Report of Task-2

Paper Title: GLOBAL OPTIMUM SEARCH FOR NONCONVEX NLP AND MINLP PROBLEMS

PaperLink: https://sci-hub.se/https://www.sciencedirect.com/science/article/abs/pii/0098135489870164

1. Summary: This paper by C. A. Floudas, A. Aggarwal, and A. R. Ciric presents a novel approach for finding the global optimum in nonconvex nonlinear programming (NLP) and mixed-integer nonlinear programming (MINLP) problems, particularly in chemical process design and control. It introduces a method involving decomposition of variable sets into complicating and non complicating variables, leading to two subproblems. Each subproblem is solved iteratively to converge on the optimal solution. The approach is significant as it addresses the challenges posed by nonconvexities in the objective functions and constraints of mathematical problems in chemical engineering.

1.1 Motivation: The motivation behind this study is the prevalent challenge in solving NLP and MINLP problems in chemical engineering, particularly due to nonconvexities in objective functions and constraints. The purpose is to develop a method that consistently reaches the global optimum solution for these problems.

1.2 Contribution: The main contribution is the introduction of a systematic approach to decompose the original problem into subproblems that can be solved for their global solutions, thereby improving the likelihood of finding the global optimum.
1.3 Methodology: The methodology involves a four-stage process: identifying sources of nonconvexities, transforming and partitioning variables and constraints, decomposing the problem into two subproblems, and iteratively solving these subproblems.
1.4 Conclusion : The paper concludes that the proposed approach effectively addresses the complexities of nonconvex NLP and MINLP problems, providing a structured and reliable method to achieve global optimization.

2. Limitations

2.1 First Limitation: The approach may be computationally intensive, especially for very large-scale problems, due to the iterative nature of solving multiple subproblems.

2.2 Second Limitation: The method assumes the ability to accurately identify and partition nonconvexities, which might be challenging or impractical in certain complex problems.

3. Synthesis: This paper's methodology can be applied to a broad range of problems in chemical engineering and potentially in other fields where nonconvex NLP and MINLP problems are prevalent. The decomposition approach can be adapted to different problem structures, offering a versatile tool for global optimization. Future work could explore the integration of this approach with other optimization techniques to handle larger and more complex problems efficiently.