Review of Modified Particle Swarm Optimization (MPSO) Algorithm-based Claim Management System for Construction Claim and Disputes in Infrastructure Projects

SWAPNIL SHANTARAM JADHAV[1], A.V. HANKARE[2]
[1]*Student, Final Year MTech Civil Engineering, TKIET Warnanagar Kolhapur*
[2]*Assistant Professor, Department of Civil Engineering, TKIET, Warananagar, Kolhapur*

Abstract—This paper deals with application of the Modified Particle Swarm Optimization (MPSO) algorithm in the claim management system for assessing risks associated with construction claims in infrastructure projects represents a significant advancement in project management and risk mitigation. The MPSO algorithm, with its enhanced capabilities and adaptability, has demonstrated its efficacy in optimizing the assessment process, thereby improving the accuracy and efficiency of risk evaluation. The primary objective is to minimize the financial impact and time implications associated with the construction claim.

Indexed Terms- Contract, Claim Management, Delay, Particle Swarm Optimization, Optimization of Claim And Time.

I. INTRODUCTION

The construction projects are complex in nature dueto their large sizes and scopes, many projects required years to complete. To manage such large & complex projects required more skills and experience. During the study it is observed that many infrastructure projects are suffers from major time and cost overruns. A data published by the government of India and industry suggest that the 20 to 25 percent projects in India suffer from time, cost overruns or under disputes. Such conditions are increasing the project costs and increasing the projects risks, to minimize the intensity of risk proper provisions to be done while preparing the project budget. To avoid such circumstances, the traditional approaches adopted in the construction industry may not be sufficient, as there are generated large number of risks to the project. Advanced ways of Contract and claim management can fulfil the needs aspired to as well as lead to added value. The goal of this study is to analyse the issues associated to contractual claims and disputes arises into the building tasks and check out a mannequin that explains the shape and presents a framework to reduce the initiatives risks.

II. LITRATURE REVIEW

1.1.1 Kiani, A.T.; Nadeem, M.F.; Ahmed, A.; Khan, I.A.; Alkhammash, H.I.; Sajjad, I.A.; Hussain, B. An Improved Particle Swarm Optimization with Chaotic Inertia Weight and Acceleration Coefficients for Optimal Extraction of PV Models Parameters. Energies 2021, 14, 2980

Kiani et al A revised version of PSO that aimed to address the limitations of the conventional PSO in terms of PV parameter estimate has been described. In order to enhance PSO performance and guarantee a sufficient balance between local and global search, a sine chaotic inertia weight mechanism is initially employed in this study. Then, acceleration coefficients are controlled in two different methods. In order to guide acceleration coefficients, a tangent chaotic approach is employed to search for the best solution.

1.1.2 Freitas, D.; Lopes, L.G.; Morgado-Dias, F. Particle Swarm Optimization: A Historical Rev2iew up to the Current Developments. Entropy 2020, 22, 362.

Freitas et al. outlined how the PSO optimization algorithm seeks to iteratively optimize a problem, starting with a set or population of candidate solutions, referred to in this perspective as a swarm of particles, in which each particle knows both the global best position within the swarm (and its resulting worth in the perspective of the problematic) and its personal best position (and its fitness cost) revealed so far during the search. Until the entire swarm converges to the global minimum, the particles move arbitrarily in the search space in an iterative process. Three parameters make up the PSO: one control parameter, two learning parameters. In the search process, each parameter is important.

1.1.3 Liu, Q., Wei, M. K., Zhou, Q., Cai, S. R., Jiang, L., Zhou, H., et al. (2020). Research on capacity optimization configuration of the South western China micro grid considering electricity cost and system self-power supply reliability. Power Syst. Prot. Control48 (10), 139–145.

Liu et al., investigated the level of charge of the energy storage system and the dependability of the system's self-power supply were taken as constraints, and the diesel micro grid was chosen as the study object in southwest China. The particle swarm optimisation (PSO) technique was utilized to solve capacity allocation. The charging and discharging threshold range of ideal retired batteries with a piecewise probability distribution function were set which decreased the recovery cost of retired batteries. The relationship between the theoretical output of wind farms and retired energy storage batteries was thoroughly considered.

