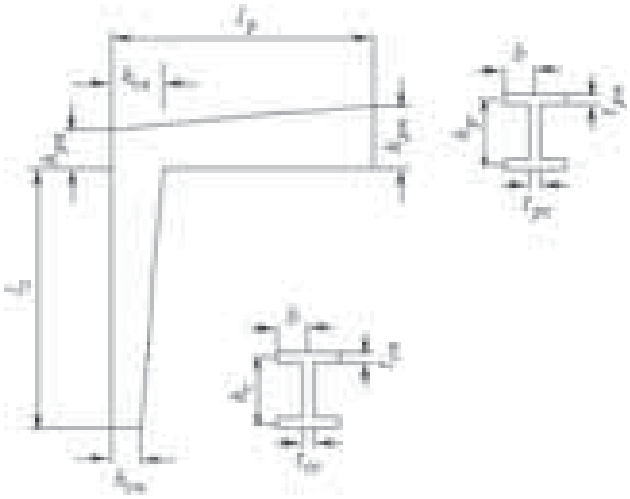

Fig. 2. Frame profile and cross-sections of the beam and support.

$0,5 \le t_{pc} \le 1,5;\ 10 \le h_{CB} \le 30;\ 10 \le h_{CH} \le 30;\ 0,5 \le t_{cII} \le 1,5;\ 0,5 \le t_{cc} \le 1,5.$

Objective function, expressing the volume of the frame material has the following form:

$$V = 2,4t_{cc}(h_{CB} + h_{CH} - 2t_{cn}) + 2t_{pc}(h_{p\pi} + h_{pn} - 2t_{pn}) + b(19,2t_{cn} + 16t_{pn})$$

From the states of watching the nearby steadiness of rib shaft cross-segment components the acceptable relations of their sizes are expressed: for the spine it is 10, for the help it is 110. The upper and lower bound of the ideal factors are expressed in the accompanying manner (in sm):

b	$h_{p\pi}$	h_{pII}	h_{CB}	h_{CH}	t_{pII}	t_{pc}	t_{cII}	t_{cc}

A similar articulation with the contrary sign characterizes the wellness work.

Utilizing the technique for limited components for count, let us break the half of the casing volume into 108 components—48 in the bar and 60 in the help, for this situation in the cross-segment there are 6 components (2 for each the spine and the divider).

As per the quantity of streamlined parameters we present the chromosome model.

Table I. Sizes of profile elements.

	b	$h_{p\pi}$	h_{pII}	t_{pII}	t_{pc}	h_{CH}	h_{CB}	t_{cII}	t_{cc}
1	55	138	143	6,4	5,0	100	105	5,0	5,0
2	69	209	231	5,7	5,1	298	281	6,6	5,0
3	50	120	157	5,6	5,0	102	158	5,0	5,0
4	50	120	194	5,6	5,0	101	108	5,0	5,0
5	63	191	252	5,2	5,0	191	300	5,8	5,0
6	50	115	123	7,0	5,0	102	119	5,0	5,0
7	50	161	162	5,5	5,0	101	121	5,0	5,0
8	51	128	169	5,6	5,0	103	116	5,0	5,1
9	51	131	154	6,1	5,1	102	120	5,0	5,0
10	50	126	161	5,8	5,0	110	117	5,1	5,1

Table II. Geometric characteristics of frame and stress.

	V	σ	b/t_{pII}	b/t_{cII}
1	0,0150	161	7,4	9,4
2	0,0265	160	11,7	10,1
3	0,0150	161	8,5	9,5
4	0,0147	160	8,4	9,5
5	0,0224	388	11,5	10,4
6	0,0153	338	6,8	9,5
7	0,0149	162	8,6	9,5
8	0,0149	162	8,7	9,7
9	0,0152	162	7,9	9,7
10	0,0149	161	8,2	9,3

To compute the edge the accompanying parameters are utilized: 20 people; 300 ages; 0,1 determination weight; 0,05 change standard; 15 substitution number.

