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REVIEW OF AN ALGORITHM SELECTION FOR ELECTROMAGNET

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***Abstract* — This paper gives an overview of a method using selection algorithm for the electromagnet design which can be used for electromagnetic launcher and allied applications. The structural constraints must be considered in the design of an electromagnet. In this paper, an algorithm based on the calculation utilizing the magnet design equations and their own constraints were utilized. This method was verified by IDE simulations, which showed that this method is more efficient than conventional calculation based selection criteria. Electromagnetic launcher can be described as an application of electromagnetic force acting on launching body, design of electromagnet necessary to sustain such magnitude of fields. Thus this paper proposes a certain electromagnet which can be utilized for such applications like SLV (Satellite Launch Vehicle), Elevators, Energy Projectiles, Weapons, EMALS etc.**

Keywords— Coil guns, electromagnetic launcher, electromagnet, acceleration, capacitor.

I. INTRODUCTION

The aim of this paper is to present experimental research information on electromagnet and related topics. Thus we hope to foster interest in the fields of physics and engineering. Our long term objective is to design and construct a multi-stage coil guns capable of firing projectiles at supersonic speeds.[1], [2]

Recent advances in energy storage, switching and magnet technology make electromagnetic acceleration a viable alternative to chemical propulsion for certain tasks, and a means to perform other tasks not previously feasible.

Magnetic repulsion can levitate the object and reduces stress on airframes because they can be accelerated more gradually to take-off speed.

Acceleration of metallic bodies by electromagnetic induction can offer advantages of being simple, absence of heat and significant reduction of the fuel cost.[3] – [10]

II. SELECTION OF TOOL

For performing the algorithm we have selected Python as a programming language as no doubt it is a programming language with dynamic exposition and the reason behind selecting python as a tool for the selection of algorithms is its increased efficiency. Since there is no compilation step, the edit-test-debug cycle is incredibly fast. Amending in Python programs is simple: a midge or wrong input will never cause a sectionalization error.

Moreover, when an error is discovered by an interpreter, it raises an exception. When the program doesn't catch the exception, the interpreter prints a stack trace. [1] C++ code can also be used as a tool but Python code is about more or less 8-10 times shorter than equivalent program in C++. Statistical evidence suggests what an individual Python programmer can finish in a few months' time, two C++ programmers can't complete within a year. Python shines as a glue language, used for combination of components written in C++. [8] – [14]

III. SELECTION ALGORITHM

The algorithm is a calculation-based method with a predefined population size. An initial estimation is randomly generated as in many evolutionary algorithms. An individual parameter within the sample space represents a single possible solution to a particular optimization problem. Then, the algorithm tries to determine using the predefined parameters and calculate the type of electromagnet suitable for the given application. The algorithm will repeat until it reaches the possible working conditions in every situation and that too at maximum efficiency. During the data entering phase, the role of a user is to access the given situation and enter the required data so as to calculate the working conditions of any given situation and decide whether any electromagnet available for selection is suitable or not and if found suitable what would be the conditions for that are required for the electromagnet to run most efficiently within the given pre-conditions. [15] – [20]

The algorithm attempts to improve the user input by selecting what is best for that particular electromagnet and what can be compromised to ensure better results and a longer life for the electromagnet. This is constructed using the mean values for each parameter within the problem space (dimension) and represents the qualities of different electromagnets from the sample space.

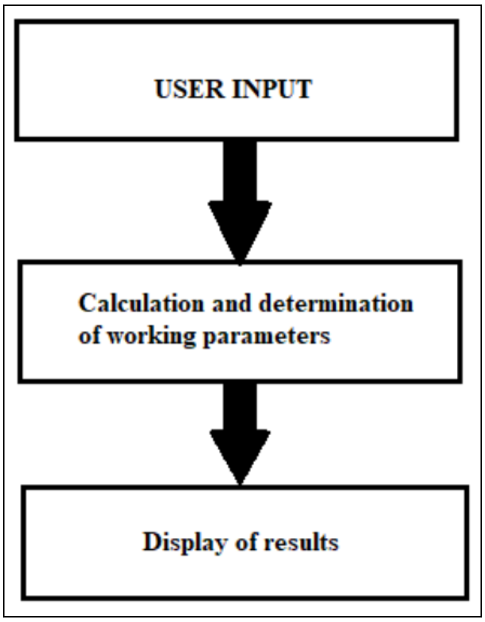

Fig. 1. Flow chart for electromagnet algorithm selection

The proposed optimization algorithm consists of pre-entered data required for further selection purposes. The algorithm is used to select an optimal solution using the user input and the rest is calculated using the formulas which have been looped into the algorithm.

The best possibility is selected as the test case and the program perform the simulations based on the data entered to check for any abnormalities in the given situation. If any abnormality is still found the best case scenario is automatically chosen and the user has to compromise some of the entered parameters to ensure the sufficient and long life of the given magnet and select the same for the design purposes. Solution is executed in the following evaluation step to search for a better working condition.

IV. CONCLUSION

For design of electromagnet necessary to sustain such energy levels, this algorithm will drastically reduce the selection time and calculation complexities. This simulation will generate results which can be catered to design an electromagnet that can be utilized for heavy duty applications in field of space launch vehicles, domestic and industrial applications like forklift and elevators etc. Thus major concern towards developing this electromagnet would be the energy costs incurred and whether this proposal would be economically and environmentally feasible. [3]

Applications for electromagnet include Ceiling fans, induction cooker, and entertainment system like speakers, generators, maglev (magnetic levitation) trains, communication systems like radio transmitters, medical applications like X-Ray machines etc.

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