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The Role of Mathematics in the Marine Industry

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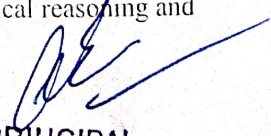
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Abstract

Marine activities occupy quite three quarters of the planet space and supply an enormous occupational industry for mankind. Of late, ship construction and usage including space management onboard the vessels and therefore the ports have caused an excellent dependency on Mathematical principles or models like statistic, linear programming and queuing theories among others. These models, however, hardly are available the shape of direct Mathematics but rather embedded in technology which, again, is made on the advancement of Mathematics. This study was aimed toward investigating the relevance (utility value) of Mathematics within the changing trends of Marine Business, Education and Training. The paper discusses the varied domains of occupational practice where Marine education and training practitioners encounter the utilization and application of Mathematics. It also identifies specific types or areas of Mathematics applicable to and/or by Marine Business, Education and Training practitioners in their day to day activities.

Introduction

Mathematics has been defined in some ways throughout the ages. Today, Mathematics is an inevitable a part of science and it's utilized in almost every field of human endeavour: be it science, engineering, art or economics. Consistent with Merriam Webster's dictionary, Mathematics is defined because the science of numbers and their operations, interrelations, combinations, generalizations and abstractions. Again, the Britannica concise encyclopaedia views Mathematics as a "Science of structure, order, and relation that has evolved from counting, measuring and describing the shapes of objects". It deals with logical reasoning and quantitative calculations.


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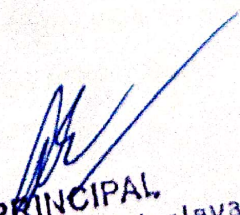
Most of our potential careers require Mathematics. The importance of Mathematics for potential careers can't be over emphasized. Students who choose to not take Mathematics seriously or to ignore it in high school and universities forfeit many future career opportunities that they might have. They essentially turn their backs on quite half the work market. Mathematics is required for the execution of non-routine activities like budgeting towards our groceries and building projects to even accuracy in projections into the longer term prospects of companies. In fact, there are huge illustrations that testify the presence of Mathematics in everything that we do.

Every area of Mathematics has its own unique applications to the various career options. For instance, Algebra is applicable in computer sciences, cryptology, networking, study of symmetry in chemistry and physics; Calculus (differential equations) applicable in Chemistry, biology, physics engineering, the motion of water, rocket science, molecular structure, option price modelling in business and economics models (Gouba, 2008).

Industrial Mathematics:

Industrial Mathematics may be a well-established field within the Mathematical sciences community. Industrial Mathematics refers to all or any sectors of producing and repair, including business and engineering; and may be a branch of applied mathematics. But where the applied Mathematics can include theoretical topics from physics, biology, economics and computing for instance, industrial Mathematics focuses on problems which come from industry and aims for solutions which are relevant to industry, including finding the foremost efficient (cost-effective) thanks to solve the matter. Applied Mathematics has always been resulting in important discoveries and parturition to new disciplines.

The creation of Mathematical and statistical modelling and therefore the development of numerical methods and/or algorithms for computers to get solutions for problems in industry has come to be called industrial Mathematical sciences or, simply, industrial Mathematics. There's a current and growing demand for mathematically trained individuals who are ready to enter business and industry. Numerous reports and studies administered by professional organizations show that there's an increasing need within the work force for Mathematics graduates with the sensible skills to figure with managers, engineers, and therefore the like (SIAM, 2016).


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Industrial Mathematics may be a specialty with a curious case of double invisibility. Within the academic world, it's invisible because so few academic mathematicians actively engage in works on industrial problems. Research in industrial Mathematics might not find its way into standard research journals, actually because the businesses where it's conducted don't want it to. Some companies encourage publication et al. don't thanks to widely varied policies; and intrinsically advisors of graduates who enter industry might not keep track of them as closely as they keep track of their students who stay in academia. Within the business world, industrial Mathematics is invisible because it's often not called "mathematics". It's called "analytics," "modelling," or just generic "research." Credit for Mathematical advances may attend "information technology" when it should really attend the people that use the technology and find out the way to employ it effectively.

