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Application of Numerical Analysis in Real Life

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Abstract: The advancement of numerical analysis and its application over the past decades have provided an incredibly powerful method for researchers to study. The use of such approaches is still not common nonetheless, and documentation of bad practice is all too often present when applied. Probably the reason for this is a lack of knowledge and direction as to the reasonable use of such approaches of study, in particular from codes of practice. It is clear that some sort of initiative is required to improve good exercise and to allow the full potential of this analytical tool to be realized from both a protective and an economic perspective. The paper commences to analyze the major benefits and application of numerical analysis over typical methodologies, and then addressing whether or not it can replace the conventional analytical tools in the design process. Existing literature is used widely to demonstrate the considerations for and against the use of numerical analysis.

Keywords: Numerical analysis, application, real life, validation.

1. Introduction

Numerical analysis nowadays is an essential part of most technological projects as well as other disciplines. Therefore, the need for result verification is critical throughout the design process so that the methodology and approach of the research can be trusted and that the designers have confidence in the estimated findings. The standard practice is to verify the outcomes against general relativity, empirical data, published research, different layout output and other numerical parallel programming. Benchmark or validation examples presented by programmers may sometimes be used for this purposes but they are not adequately detailed to address an entire spectrum of issues. The analysts must evaluate before conducting the numerical analysis whether accurate the input data is, whether the software tool can resolve the issue in question as well as how to assess the validation the data. Whereas the authentication of the process was followed by many professionals as part of the quality improvement protocol, costly losses often happened [1, 2].

2. History of Numerical Analysis

The concept of numerical analysis predates the centuries-long development of digital computers. More than thousands years ago, linear interpolation was also in operation. Numerical analysis has concerned many great mathematicians of the past, as

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is obvious from the names of important algorithms such as Lagrange polynomial interpolation, Newton's method, Lagrange polynomial interpolation, Euler's methods or Gaussian elimination.

Large books with formulas and data tables such as interpolation points and function coefficients were created to promote computations by hand. Using these tables, frequently measured for some functions to 16 decimal places or more, one might look up values to fit in the specified formulas and get very good numerical estimates of some functions. The standard field work is the NIST paper edited at several stages by Abramowitz and Stegun, a 1000-plus page book containing a very large variety containing widely used formulas and functions and their meanings. The feature values are no longer so helpful when a machine is open, but the lengthy list of formulas can also be very useful [3].

Also, the mechanical calculator was designed as a hand calculating tool. By the 1940s, these calculators were electronic devices, and it was discovered that these machines were often useful for administrative purposes. But the electronic technology has affected the field of numerical analysis, as longer and more complex equations could now be carried out.

3. Affordability

Except for conventional methods, the use of numerical analysis can lead to more affordable design, and consequently the use of such sort of analysis is likely to increase in the future. While most professionals have had familiarity with numerical analysis, this has usually been at arm's length and many do not fully understand the difficulties and complexities implicit in using it. It is essential for such research to be used rationally, and for possible disasters to be eliminated, that geotechnical engineers realize both the potential of this sort of analysis and its drawbacks. Numerical methods have reached the point where they are superior to conventional approaches and can replace them in the phase of geotechnical design. 'Evidence both for and against motion are then addressed using a sequence of specific examples [4].

4. Learning Syllabus

Preferably, several numerical analysis and fundamental simulations should be included in the learning syllabus. It suggests however a massive increase in the students' workload. Since both undergraduate and postgraduate programs are already complete, this then brings up the question of what content can be skipped. Maybe there is space for less teaching on related subjects like administration, or less teaching on conventional study. It is clear that some tough decisions have to be taken and academics may need support from both the profession and industry in this aspect. The profession and industry need to provide recommendations on policies and procedures and adequate training for using numerical analysis. That should be dependent on unbiased advice. It should be observed that although there are many advice papers on laboratory and field research, there are a few that discuss methodologies for numerical analysis [4].

5. Applications

Numerical analysis may contain any one or a combination of the following three fundamental disciplines in a traditional civil engineering venture: structural mechanics, geo-mechanics, and fluid mechanics; the existence of the issue can be categorized as one of interaction soil-structure, interaction fluid-structure or soil-fluid interaction. In several situations all three may be present. Due to the potential difficulty, some observations and idealization must also be made to clarify the issue without sacrificing much precision and for intents and purposes still capturing the significant behavior. There is much more particular-purpose and advanced numerical analysis software that can fix these problems [2].

6. Accident Reconstruction

Accident reconstructions and numerical simulations are being used as a supplement to other approaches, such as epidemiological and laboratory studies, to determine and strengthen protective structures. It points out how the simulated modeling and numerical methods will lead to forensic science and injury biomechanics in vulnerable road users. The use of artificial simulations has progressively evolved yet some precision improvements are still needed, specifically in parts and material modeling. Apparently, numerical simulations serve as the basis on which the numerical models of computer aided engineering may represent the tissue level responses to provide details on the location and intensity of injury. The extension of numerical simulations allows for expanding the possibility and scope of operation including prone road user safety in view of a motor vehicle collision Even though a test's physical verification appears to be costly, it assesses whether future progress can be made in terms of improving safety. The data from the accident indicates the consistency of the reconstructions of the incident, which in turn lays the groundwork for testing FE models. This illustrates the enormous potential of using computer aided engineering and describes the numerical approach to validation of head injury that happens in a real world transport accident, in specific a comprehensive case that has already been evaluated by many accidents reconstructionist, experts and observers who have been consulted by different courts [5].

