INDUSTRIAL MATHEMATICS AND APPLICATIONS OF OPERATION RESEARCH IN FIELD OF INDUSTRY AND INFORMATION TECHNOLOGY

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Abstract

Mathematics is an interdisciplinary subject and there is huge number of applications in various fields such as engineering, industry, computer science, medicine etc. New invention and development in industry, Engineering, computer are influence by mathematics. In this article we study the concept of Industrial mathematics and operation research. we also see how operation research is important for solving industrial problems. This article explain the applications of operation research in industry. At last this paper explore the application of operation research in information technology.

Keywords: *Industrial mathematics, mathematical modeling, operation research, industry , technology*

INTRODUCTION

Mathematics is the oldest, useful, applied, and fundamental science. All the engineering field and natural sciences groups are based on mathematics. Mathematicians use theoretical mathematics, algorithm, computational techniques, and computer technology to solve the different problems arising from various fields such as engineering, business, economics, computer science, banking, social sciences etc.

Pure Mathematics and applied mathematics are two classes of mathematics. Mathematicians use pure mathematics and advance mathematical knowledge by developing new principles and recognizing previously unknown relationships between existing principles of mathematics. On the other hand, applied mathematics like mathematical modeling and computational method are used to formulate and to solve practical problems in banking, engineering, administration, business, medicine, physical science and so on. By using applied mathematics, mathematicians may analyze the most efficient way to schedule airline routes between cities, the cost-effectiveness of alternative manufacturing process, the effect and safety of new medicines and drugs, the aerodynamic characteristics of an experimental automobile etc. They may enhance mathematical methods when solving problems. Applied mathematics is used in industrial research and development. Applied mathematicians start with a practical problem, envision the separate elements of the process under consideration and then reduce the elements into mathematical variables. They often use computers to analyze relationships among the variables and solve complex problems by developing models with alternative solutions. It is, therefore, we can say that applied mathematics is an essential part of the industry.

Mathematics plays an even increasing role in Industry. There are many useful and interesting ways to use mathematics in industry. Mathematics helps us to understand how the things are related to

one another and changes with time. Many mathematics subjects like ordinary differential equation, numerical analysis, optimization techniques, and graph theory are widely used in Engineering, computer science, Medicine, Industry.

Operation research is the scientific approach to execute decision making which consist of the art of mathematical modeling of complex situations, the science of the development of solution techniques, the ability to effectively communicate the results to decision maker. So it is most often used to analyze complex industrial problems typically with the goal of improving performance.

INDUSTRIAL MATHEMATICS

The meaning of industrial mathematics is mathematical modeling and scientific computing of industrial problems. Industrial Mathematics is a branch of applied mathematics which deals with the problems posed by different industries which are of organizational, technical and economic nature. It focuses on problems which come from industry including manufacturing, service, business and engineering etc. Furthermore, It is characterized by the origin of the problems appearing from industry, research and development, finances, communications etc. Industrial mathematics includes variety of mathematical disciplines such as Partial differential Equations, Dynamical Systems, Graph theory, Optimization, Control Theory, Discrete Mathematics, Probability and Statistics.

Aims of industrial Mathematics are to provide relevant solution to industry and find the most efficient way to solve the problems and to gain better understanding of industrial models and processes through mathematical ideas and computations. The main objective of industrial mathematics are to understand the real world industrial problems, to transform them into appropriate mathematical model, to find possible solutions to these problems by suitable method (analytical or numerical), to test the accuracy, validity and reliability of obtained solutions and finally to implement the realizations in terms of original real-world industrial problems.

Industrial mathematics and its applications is a fast growing field within a mathematical science. There are several methods to handle industrial problems according to the nature of the problems. Partial Differential Equations, Probability and Statistics, Mathematical Modeling, Simulation, Discrete and Continuous Optimizations, Numerical Methods etc are some of the computational methods or tools to tackle the industrial problems. Investigations of new ideas, methods, algorithms, implementation and analysis of their realization are the crucial points of research in this area. The role of industrial mathematics is increased in the field of higher technology due to the design of more and more powerful computers, robots, flexible machine systems etc. Operations research is one of the class of industrial mathematics that has number of applications in industry as well as information technology.

OPERATION RESEARCH (OR):

Operation research is the scientific study of operations for the purpose of making better decisions. Operations research is an analytical method of problem solving and decision making that is useful in the management of industry. Operations research includes statistical analysis, management science, game theory, optimization theory, artificial intelligence and network analysis. All of these techniques have the goal of solving complex problems and improving quantitative decisions. The

purpose of operations research is to achieve the best performance under the given circumstance. In operations research, problems are broken down into basic components and defined steps by mathematical analysis then solved it.