Transformation deviations have direct character and sum 0,001. . .0,0001 for spine and divider thickness, however for different components 0,01. . .0,001.

The acquired outcomes (sizes are in mm) are introduced in the Table I. In the Table II the edge volume V, m3, the biggest ordinary pressure, MPa, and the connection and are exhibited.

From the Table II it is clear that the relations of and are surpassed in the second and fifth lines. In the fifth and 6th lines the determined pressure is surpassed. Along these lines, the three variations of arrangement ought to be overlooked.

The divider thicknesses relate to determined lower bound. Different parameters are in the scope of indicated limits. In the rest seven variations of arrangement the volume isn't adequately unique (in the scope of 3,4%). The negligible volume relates to the fourth variation of arrangement [25–27].

4. CONCLUSION

1. Genetic calculations are incredible discovering implies. The arrangement got on their premise is problematic, however it doesn't keep from utilization of calculations to scan for worldwide extremums at structure development enhancement.
2. Genetic calculations are adequate for arrangement of multipara metric nonconvex issues in examination with the known expository techniques for improvement.
3. The arrangement can be made increasingly precise having expanded the matrix thickness of the limited components. Expanding the quantity of streamlined parameters results in increment of the quantity of people and ages. In addition, machine time utilization builds, that occasionally may fill in as an assessment parameter of utilizing hereditary calculations.

References

1. (a) Vatin, N.I., Nazmeeva, T. and Guslinscky, R., **2014**. Problems of cold-bent notched c-shaped profile members. *Advanced Materials Research, 941–944*, pp.1871–1875; (b) Garifullin, M., Vatin, N.,

Jokinen, T. and Heinisuo, M., **2016**, **2017**. Numerical Solution for Rotational Stiffness of RHS Tubular Joints. *Advances and Trends in Engineering Sciences and Technologies II-Proceedings of the 2nd International Conference on Engineering Sciences and Technologies*, ESaT, pp.81–86.