7. Dynamics Mechanics

In the last century, significant advances in efficiency and energy density were made in turbomachines. In large part, this improvement has been the result of a deeper understanding of the dynamic mechanics of these conceptually simple systems. The perception originated from scientific, theoretical, and more recently American Aeronautics and Astronautics Institute 2 numerical tools. Numerical methods (Computational Fluid Dynamics, or CFD) are today a key tool for turbomachine design. Till now, the majority of turbomachinery flow numerical analysis was based on two main simplifying assumptions. The first being that in the reference frame of that blade row the flow in each blade row is steady; the second is that the flows in each blade passage in one row are similar. It is interesting that these two gross simplifications have been so active in efficient valuable output predictions and providing a rich understanding of the physics of flow. However accurate and fast, being able to simulate the unstable flow does not automatically imply that we recognize the physics of flow. Sequencing and awareness of flow physics also requires a different approach; and the availability of unpredictable CFD flow outcomes provides flow analysts both the freedom to explore and the challenge to sift through vast amounts of information. This section explains what the researchers have learned in recent decades about large-scale unstable flow simulations and how to test and challenge the empirical findings [6].

8. Realistic Solutions

Solar cells have exhibited a reliable and efficient analytical capability. The methodology of numerical analysis offers realistic solutions of the equations of semiconductors describing the transport of charge in the cell subject to defined constraints and device morphology. This functionality can be used efficiently in the design of solar cells to complement and reduce reliance on, test and error cell fabrication. The theoretical under pinning of the system analysis technique was explained by simulating the conventional silicon solar cell in order to generate a total power conversion first. Calculated results of this and subsequent evaluations of systems were then used to focus on areas where performance improvements could be most conveniently performed. The most rational, or realistic, steps toward the practical achievement of a design of n $>$ 20 percent of solar cells were taken systematically. This included some analysis and evaluation of the electric field at the back-surface.

The study suggested the cell design specifications and the requisite material parameter refinements, all of which are not inherently releasable with the current state of the art processing to achieve a 20% silicon solar cell in the most efficient way [7].

9. Numerical Binding System

This is to inform the reader of both the broad applications of a technique for numerical binding analysis and the ease of use of the particular BIOEQS system. Using such a method, the scientist may spend more time on model testing and experimental design, instead of experiencing both drudgery and the limitations of creating and applying analytical expressions to define the evidence. While BIOEQS, as currently implemented, is able to handle a large number of complex issues, we find it to be a software development project underway. There are a variety of features that are being integrated into the next version. Some of these include completion of hydrostatic pressure integration as an additional independent axis, enhanced graphical output and a more robust input system. Furthermore, we envisage extending BIOEQS ' capacities to meet not only the macroscopic chemical potentials as currently configured, but also the inherent site predispositions within a given complicated stoichiometry. Of course, restoration of such specifications depends on being able to define with a particular stoichiometry the relative population of the same site isomers. Moreover, there are strategies that provide these capabilities, such as DNase foot printing. We have taken care to design the BIOEQS program on a highly simplified basis so that new features can be introduced with relatively easily. We presume that the ongoing development of numerical analytical abilities for the analysis of biological interactions will.

10. Contact Problem Solving

Contact problem solving for layered elastic solids generally requires numeric methods. The Fast Fourier transformation (FFT) technique has recently been applied to such contacts. Although very fast, FFT applies strictly only to periodic contact problems. When it is extended to essentially non periodic contacts the numerical solution produces an error. In this paper a new method is presented that eradicates the limitation of the "straight forward" FFT approach to solve non periodic layered contact problems. To compensate the FFT results for the periodicity error, a special correction protocol based on the multi-level multi-summation technique is used. Using a robust iteration structure based on the principle of conjugate gradient guarantees the new method extends to communication problems involving real rough surfaces.

11. New Approaches

The new numerical approach, which integrates a MLMS based periodicity correction method with an FFT based algorithm for layered contact analysis, is nearly as accurate as, but far more accurate as the straight FFT method established by Nogi and Kato. The correction technique implemented in this work is a much more effective way to improve FFT based contact analysis accuracy than the use of grids that stretch far beyond the contact area. The new approach is suitable for solving the concentrated contact issues with particularly rough surfaces for layered solids. It can be used to study the effect of protective coatings on contact fatigue and other engineering surface failures [5, 9].

The overarching objective of the field of numerical analysis is to construct a model and evaluate techniques in order and provide estimated but reliable solutions to difficult problems, the diversity of which is indicated in the following.

(1). Advanced numerical methods are important to understand and feasible the numerical weather forecasts.

(2). Computing a spacecraft's trajectory involves a precise numerical solution of the scheme of ordinary differential equations.

(3). Automotive companies can maximize the safety of their cars by using automobile accident simulations. These simulations consist basically of the numerical solution of partial differential equations.

(4). Hedge funds/private investment funds use skills from all technical analytical fields to measure stocks and derivatives more efficiently than other market participants.

12. Conclusion

Modern computation has provided us with the capacity to solve some tedious daily day problems that involve the use of mathematics. Numerical Analysis is one of the branching fields that are used to cope with the same.

It has implementations in all sectors of technology and physical sciences but in the 21st century, features of scientific mathematical calculations have been embraced by the sciences and even the arts. Equations of ordinary differential arise in the movement of cosmic bodies (stars, plants and galaxies); optimization happens in portfolio management; computational linear algebra is important for data analysis; stochastic process and Markov chains are central in the simulation of biology and medicine.

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