1.1.4 Kong, X.; Zhang, T. Non-Singular Fast Terminal Sliding Mode Control of High-Speed Train Network System Based on Improved Particle Swarm Optimization Algorithm. Symmetry 2020, 12, 205

Kong et al described a technique called improved multi-strategy particle swarm optimization (IMPSO). In order to improve the global optimizing performance of particle swarms, it is suggested that the structure and parameters be optimized. This will allow for a better mapping of the extremely nonlinear properties of railway traction brakes. An adaptive inertia weight factor (AIWF) is included in the equation for the PSO velocity update.

1.1.5 Safapour, E. Kermanshachi, S. Identifying early indicators of manageable rework causes and selecting and mitigating best practices for construction. J. Manag. Eng. 2019, 35, 04018060.

Safapour et al. examined and evaluated five critical best practices in order to decrease schedule delays and lower the cost of building projects for the construction customers. These five Best Practises include front-end planning, team development, alignment, change management, and partnership. Different types of topology structures have been researched in the literature to improve PSO performance. An information flow mechanism was used to update each particle's position in a fully informed particle swarm (FIPS). The velocity adjustment in FIPS was affected by positions outside of the particle's immediate neighbourhood as well as the best position within it, allowing all neighbourhood members to fairly contribute their search information.

1.1.6 Garg, H. A Hybrid GSA-GA Algorithm for Constrained Optimization Problems. Inf. Sci. 2019, 478, 499–523.

Garg stated that the PSO is used to improve vector location and the genetic algorithm (GA) is utilized to modify the decision vectors using genetic operators. Levy flight distribution and the sine cosine algorithm (SCA) are combined with the PSO method. The SCA method bases the updating solution on the sine and cosine functions, whereas levy flight is a random walk that first generates search steps using the levy distribution before employing large spikes to search the exploration space more thoroughly. The merging of the exploration skills of the grey wolf optimizer (GWO) with the PSO's exploitation capabilities results in the proposal of a novel hybrid algorithm. By switching a particle from the PSO with a low.

1.1.7 Kermanshachi, S.; Anderson, S.; Molenaar, K.R.; Schexnayder, C. Effectiveness Assessment of Transportation Cost Estimation and Cost Management Workforce Educational Training for Complex Projects. In Proceedings of the ASCE International Conference on Transportation & Development, Pittsburgh, PA, USA, 15–18 July 2018.

Kermanshachi et al. find out that the poor construction performance has been a topic of discussion among academics and industry professionals for decades. Many businesses are compelled to continuously monitor and enhance their performance because of the economy's consistent growth, the existence of fierce competition, and the construction industry's rapid changes. Additionally, it has been demonstrated that the three Engineering, Procurement, and Construction (EPC) phases can be implemented successfully to produce a construction performance that is effective. Specifically, schedule, cost, and quality can all be used to evaluate how well each EPC phase performed.

1.1.8 Deetjen, T. A., Martin, H., Rhodes, J. D., and Webber, M. E. (2018). Modeling the optimal mix and location of wind and solar with transmission and carbon pricing considerations. Renew. Energy120, 35–50.

Deetjen et al. created a model to determine the best wind, solar, and transmission capacities for an area in Germany. It is important to set up a specific energy storage system on the basis of the complimentary nature of solar and wind power as well as the output volatility, which is still significant. The goal of their study was to determine the best time to use complementary optical storage energy. The optimal economic efficiency of the system was used as the objective function to create the mathematical model for the optimal economic scheduling, which was then solved using the particle swarm optimization algorithm.

1.1.9 Cui, Q.; Li, Q.; Li, G.; Li, Z.; Han, X.; Lee, H.P.; Liang, Y.; Wang, B.; Jiang, J.; Wu, C. Globally Optimal Prediction-Based Adaptive Mutation Particle Swarm Optimization. Inf. Sci. 2017, 418–419, 186–217.

Cui et al. have been striving to modernize the conventional PSO by including mutation operators to maintain population variety and address the issue of early convergence. In the paragraph that follows, a few of the revised mutation processes are discussed. The extended nonuniform mutation operator is used to describe an adaptive mutation method where imprisoned particles are extracted from local optimum with the aid of adaptive mutation. To avoid local algorithm convergence in complex networks, the hybridizing inertia weight modification technique has been utilized. It is based on new particle diversity and an adaptive mutation method.

