



REVIEW ON OPTIMIZATION TECHNIQUES FOR VARIOUS ENGINEERING APPROACH

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ABSTRACT

In this manuscript, we have presented a literature survey on various methods of optimization techniques for engineering applications. The use of various optimization techniques, whether linear or nonlinear, has grown rapidly in the current scenario. The researchers are aiming to provide the best industrial and non-industrial solutions through these techniques in all types of engineering applications. In this paper, the Adaptive Double Chain Quantum Genetic Algorithm (Adcqga), Optimization of Ultrasonic Array Inspection Techniques, Virtual-Machine Abstraction, Life Prediction Techniques of Products, Multi-Pass Laser Bending, Virtual-Machine Abstraction techniques have been discussed.

INTRODUCTION

Optimization problems are often highly constrained and Evolutionary Algorithms (EAs) are effective methods to tackle the problems in engineering applications [1]. The use of ultrasonic arrays for non-destructive evaluation (NDE) applications has grown rapidly in recent years [2]. Many users and companies alike feel uncomfortable with execution performance of interpreters, often also dismissing their use for specific projects [3]. Optimization of heat transfer systems is of significant importance in many engineering applications, particularly those employing compact heat exchangers [4]. Different methods and approaches are used for fault diagnosis [5]. In literature, experimental and theoretical studies have been carried out to understand the influence of process parameters involving analytical models, numerical simulations, empirical models as well as Artificial Intelligence techniques [6]. Through-life engineering services (TES) are essential to the support of manufactured complex engineering products. As organizations adopt Industrial Product Service Systems (IPSS) there is the need to maximise the product availability for use [7]. Design of an optimal controller requires optimization of multiple performance measures that are often non-commensurable and competing with each other [8]. Different kind of statistical optimization techniques are available for optimizing the different parameters of a CNC end milling process [9]. Population-based optimization techniques have gained currency in recent years in their application to Water Distribution Systems (WDS) design and operation, with the emergence of genetic algorithms and mimetic algorithms such as the Shuffled Frog Leaping Algorithm and Ant Colony Optimization [10]. Nowadays multicore architectures are omnipresent and can be found in all market segments [11]. The power engineering domain uses both models and classic methods of operational research and the most recent ones are based on artificial intelligence for solving a large number of optimization problems [12]. In next section, we will discuss the literature on various methods of optimization techniques for engineering applications.

ADAPTIVE DOUBLE CHAIN QUANTUM GENETIC ALGORITHM (ADCQGA)

K. Haipeng et al. [1] presented this algorithm to solve inhibited optimization problems related to search efficiency improvement and/ or convergence rate of EAs. The algorithm was further used for feasible and infeasible solutions to formulate use of double individuals by defining Fitness (or evaluation) functions for both types. Three different techniques viz adaptive evolution process (AEP), adaptive mutation and replacement techniques of step evolution (SE) were utilized to enhance the search capability and convergence rate. To find different solutions to update individuals, an adaptive rotation technique was proposed. Multi-aircraft cooperative target allocation problem design in engineering had been solved through this technique.

OPTIMISATION OF ULTRASONIC ARRAY INSPECTION TECHNIQUES

Yousif Humeida et al. [2] proposed a general framework for the optimization of ultrasonic array inspection techniques in NDE to find out defects in engineering structures in order to maintain their integrity and assess their performance. Earlier, it was done manually through optimization by empirical measurements and parametric studies which were lengthy, difficult, and slow and may not provide the actual results. The authors proposed the optimisation framework by defining defect detection rate as the main inspection objective. Various types of defects like crack type and location, material properties and geometry, etc. could be find out through statistical



modelling of the inspection by solving the optimization problem. A genetic algorithm was used to solve the global optimisation problem. As a demonstration, the optimization framework was used with two objective functions based on array signal amplitude and signal-to-noise ratio (SNR) in the paper.

VIRTUAL-MACHINE ABSTRACTION

Stefan Brunthaler et al. [3] discussed the virtual machine abstraction and optimization techniques. Most of the subscribers whether individuals or groups do not prefer with execution performance of interpreters for their projects due to security reasons. Another disadvantage is the mismatching speed of virtual machines and their native machine on which execution to be performed. Actually, the abstraction level of virtual machine is much higher than their machines resulting performance issues. Many researchers have proposed a number of optimization techniques but all in vain. These techniques fail to deliver their full potential on them.

DIMENSIONALITY REDUCTION TECHNIQUES

N.R. Sakthivel et al. [5] proposed the techniques to reduce the dimensionality faults. They have compared two types of optimization techniques viz. traditional dimensionality reduction techniques and nonlinear dimensionality reduction techniques. These techniques can be diagnosed and reduce various mechanical faults like bearing, impeller, seal and cavitation in a mono block centrifugal pump and makes the operation reliable. Also, these mechanical faults have been discussed and classified through continuous acquisition of signals. The structural deformation in the signals has been described by measuring available data and employing data mining approaches. Visual analysis has been performed to show the effectiveness of each dimensionality reduction technique.

MULTI-PASS LASER BENDING

F. Lambiase et al. [6] optimized multi pass laser bending through soft computing techniques. The laser bending process productivity is limited by the number of increasing in multi pass laser bending. The second factor which reduces the performance of the laser is the angle of the bending. The relatively small angle causes the higher losses at the moment of bending. These problems including forced cooling of sheets as well as optimization of process parameters are defeated by different strategies in the paper. This was achieved by means of an Artificial Neural Network. An iterative procedure was used to find out or measure the optimized processing condition in order to authorize the fabrication of a small bending angle.

LIFE PREDICTION TECHNIQUES OF PRODUCTS

C. Okoh et al. [7] have discussed various optimization techniques to find out the remaining useful life of an engineering product. The reliability or life span of any product is a very important parameter in the products properties. The trend and cost/ sale of the product is entirely depend on the life or multiple use of the product. These properties are indispensable properties in both (manufacture and servicing of complex engineering products) types of the companies. This can be achieved through easement of failure time of the product. In the paper, the authors have proposed optimization techniques to identify failure mechanisms and emphasise the failure events prediction approaches that can effectively reduce uncertainties based on current products in-service with regards to predictability, availability and reliability.

CONCLUSION

In this paper, the Adaptive Double Chain Quantum Genetic Algorithm (Adcqga), Optimisation Of Ultrasonic Array Inspection Techniques, Virtual-Machine Abstraction, Life Prediction Techniques Of Products, Multi-Pass Laser Bending, Virtual-Machine Abstraction techniques in the field of engineering has been discussed. Different methods and approaches of optimization techniques have been presented.

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