2. Tinkov, D.V., **2015**. Comparative analysis of analytical solutions to the problem of truss structure deflection. *Magazine of Civil Engineering, 57*(5), pp.66–73.
3. Tinkov, D.V., **2016**. The optimum geometry of the flat diagonal truss taking into account the linear creep. *Magazine of Civil Engineering, 61*(1), pp.25–32.
4. Kirsanov, M.N., **2015**. Analysis of the deflection of a strut-type lattice girder truss. *Magazine of Civil Engineering, 57*(5), pp.58–65.
5. Kirsanov, M.N., **2016**. Analysis of the buckling of spatial truss with cross lattice. *Magazine of Civil Engineering, 64*(4), pp.52–58.
6. Alekseytsev, A.V. and Kurchenko, N.S., **2017**. Deformations of steel roof trusses under shock emergency action. *Magazine of Civil Engineering, 73*(5), pp.3–13.
7. Serpik, I.N., Alekseytsev, A.V., Balabin, P.Yu. and Kurchenko, N.S., **2017**. Flat rod systems: Optimization with overall stability control. *Magazine of Civil Engineering, 76*(8), pp.181–192.
8. Indeykin, I.A., Chizhov, S.V., Shestakova, E.B., Antonyuk, A.A., Evtukov, E.S., Kulagin, K.N., Karpov, V.V. and Golitsynsky, G.D. **2017**. Dynamic stability of the lattice truss of the bridge taking into account local oscillations. *Magazine of Civil Engineering, 76*(8), pp.266–278.
9. Tusnina, O.A., **2018**. Finite element analysis of crane secondary truss. *Magazine of Civil Engineering, 77*(1), pp.68–89.
10. Hezhev, T.A., Zhurtov, A.V., Tsipinov, A.S. and Klyuev, S.V., **2018**. Fire resistant fibre reinforced vermiculite concrete with volcanic application. *Magazine of Civil Engineering, 76*(4), pp.181–194.
11. Khezhev, T.A., Pukharenko, Yu.V., Khezhev, Kh.A. and Klyuev, S.V., **2018**. Fiber gypsum concrete composites with using volcanic tuff sawing waste. *ARPN Journal of Engineering and Applied Sciences 13*(8), pp.2935–2946.
12. Zagorodnyuk, L.Kh., Lesovik, V.S. and Sumskoy, D.A., **2018**. Thermal insulation solutions of the reduced density. *Construction Materials and Products, 1*(1), pp.40–50.
13. Klyuev, S.V., Khezhev, T.A., Pukharenko, Yu.V. and Klyuev, A.V., **2018**. The fiber-reinforced concrete constructions experimental research. *Materials Science Forum, 931*, pp.598–602.
14. Klyuev, S.V., Khezhev, T.A., Pukharenko, Yu.V. and Klyuev, A.V., **2018**. Fiber concrete on the basis of composite binder and technogenic raw materials. *Materials Science Forum, 931*, pp.603–607.
15. Zharikov, I.S., Laketich, A. and Laketich, N., **2018**. Impact of concrete quality works on concrete strength of monolithic constructions. *Construction Materials and Products, 1*(1), pp.51–58.
16. Elistratkin, M.Yu. and Kozhukhova, M.I., **2018**. Analysis of the factors of increasing the strength of the non-autoclave aerated concrete. *Construction Materials and Products, 1*(1), pp.59–68.
17. Klyuyev, S.V., Klyuyev, A.V., Lesovik, R.V. and Netrebenko, A.V., **2013**. High strength fiber concrete for industrial and civil engineering. *World Applied Sciences Journal, 24*(10), pp.1280–1285.
18. Lesovik, R.V., Klyuyev, S.V., Klyuyev, A.V., Netrebenko, A.V. and Kalashnikov, N.V., **2014**. Fiber concrete on composite knitting and industrialsand KMA for bent designs. *World Applied Sciences Journal, 30*(8), pp.964–969.
19. Klyuev, S.V., Klyuev, A.V., Khezhev, T.A. and Pucharenko, Yu.V., **2018**. Technogenic sands as effective filler for fine-grained fibre concrete. *Journal of Physics: Conference Series, 1118*, p.012020.
20. Klyuev, S.V., Klyuev, A.V. and Vatin, N.I., **2018**. Fine-Grained Concrete with Combined Reinforcement by Different Types of Fibers. *MATEC Web of Conferences*, Vol. 245, p.03006.
21. Klyuev, S.V., Klyuev, A.V. and Vatin, N.I., **2018**. Fiber concrete for the construction industry. *Magazine of Civil Engineering, 84*(8), pp.41–47.
22. Klyuev, S.V., Abakarov, A.J., Lesovik, R.V., Muravyov, K.A. and Tatlyev, R.Dz., **2018**. Optimal engineering of rod spatial construction. *Journal of Computational and Theoretical Nanoscience, 6*(1), pp.200–203.
23. Yuryev, A.G. and Zinkova, V.A., **2019**. Ata el-karim soliman truss design calculation. *Construction Materials and Products, 2*(1), pp.37–44.
24. Amanlou, M. and Mostafavi, S.M., **2017**. *In sillico* screening to aim computational efficient inhibitors of caspase-9 by ligand-based pharmacophore modeling. *Medbiotech Journal, 1*(01), pp.34–41.
25. Mostafavi, S.M., Bagherzadeh, K., and Amanlou, M., **2017**. A new attempt to introduce efficient inhibitors for caspas-9 according to structure-based pharmacophore screening strategy and molecular dynamics simulations. *Medbiotech Journal, 01*(01), pp.1–8.
26. Heidary, S., Imani, M. and Mostafavi, S.M., **2017**. A validated and rapid HPLC method for quantification of human serum albumin in interferon beta-1a biopharmaceutical formulation. *Medbiotech Journal, 01*(01), pp.29–33.
27. Nehzat Ebrahimi and Jalil Rashidinia, **2014**. Spline collocation for volterra-fredholm integro-differential equations. *UCT Journal of Research in Science, Engineering and Technology*, (1), pp.01–03.

Received: 1 January 2019. Accepted: 11 March 2019.