



**COMPARAÇÃO ENTRE ALGORITMO GENÉTICO E PROGRAMAÇÃO LINEAR
PARA OTIMIZAÇÃO DO CRONOGRAMA DE MANUTENÇÃO DE USINAS DO SUL
COMPARISON BETWEEN GENETIC ALGORITHM AND LINEAR PROGRAMMING
FOR OPTIMIZING THE MAINTENANCE SCHEDULE OF POWER PLANTS IN THE SOUTH**

Jhulia Macedo Silva Ferraz¹

¹ PUC-Rio – jhuliamsferraz@gmail.com

RESUMO

O planejamento das intervenções é um processo com impactos relevantes para o Sistema Interligado Nacional (SIN). Dessa forma, um cronograma alinhado às estratégias operativas e às necessidades do sistema contribui para a confiabilidade do atendimento à demanda. Exposto isso, este artigo apresenta a comparação entre um modelo baseado em Algoritmo Genético e outro baseado em Programação Linear, desenvolvidos com o objetivo de modelar com dois métodos a otimização do cronograma de manutenções de usinas, considerando o comportamento da carga, a geração e o recebimento de energia no Sul por meio da interconexão com o subsistema Sudeste/Centro-Oeste. Aplicado às usinas do Sul, o modelo busca respeitar o número mínimo de máquinas disponíveis estabelecido para cada grupo elétrico englobado. Espera-se que os resultados obtidos demonstrem qual método possui mais potencial para auxiliar nas análises do cronograma, oferecendo soluções estratégicas para minimizar os impactos ao SIN e atender às solicitações.

Palavras-chave: cronograma; otimização; manutenção; máquinas; Sul;

ABSTRACT

The planning of interventions is a process with significant impacts on the National Interconnected System (SIN). Thus, a schedule aligned with operational strategies and system needs contributes to the reliability of demand supply. Based on this, this paper presents a comparison between a model based on a Genetic Algorithm and another based on Linear Programming, both developed with the objective of modeling, through two different methods, the optimization of the maintenance schedule of power plants, considering load behavior, generation, and energy exchange in the South through the interconnection with the Southeast/Central-West subsystem. Applied to the plants in the South, the model seeks to respect the minimum number of available units established for each encompassed electrical group. The results are expected to demonstrate which method has greater potential to support schedule analyses, offering strategic solutions to minimize the impacts on the SIN and meet requests.

Keywords: schedule; optimization; maintenance; machines; South;

1 INTRODUCTION

The supply of Brazil's electricity matrix is predominantly renewable, with hydroelectric plants as the main sources of generation to system. In this context, the operation and coordination of plant maintenance are managed by the National Electric System Operator (ONS). Therefore, it is important that intervention planning considers operational conditions and observes the



particularities of each subsystem and their interconnections. In this context, the objective of this paper is to compare a model based on the Genetic Algorithm with another using Linear Programming in order to optimize the scheduling of maintenance dates and assess which model demonstrates better performance.

2 METHODOLOGY

The optimization of the schedule aims to allocate interventions based on the load of the SIN, power generation, and energy inflows in the South. In addition, the model seeks to minimize the distance between the originally scheduled periods and the newly proposed ones. As constraints, overlapping interventions in the same plant are avoided, and the reference minimum number of available units is respected. For this purpose, the Genetic Algorithm will first be applied, a probabilistic method that allows the use of parallel and adaptive search mechanisms to find solutions (Pacheco, 1999). In this sense, the Distributed Evolutionary Algorithms in Python (DEAP) package will be used to perform the optimization in Python (DEAP, 2025). Subsequently, Linear Programming will be used to model this proposal, and the results will be compared.

3 RESULTS E DISCUSSION

It is expected that the analysis of normalized monthly average data will guide the identification of the most suitable periods for maintenance in both models. In general, major interventions should be concentrated during periods of lower system load, avoiding months that are less favorable to unavailability in both approaches. The results should also highlight the use of extended holidays and the rescheduling of simultaneous interventions within the same plant. Thus, the main differences in the results of the two models will be assessed, and the analysis will identify which one best fits the evaluation based on the outcomes obtained.

4 CONCLUSION

This article is expected to compare the results of two optimization methods to support maintenance planning, minimizing impacts on the SIN and fulfilling the requests to contribute to the proper operation of the plants. Additionally, in the search for feasible solutions, the results should incorporate signaling variables aligned with the operational strategy, bringing the model closer to real-world conditions. In this way, it is expected to identify which method shows greater applicability by analyzing the results obtained.

REFERENCES

- DEAP – Distributed Evolutionary Algorithms in Python. DEAP Documentation – Overview. Disponível em: <https://deap.readthedocs.io/en/master/overview.html> . Acesso em: junho.07.2025.
- PACHECO, Marco Aurélio Cavalcanti. Algoritmos Genéticos: Princípios e Aplicações. ICA, PUC-Rio, 1999. Disponível em: <http://www.ICA.ele.puc-rio.br/MQ-introapost.pdf> . Acesso em: junho.21.2025.
- ONS – Operador Nacional do Sistema Elétrico. Instruções de Operação – IO-ON.SSE Rev.142. Disponível em: <https://encurtador.com.br/uPFQR> . Acesso em: junho.04.2025.