Industrial Mathematics is an inherently interdisciplinary field. additionally to Mathematics, it includes subjects from fields outside Mathematics like business, computing and engineering, and trains Mathematics students the way to apply Mathematical analysis to problems arising in these areas. An industrial mathematician has strong analytical and problem-solving skills built upon a background of computing, Mathematics, statistics, and basic science. Additionally, industrial Mathematics emphasizes written and oral skills alongside teamwork, skills which are valued highly in industry, but aren't a part of most traditional Mathematics programs. Since these skills are necessary for graduates to figure effectively with less mathematically inclined co-workers, they're an important a part of industrial Mathematics.

With the increasing complexity and class of recent industry, personnel who are ready to understand technical issues, who are ready to formulate precise and accurate Mathematical models, who can implement solutions using the newest computer techniques, and who can convey these ideas to their co-workers who could also be managers, engineers, etc. are getting a necessary a part of many organizations and corporations. Samples of areas in industry that industrial mathematicians can find employment are signal processing, special effects, risk management, system reliability, software testing and verification, database systems, assembly line optimization, and market research.

Manufacturing and repair industries have changed drastically in times thanks to the explosion within the knowledge economy. Fast and cheap computing, office products, and development and utilization of huge databases, have necessitated sophisticated methods to satisfy new demands. Industrial Mathematics is that the enabling thinks about realizing and implementing

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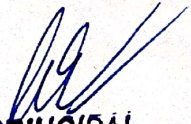
these methods. In recent years the Mathematical community worldwide has skilled this growing need for mathematically trained personnel in industry. Organizations like the Fields Institute, the Mathematics of data Technology and sophisticated Systems (MITACS), and Pacific Institute for the Mathematical Sciences (PIMS) in Canada, and Society for Industrial and applied Mathematics (SIAM) and therefore the National Science Foundation (NSF) within the us among others are promoting the interaction of Mathematics with industry and still develop ways to satisfy industry's demand for Mathematically trained personnel (SIAM, 1996).

The above and a number of others show that Mathematics stands as an enormous opportunity on one hand; and a terrible obstacle on the opposite, counting on how it's handled whilst in class. Every area of Mathematics has its own unique applications to the various career options.

At professional and occupational settings, Mathematics plays a serious role within the day to day administrative activities of management officials. as an example, the top of a container terminal during a shipping port must assess the space of his yard using the idea of capacity and applied Mathematics involving resource allocation before admitting containers of varied sorts of cargo into them. An insurance firm must study the actuarial computations before the determination of payment of claims; a wedding counsellor needs some knowledge in statistical rank correlation studies and Mendelian blood type Mathematics to be ready to scientifically prepare the would-be-couple in understanding their compatibilities, and therefore the like.

Mathematics and the Marine Industry:

The Marine and offshore industries employ advanced Mathematical methods within the design of ships and mechanical analysis of offshore structures. An example is that the dynamical behaviour of floating structures under wave force effects and wind conditions. Individual technical tasks just like the optimal design of an anchor cable or the laying of communication cables stumped bottom results in interesting Mathematical problems. One particular challenge is that the modelling of the ocean and therefore the wave conditions itself for the sake of simulation purposes (Heilio, 2004). Akakpo and Marios (2015) claimed and developed a Mathematical model for the determination of collision distance and collision zone between two ensuing ships on collision course and the way it might be avoided.


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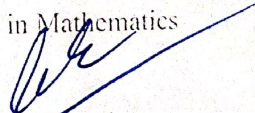


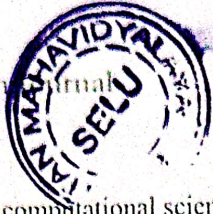
Marine industries comprise companies whose activities supply innovative products and services associated with the normal Marine sector. Generally, Marine industries include all enterprises engaged within the business of designing, constructing, manufacturing, acquiring, operating, supplying, repairing and/or maintaining vessels, or component parts thereof: of managing and/or operating shipping lines, and customs brokerage services, shipyards, dry docks, marine railways, marine repair shops, shipping and freight forwarding services and similar enterprises. This emerging industry also includes a big component of traditional oil and gas and renewable energy (particularly wind, but also marine turbines) (Monfardini, et al, 2012). Indeed, a Marine industry may be a centre of total human endeavour attracting professionals from all walks of life including mathematicians.