1.1.10 Dong, W.Y.; Kang, L.L.; Zhang, W.S. Opposition-Based Particle Swarm Optimization with Adaptive Mutation Strategy. Soft Comput. 2017, 21, 5081–5090

Dong et al. puts forth a unique notion that might assist to increase the exploratory potential of the search domain and quicken the convergence of the candidates: local pursuit of the global optimum particle in the current population using an adaptive mutation-selection technique. The purpose is to build a novel algorithm and to discover the optimal answer by combining stochastic approaches, PSO, and an adaptive cauchy mutation method. To overcome the two main problems of PSO, the author introduces a multiple scale self-adaptive cooperative mutation strategy-based particle swarm optimization method (MSCPSO).

1.1.11 Khan, S.; Kamran, M.; Rehman, O.U.; Liu, L.; Yang, S. A Modified PSO Algorithm with Dynamic Parameters for Solving Complex Engineering Design Problem. Int. J. Compute. Math. 2017, 95, 2308–2329.

B Khan et al. suggested a fresh method for addressing the learning parameters. This hypothesis states that the particles escaping from a local optimum and convergent to the global optimal solution are affected by the dynamic modification of the two learning variables. Investigated is the use of Gaussian and Cauchy mutation in the modified PSO. The main goal is to increase convergence and get the best outcomes while solving different real-world situations. The PSO is used as a foundation in the

field of swarm intelligence. In comparison to the conventional PSO, the proposed PSO used a better weight factor to achieve better convergence.

1.1.12 Larson, E.W, Gray, C.F. A Guide to the Project Management Body of Knowledge: Pmbok Guide; Project Management Institute: Newtown Square, PA, USA, 2015.

Larson et al. stated that the Gross Domestic Product (GDP) of many nations is mostly comprised 2of the construction industry. The World Bank estimates that emerging nations account for between 6 and 9% of global GDP, therefore the expansion of the construction sector frequently contributes to and maintains long-term economic development and stability. The productivity and success rates of construction projects, which typically serve as the essential tenets for the effective execution of project management and optimization, have been the subject of several recent attempts to increase. The management and control processes of the present project and careful planning for future projects are the primary pillars of successful construction projects.

1.1.13 Ganesh MR, Krishna R, Manikantan K, Ramachandran S (2014) Entropy based binary particle swarm optimization and classification for ear detection. Eng Appl ArtifIntell 27:115–128

Ganesh et al. concluded that for the created response surface models, the PSO was used to optimize the cutting conditions. The PSO programme provided the minimal values of the factors taken into consideration together with the accompanying ideal cutting circumstances. The squared error between the observed values and the modelled ones in system identification issues was solved by using an enhanced PSO method that employed a mixed fitness function. Five benchmark functions were utilized in numerical simulations to verify the viability of PSO, and numerical tests were also conducted to gauge how well the modified PSO performed. Consistent outcomes showed that the combined fitness function based PSO algorithm was practical and effective for system identification, and that it could outperform the traditional PSO approach.

1.1.14 Chi, HL, Kang, SC, & Wang, X. (2013). Research trends and opportunities of augmented reality applications in architecture, engineering, and construction. Journal of Automation in Construction, Elsevier, 33, 116–122

Chi et al. focused on four AR technologies: localization, natural user interface, cloud computing, and mobile devices. Discusses developments in AR applications for the AEC/FM. The research analyses 101 articles and presents six prospects for implementing AR in the AEC/FM sector going forward: Field exploration based on hybrid localization, in-field gesture or kinesthetic control of the AR interface, integration with location-specific data, access to field data using ubiquitous services, portable AR devices in the field, and context-aware augmented reality in the AEC/FM fields are just a few examples of how augmented reality is used today.

1.1.15 Imran, M.; Hashim, R.; Khalid, N.E.A. An Overview of Particle Swarm Optimization Variants. Procedia Eng. 2013, 53, 491–496.

Imran et al. explained that many researchers have used various mutation operators to strengthen the optimal algorithm and enhance the capability of exploration and exploitation searches of the particles in order to control the premature convergence. The majority of the techniques, however, are problem oriented. For instance, student "T" mutation, which is employed in local search, may not succeed if the distance between the present search and the ideal place is too great. According to the research, a PSO's performance depends on three fundamental factors: inertia weight, cognitive constant and social constant.

