Department of Electrical Engineering and Information Technology

Research Project/Master

SS2024

Implementation of a Multiobjective Optimization Algorithm for Wireless Power Transfer

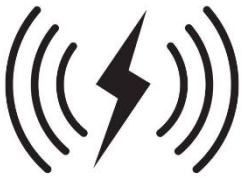
Project type: ▒ Hardware ✓ Software ▒ Hardware/Software ✓ Simulation ▒ Modelling

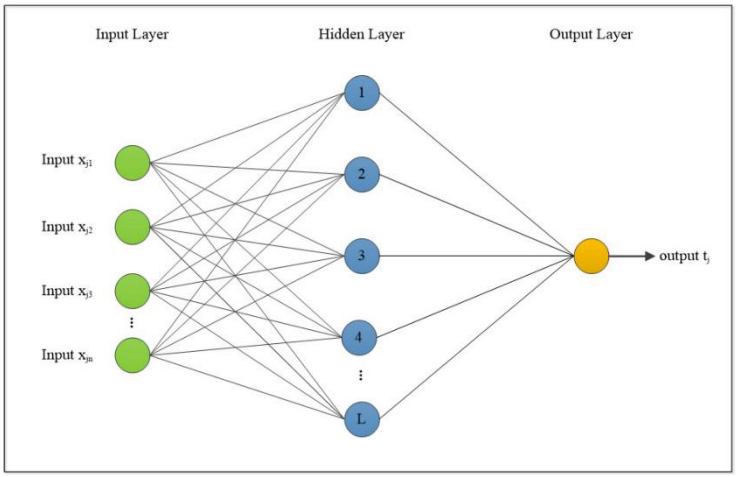
Project description:

Optimization of Wireless Power Transfer Systems Using Meta-heuristics / Genetic Algorithms for Multiobjective Optimization

Wireless Power Transfer (WPT) is an innovative technology that enables the transmission of electrical energy from a power source to a load without the need for physical connectors or wires. This technology has gained significant attention in recent years due to its potential applications in various fields, including consumer electronics, electric vehicles, medical devices, and industrial automation. WPT systems rely on electromagnetic fields to transfer energy between coils or resonators, allowing for convenient and efficient power delivery over short to moderate distances.

Despite the promising advantages of WPT, several challenges must be addressed to optimize its performance. These include maximizing power transfer efficiency, minimizing energy losses, and ensuring stable operation under varying conditions. Achieving these goals requires a sophisticated approach to system design and parameter optimization. This project seeks to address these challenges through the implementation of a multiobjective optimization algorithm inspired by meta-heuristics (ex: Genetic Algorithms). By optimizing key parameters of the WPT system, we aim to enhance its overall performance and reliability.





Methodology:

1. Literature review: Conduct a comprehensive review of existing WPT systems and optimization techniques.
2. System modeling: develop a detailed model of the WPT system, including the transmitter, receiver, and wireless medium.
3. Parameter identification: Identify key parameters that influence the performance of the WPT system, such as frequency, coil size, distance between coils, and load conditions.
4. Algorithm development: design and implement a meta-heuristics algorithm to perform multiobjective optimization. The algorithm will use a population-based approach to explore the solution space and find optimal parameter sets.
5. Simulation and testing: Simulate the optimized WPT system under various scenarios to validate the effectiveness of the GA-based optimization.

6. Analysis and validation: Analyze the results to ensure that the optimized system meets the multiobjective criteria. Compare the performance with existing methods to demonstrate improvements.

Tasks:

Task 1: Genetic algorithms development on MATLAB/Python… for objective/multiobjective optimization
Task 2: Model creation of the coil on COMSOL Multiphysics
Task 3: Algorythm implementation on COMSOL for automated optimized model generation
Task 4: Analysis of results ,report and presentation preparation
Throughout the project, students will develop their analog electronics skills, embedded programming, and battery diagnosis skills.

Competences:

• Electromagnetic theory knowledge / Coding / meta-heuristics algorithm / Genetic Algorythm
• COMSOL / MATLAB / Python / WPT
• Post processing and interpretation, creative thinking and Problem-Solving Skills

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