The process of operation research can be divided into following steps

1. Identifying a problem that needs to be solved.
2. Constructing a model around the problem that resembles the real world and variables.
3. Using the model to derive solutions to the problem.
4. Testing each solution on the model and analyzing its success.
5. Implementing the solution to the actual problem.

IMPORTANCE OF OPERATIONS RESEARCH IN INDUSTRY

The field of operations research produces a more powerful approach to decision making than ordinary software and data analytics tools. Applying operations research professionals can help companies to achieve more complete datasets, consider all available options, predict all possible outcomes and estimate risk. Moreover, operations research can be tailored to specific business processes or use cases to determine which techniques are most appropriate to solve the industrial problem. Operation research has not only beed useful for solving industrial problems in better way but it has also been used to check designs before manufacture and to explain the occurrence of faults in process that help the companies to have calculated risk.

In many problems of practical interest, the selection of the best configuration or set of parameter to achieve certain goal are the most optimization problems having continuous and discrete variables. The main objectives of mathematical programming are to identify the problems, to transform them into mathematical model and solve them by suitable method to find the numerical solution of the problems. Since the operation research has expanded into field of industries ranging from petro-chemical to airlines, finances, logistics etc. It has become an area of industrial research.

APPLICATIONS OF OPERATIONS RESEARCH IN INDUSTRY

- LPP: by using linear programming problems one can formulate the problems of production with available resources in manufacturing industry and find the optimal feasible solution to maximize the profit and minimize the cost in given time.
- Optimal schedule model is used to schedule the production in more than one plants say A, B,C,... each of which can manufacture more than one the products to maximize profits while meeting the market requirements.
- Many practical problems such as optimal operating conditions of boiler, optimal distillation flux, optimal insulation thickness, multi-plant product distribution and scheduling can be formulated in mathematical model by optimal schedule model.
- Operation research is used in airline industry for routing and flight plans, crew scheduling, revenue management etc.
- It is also useful in telecommunication for network routing and queue control
- Operation research is also applicable for production scheduling, capacity planning, and inventory control system throughput and bottleneck analysis in manufacturing industry.
- Transportation algorithm is essential tool of linear programming analysis which has objective decision making especially in product and inventory shipment.

- Transportation problems are concerned with maximization of profit, minimization of cost and other industrial benefit.
- Operation research is also utilize for enterprise resource planning, supply chain management , agricultural planning, time management, Supermarket serving the maximum number of peoples, Network optimization and engineering etc.
- A utilities company applying operation research to lay cables along the roads connecting the towns such that all towns are connected with each other using the minimum length of cable.

APPLICATION OF OPERATION RESEARCH IN INFORMATION TECHNOLOGY

By arrival of information technology and the usage of computer the operation research modeling has become much easier. The practices of operation research involves formalization , model construction, validation, computational part, analysis of solution arriving at conclusion and implementation of the decision in technology. Database and computer networks make reliable data from available data for effective decision making. TORA and SIMNET II are software packages in operation research.

A computer simulation or a computer model is computer program that attempts to simulation an abstract model of system. Computer simulations have a useful part of mathematical modeling of many systems such as astrophysics, computational physics and in process of engineering new technology. A computer simulations are used in analysis of air pollutant dispersion , design of complex systems such as aircraft and logistic system, weather forcasting, flight simulation to train pilots etc.

The network flow programs is very important class because many aspects of real situations are recognized as networks and the representation of the model become more compact than general linear program. It included problems such as transportation problem, the assignment problems, shortest path problem, the maximum flow problem, minimum cost problem etc. Network models are constructed by the Math Programming add-in and may be solved by either by the Excel Solver, Jensen LP/IP Solver or the Jensen Network Solver.

Data mining consists of extract, transform and load transaction data onto data warehouse system.

It store and manage the data in multidimensional database system and provide data access to information technology professionals to analyze the data by application software then present data in a useful format

In the design of computer, communication, and manufacturing systems, the most important criterion presently is quality of service, in relation to the costs of the system. The quality of service is expressed in terms of performance and reliability of the systems in relation to their applications. Stochastic networks provide the mathematical models for the description and analysis of these systems. Technological developments have in recent years led to new forms of the processing, storage and transmission of information, and have changed considerably the way companies are organized.

CONCLUSION

Modern manufacturing and service industries have changed drastically with the rapid development of science and technology. In this paper we study industrial mathematics and its aim, objectives and applications. Operation research is a problem solving and decision making techniques. Applying operations research professionals can help companies to achieve more complete datasets, consider all available options, predict all possible outcomes and estimate risk. A properly implementation of solution obtained from application of Operation research techniques can improve working conditions and gains industrial management support. Operation research is a tool that can do a great deal with improve productivity. This paper focused on the applications of operations research in industry and information technology

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