1.1.16 Yong Zhang, Dun-Wei Gong, Zhonghai Ding," A barebones multi-objective particle swarm optimization algorithm for environmental/economic dispatch", Information Sciences 192 (2012) 213–227
Yong et al. stated that the challenges including the environment or the economy, the authors suggested the Bare-Bones multi objective particle swarm optimisation (BBMOPSO) algorithm. This paper has three characteristics. The particle update approach does not need its control settings adjusted. Utilize the mutation operator to increase the search capacity and

to prevent the premature convergence issue. The variety of particles will inform the world's particle leaders. According to their findings, the BB-MOPSO method produces an outstanding approximation of the genuine pareto front and is suited for solving all different kinds of multi-objective optimization issues. In terms of convergence performance, the BB-MOPSO method outperforms other algorithms like SMOPSO, CMOPSO, and TVMOPSO. The BBMOPSO algorithm outperforms the CMOPSO and TVMOPSO algorithms in terms of how solutions are distributed on the resulting Pareto front. The least standard deviation value is achieved with BB-MOPSO.

1.1.17 Dong Li Jia, Guo Xin Zheng, Bo Yang Qu, Muhammad Khurram Khan, "A hybrid particle swarm optimization algorithm for high-dimensional problems", Computers & Industrial Engineering 61 (2011) 1117–1122.

Dong Li Jia et al. The Hybrid PSO method (CGPSO) was suggested by the authors for issues with high dimensions. The CGPSO algorithm combines the classical PSO with a chaotic and Gaussian local search method and a "shrinking" technique on the best particle. In terms of scalability, search capability, and convergence time, CGPSO outperforms PSO. The authors concluded from the findings that the CGPSO algorithm is superior to algorithms like CPSOH, DMS-L-PSO, DEa-hcSPX, and MA-S2.

1.1.18 Manavazhi, M.R.; Xunzhi, Z. Productivity oriented analysis of design revisions. Constr. Manag. Econ. 2011, 19, 379–391

Manavazhi and Xunzhi find out deviation in construction performance has spread throughout the sector, especially in emerging nations, to the point that more than half of the projects in the United Arab Emirates (UAE) postponed their significant completion. Determining the important Performance Indicators is therefore essential to closing this construction gap and assisting developing nations in boosting their economies.

1.1.19 Mojtahedi SMH, Mousavi SM, Makui A. 2010. Project risk identification and assessment simultaneously using multi-attribute group decision making technique. Safety Sci. 48:499–507.

Mojtahedi et al. suggested risk management techniques typically fall into one of two categories: qualitative or quantitative. The majority of qualitative research methods rely on checklists, rating alternatives, assumption analysis, probabilistic impact descriptions, cause and effect diagrams, flowcharts, influence diagrams, etc. Most of these methods demand individual skill, judgements based on prior experience, or analysis of historical data. Monte Carlo simulation, fuzzy logic, anticipated value tables, and sensitivity analysis are examples of common quantitative methodologies, examination of significant building contracts found that formal risk assessment techniques are not routinely used.

1.1.20 Lu Hong. A particle swarm optimization based on immune mechanism. In International Joint Conference on Computational Sciences and Optimization, pages 670–673. IEEE, 2009.

A modified PSO algorithm has been created by Hong. The traits of traditional PSO and immune mechanisms have been inherited by the newly suggested algorithm. It may improve one's ability to find the global optimum and the rate of evolution. To carry out parameter learning, the inclusion of the most important PSO Vmax, from the ideas of immune principle, is employed. The algorithm may seek for potential solutions while maintaining multiplicity, analogous to the biological immune system. The clonal selection principle, the properties of the suggested algorithm, and the theory of the idiotypic immunity network are all used to improve the global convergence performance.

CONCLUSION

So, we conclude that, the application of the Modified Particle Swarm Optimization (MPSO) algorithm in the claim management system for assessing risks associated with construction claims in infrastructure projects represents a significant advancement in project management and risk mitigation. The MPSO algorithm, with its enhanced capabilities and

adaptability, has demonstrated its efficacy in optimizing the assessment process, thereby improving the accuracy and efficiency of risk evaluation.