The Commercial Mathematics:

Cipra (2004) reported that in 2002, Virginia Concrete, the seventh-largest concrete company within the nation, began using optimization software to schedule deliveries for its drivers. The corporate owns 120 trucks, which had been assigned to 10 concrete plants. However, a big constraint is that a cement truck has roughly two hours to deliver its load before it starts hardening inside the truck. Also, the development business is extremely unpredictable; typically, 95 percent of a company's orders are going to be changed within the course of each day. Consistent with Cipra (2004) Virginia Concrete brought in mathematicians from Mason University and Decisive Analytics Corporation to develop tools to automate truck dispatching. Among other changes, the mathematicians found that the corporate could improve delivery times significantly by moving far away from the model during which individual trucks were assigned to a "home" plant. Instead, they recommended that trucks should be ready to attend whichever plant is closest. Also, in overnight planning it clothed to be useful to incorporate "phantom" trucks, representing orders that were likely to be cancelled. If the order wasn't cancelled, it might be reassigned to a true truck.

For testing purposes the corporate used the software to form all of the scheduling decisions; however, since system's installation, dispatchers are allowed to override the pc. The system has enabled Virginia Concrete to extend the quantity of concrete delivered per driver by 26% (Cipra, 2004). Of course, to SIAM (2012), it'll be no revelation to read that Mathematics can make an enormous difference for personal enterprises and, through them, for society as an entire. Several universities and colleges began building centers and programs in Mathematics


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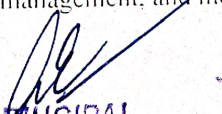


and computational science with a real-world focus. Finally, the business press has discovered the importance of Mathematics, statistics, and computing to innovation (Hardy, 2010).

The software industry is making an enormous bet that data-driven decision making...is the wave of the longer term. The drive to assist companies find meaningful patterns within the data that engulfs them has created a fast-growing industry in what's referred to as "business intelligence" or "analytics" software and services. Major technology companies-IBM, Oracle, SAP, and Microsoft-have collectively spent quite \$25 billion buying up specialist companies within the field (Lohr, 2011).

The modern toolbox of analytic and numerical method has made Mathematics a true machine for design engineers, production engineers, architects etc. One can bypass costly trial and error prototyping phases by resorting to symbolic analysis and numerical models. Mathematics may be a natural tool to handle geometrical shapes, just like the surfaces of car bodies and within the visualization techniques in CAD and virtual prototyping. Actually show business is one among the good clients for Mathematical software nowadays. Visualization and animation is that the basis of computer games and therefore the vivid computer graphics in movies etc. These tricks are made possible by Mathematical models. The planning engineers and systems engineers have always been active users of Mathematics in their profession. The likelihood to line up realistic large-scale system models) and therefore the development of recent control theory have made the computational platform a strong tool with new dimensions.

Business analytics has become a replacement catchall phrase that has well-established fields of applied Mathematics like research and management science. At an equivalent time, however, the term also features a flavor of something new: the appliance of the immense databases that are getting more and more readily available to business executives. Mathematical approaches to logistics, warehousing, and facility location are practiced a minimum of since the 1950s. The new opportunity, both for businesses and for college kids hoping to enter industry, lies within the development of algorithms and techniques to handle large amounts of structured and unstructured data at low cost. Corporations are adopting business intelligence (i.e., data) and analytics (i.e., quantitative methods) across the enterprise, including such areas as marketing, human resources, finance, supply chain management, facility location, risk management, and merchandise and process design.


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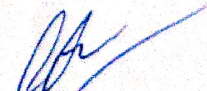
One cannot escape the sensation that these Mathematical formulas have an independent existence and an intelligence of their own, that they're wiser than we are, wiser even than their discoverers that we get more out of them than was originally put into them. The important role that Mathematics plays in our society in relationship with the various practical applications goes without saying. Regrettably, full insight into this relationship remains largely missing. The hypothesis is that with this insight, the utilization of Mathematics will become even simpler. It'll cause a methodological approach towards design of Mathematical models quite available at the present.

SIAM (2016) reported that a study involving 203 mathematicians (102 master's and 101 doctoral graduates from 1988-1992) and 75 managers indicated that Mathematics was a serious think about many non-academic sector job recruitments.