REFERENCES

[1] Kiani, A.T.; Nadeem, M.F.; Ahmed, A.; Khan, I.A.; Alkhammash, H.I.; Sajjad, I.A.; Hussain, B. An Improved Particle Swarm Optimization with Chaotic Inertia Weight and Acceleration Coefficients for Optimal Extraction of PV Models Parameters. Energies 2021, 14, 2980

[2] Freitas, D.; Lopes, L.G.; Morgado-Dias, F. Particle Swarm Optimization: A Historical Rev2iew up to the Current Developments. Entropy 2020, 22, 362.

[3] Liu, Q., Wei, M. K., Zhou, Q., Cai, S. R., Jiang, L., Zhou, H., et al. (2020). Research on capacity optimization configuration of the Southwestern China microgrid considering electricity cost and system self-power supply reliability. Power Syst. Prot. Control48 (10), 139–145.

[4] Kong, X.; Zhang, T. Non-Singular Fast Terminal Sliding Mode Control of High-Speed Train Network System Based on Improved Particle Swarm Optimization Algorithm. Symmetry 2020, 12, 205

[5] Safapour, E. Kermanshachi, S. Identifying early indicators of manageable rework causes and selecting and mitigating best practices for construction. J. Manag. Eng. 2019, 35, 04018060.

[6] Garg, H. A Hybrid GSA-GA Algorithm for Constrained Optimization Problems. Inf. Sci. 2019, 478, 499–523.

[7] Kermanshachi, S.; Anderson, S.; Molenaar, K.R.; Schexnayder, C. Effectiveness Assessment of Transportation Cost Estimation and Cost Management Workforce Educational Training for Complex Projects. In Proceedings of the ASCE International Conference on Transportation & Development, Pittsburgh, PA, USA, 15–18 July 2018

[8] Deetjen, T. A., Martin, H., Rhodes, J. D., and Webber, M. E. (2018). Modelling the optimal mix and location of wind and solar with transmission and carbon pricing considerations. Renew. Energy120, 35–50.

[9] Cui, Q.; Li, Q.; Li, G.; Li, Z.; Han, X.; Lee, H.P.; Liang, Y.; Wang, B.; Jiang, J.; Wu, C. Globally Optimal Prediction-Based Adaptive Mutation Particle Swarm Optimization. Inf. Sci. 2017, 418–419, 186–217.

[10] Dong, W.Y.; Kang, L.L.; Zhang, W.S. Opposition-Based Particle Swarm Optimization with Adaptive Mutation Strategy. Soft Compute. 2017, 21, 5081–5090

[11] Khan, S.; Kamran, M.; Rehman, O.U.; Liu, L.; Yang, S. A Modified PSO Algorithm with Dynamic Parameters for Solving Complex Engineering Design Problem. Int. J. Comput. Math. 2017, 95, 2308–2329.

[12] Larson, E.W, Gray, C.F. A Guide to the Project Management Body of Knowledge: Pmbok Guide; Project Management Institute: Newtown Square, PA, USA, 2015.

[13] Ganesh MR, Krishna R, Manikantan K, Ramachandran S (2014) Entropy based binary particle swarm optimization and classification for ear detection. Eng Appl ArtifIntell 27:115–128

[14] Chi, HL, Kang, SC, & Wang, X. (2013). Research trends and opportunities of augmented reality applications in architecture, engineering, and construction. Journal of Automation in Construction, Elsevier, 33, 116–122

[15] Imran, M.; Hashim, R.; Khalid, N.E.A. An Overview of Particle Swarm Optimization Variants. Procedia Eng. 2013, 53, 491–496.

[16] Yong Zhang, Dun-Wei Gong, Zhonghai Ding," A barebones multi-objective particle swarm optimization algorithm for environmental/economic dispatch", Information Sciences 192 (2012) 213–227

[17] Dong Li Jia , Guo Xin Zheng, Bo Yang Qu, Muhammad Khurram Khan, "A hybrid particle swarm optimizationalgorithm for high-dimensional problems", Computers & Industrial Engineering 61 (2011) 1117–1122.

[18] Manavazhi, M.R.; Xunzhi, Z. Productivity oriented analysis of design revisions. Constr. Manag. Econ. 2011, 19, 379–391

[19] Mojtahedi SMH, Mousavi SM, Makui A. 2010. Project risk identification and assessment simultaneously using multi-attribute group decision making technique. Safety Sci. 48:499–507.

[20] Lu Hong. A particle swarm optimization based on immune mechanism. In International Joint Conference on Computational Sciences and Optimization, pages 670–673. IEEE, 2009.