The study revealed that 28% of the PhD Mathematics graduates were in government jobs, 19% in engineering research, computer services and software Mathematics related jobs, a complete of 83% of PhD Mathematics and 76% of the Master's holder respondents were in Mathematics related jobs respectively.

According to Heilio (2004), Mathematical technology may be a term pertaining to the interdisciplinary area combining applied mathematics, engineering and computing. Computational technology has made sophisticated Mathematical methods viable for practical applications. There's a window of opportunity for interdependent two-way knowledge transfer between academia and industry. This also means a challenge for the university education. The fashionable and dynamic view of Mathematics should be reflected in educational practices. This suggests new sorts of expertise are involved.

Heilio (2004) stated that Industrial Mathematics may be a fast growing field within the Mathematical sciences. It's characterized by the origin of the issues which it engages; all of them come from industry: Research and Development, finances, and communications. The common feature running through this enterprise is that the goal of gaining a far better understanding of commercial models and processes through Mathematical ideas and computations. consistent with Heilio (2004) there's an approach of presenting real industrial problems and their Mathematical modelling as a motivation for developing Mathematical methods that are needed for solving the issues.


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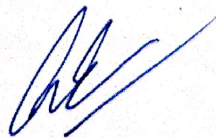


Mathematics and MET Curriculum:

In general more Mathematics courses in our universities are all direct lectures and sit down face of the assessment based. Their delivery doesn't involve any field experience or excursion for industrial observation where students are confronted with industrial Mathematical reality. Where students continue attachment, their focus isn't on the identification of problems and therefore the role Mathematics can play within the modelling and determination of their solutions. These Mathematics courses have therefore become isolated academic programmes that are just studied within the classroom, examinations taken and abandoned never to be called upon for the determination of life's challenges.

The need for Mathematics and its role within the Marine industrial performance still remains more relevant than before. The introduction of recent sophisticated equipment within the operations within the Marine industry laid credence to the assertion that Mathematics curriculum must be redesigned to satisfy these changing trends squarely, especially within the face of the rapid climb of within the industry. Marine Education and Training practitioners are expected to trace this apparent relevance of Mathematics within the Marine industry and fashion out their training curricula so as to not lag behind the planet order.

As stated earlier, the fashionable computer/technology age has generated a requirement and a window of opportunity for a replacement quite expertise in problem identification and solution within the Marine industry. This field might be called industrial Mathematics, Mathematical technology, or computational engineering. This new trend of development, if accepted, presents a challenge to the Marine educational programmes and curriculum development. Some universities already offer specialized Microsoft (MS) programmes oriented towards the professional use of Mathematics. There are excellent programmes that equip the scholars with the talents that are needed within the Mathematical projects within the Research and Development (R&D) sections within the Marine industry. Generally there's still tons of room for improvement. Pathetically, some Mathematics departments have stayed too long within the pasture of isolated abstract Mathematics and did not face the challenge coming from the changing Marine world.



Conclusion:

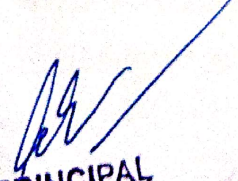
A good Marine educational package would contain a variety of Mathematics, computing skills and basic knowledge of physics, engineering or other professional input. The work life in industry is extremely seldom that of a mathematician. It is often a researcher, a search engineer, systems specialist, or development manager. But the truth is that Marine industry may be teamwork even as industrial Mathematics is teamwork. Success stories are born when a gaggle of specialists can join their expertise and visions together during a synergic manner. The team-work makes communications skills a necessary matter. It might be vital to coach oneself et al. to figure during a project team, where the interpersonal communication is continuously present. To become an honest applied mathematician one should be interested by other areas also, to have an interest and learn basic facts from a couple of neighbouring areas outside Mathematics. To tackle the fascinating tasks and challenges also as developing questions in modern industry, the scholar needs a solid and sufficiently broad theoretical education and operational skills within the methods of applied mathematics. However, the foremost important single skill is that the experience in modelling projects. The lectures, books and laboratory exercises are necessary, but the particular process of maturing into an expert can only be achieved by "treating real patients" with realistic dose of healing targeted medication.

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