

Web-Based Numerical Algorithm Library: A Review

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Abstract

The purpose of this paper is to present and analyze the current literature related to developing a numerical algorithm computing library for mathematical modeling repository to support multidisciplinary industries. In this paper, articles in the literature are classified to give an overview of the numerical algorithm computing library. In this paper a review on developing web-based library, which allows the performance and characteristics of the solution of algorithmic, had been done. The focus of this study is to develop a modeling numerical algorithm which can eliminate the time consuming effort which involves the learning of the numerical approach and the development of the model.

The importance of internet

For most of the years, internet had become one of the important tools in gathering information and gain new knowledge. The internet had a big impact on education by streamlining access to information and making it easier for the students to engage in online learning. Distance education programs make it easier for students from a variety of backgrounds to attend classes remotely, cutting down the need for travel and reducing the resources required for education [9].

People nowadays are unquestionably dependent on computers and the Internet that connect them. The emergence of Internet has affected the way people live. Collecting the information and communication become a lot easier. Rather than searching all the information at the library, the users can just find them through internet. For not only education, but internet also give huge impact on businesses, where people nowadays tend to work from home. For medical, doctors in rural area can communicate with the experts around the world for the patients' treatments and diagnoses [17 & 18].

The growth of Internet exceeds according to recent statistics reported in Internet World Stats until March 2017 on world Internet users, there is more than 3 billion people use Internet. Asia region users rank highest on the chart with 1874 million of internet users. 1.2% users are from Malaysia. The internet has introduced a robust time mechanism for communication and interaction. In the near future, the development and deployment of the Next Generation Internet will lay down the

infrastructure for a worldwide communication network, that is even faster and broader than most of today's local networks.

The Internet and its multimedia front-end, the World-Wide-Web (WWW), has experienced tremendous growth since its development by Tim Berners-Lee of CERN (Centre for European Nuclear Research) in the early 1990s, achieving world wide acceptance [1].

WEB-BASED LIBRARY

Web-based library allows user to get information from database in the web. Means that, we can get all the information at one place. Saving time and cost. The web has become commonplace throughout the world, a natural complement to traditional library services and develops innovative ways to meet the information needs of users. Traditional online services have transformed themselves into web-based services using web technologies [4, 21 & 22]. A library portal serves as an integrated interface to a wide variety of digital resources and web-based library services. Web portals are also important tools for users to access and utilize library and information services over a network. This is because an informative homepage provides users with helpful information about the library, its collection, and services. Besides, library portals also host links to important internet resources useful for the parent organization [3, 19].

In some university, they developed a web-based library known as web-based assessment library (WeBAL) which used to support their faculty when assessing or evaluating students' engineering communication or teamwork activities. A simple, online, menu-based selection process guides faculty users to appropriate instruments to meet specific needs, and all instruments may be downloaded and adapted as desired by faculty [5].

A web-based library developed by Sacham used to test the performance of numerical software to of non-linear algebraic equation (NLE). The NLE contains presently over 70 problems of various dimensions on lower, average, and higher difficulty levels. Some of the problems exhibit multiple solutions in the feasible and/or the infeasible subspaces, discontinuities, and false solutions that are identified as true solutions by most numerical solvers. This library can be of significant benefit to users and developers of NLE solvers for

verifying the robustness and reliability of NLE solvers [6]. The GNU Scientific Library (GSL) is a collection of routines for numerical computing. The routines have been written from scratch in C, and present a modern Applications Programming Interface (API) for C programmers, allowing wrappers to be written for very high level languages [8 & 20]. The Numerical Algorithm Group (NAG) developed a library collecting the numerical and statistical algorithms for Java programmers that provides them with the latest tried and tested routines [10 & 21].

Digital libraries (DLs) are among the most advanced and complex types of information system, going far beyond search engines, since they offer many other valued services and normally designed for specific user communities, which must be involved with many aspects, from specification to utilization. One way to deal with these issues is through the creation of specific software component toolkits, in which each component is responsible for a small part of the functionality of a DL and integrates with other components in order to build a complete system. Such toolkits offer a generic, extensible and reusable framework for building DLs, allowing, for example, to reduce the necessary effort to develop them [11].

Web-based Simulation

The area of Web-based simulation (the integration of the Web with the field of simulation) (WBS) has grown since the mid-1990s. The Web itself has evolved rapidly, and current Web-related research areas include Web 2.0, service-oriented architectures and the Semantic Web [1].

The web-based library contains complete problem descriptions with the following information: the model equations in the same form as the input for the numerical solver, the explicit definitions of constraints on the variables, the initial estimates and function values at the initial estimates, and the variable values and function values at the solution. All variables and function values reported with the full precision of the numerical solution. Simulation applications have traditionally been provided as desktop systems, but during the last few years the interest for web-based simulation has grown [19, 22 & 23].

“Web-based simulation” does not have an exact meaning, but is a broad term including various approaches to integrate the web with the field of simulation. Byrne, Heavey, and Byrne (2010) states that web based simulation “. . . can be defined as the use of resources and technologies offered by the World-Wide-Web (WWW) for interaction with client and server modelling and simulation tools”.

A web-based library for physical problems that is most beneficial for potential users should include more information and in a different form than that found in existing problem collections. Several important aspects of the library can be

demonstrated by the examples. In the library created from the previous works, the equations are stored in the same form as the input for the numerical solver, constraints on the variables are defined explicitly, and initial estimates and function values at the initial estimates are included [19 & 22]. Variable values at the solution are reported with the full precision of the numerical solution along with the function values at the solution. References, which provide information regarding the physical basis of the model represented by the system of equations, are also included as this can be helpful in verifying the physical validity of the solution [15].

The concepts of computing scientific library as an encoding language lend itself for expanding the approach one step further to include a database. Instead of storing data in an input file and having a plethora of files crowding the file system, a database could serve as a data repository for all modelling efforts. In fact, it should be possible to utilize the suggested technology to entirely eliminate input files and have the numerical engine use the database directly for data feeds. This would not only make data file input and output formats obsolete, but also would allow the population of the database by users that do not necessarily partake in modelling efforts.

The engineering models involve multiple disciplines, design process, various analysis tools and lots of participants working on heterogenous platform and dispersed geographically. Thus, an integrated and collaborative environment for scientific computing library is essential [16]. In addition, scientific computing library is inherently a multi-step process and refers to various types of design data and knowledge, analysis tools, optimization algorithms, computer aided design (CAD) and other design resources. (Khazaal, et al, 2014).

ADVANTAGES AND DISADVANTAGES

In this section, we discussed about the advantages and disadvantages in developing the web-based library system.

Advantage	Disadvantage
Web is easy to use and navigate	The time required to obtain a solution to a test problem ranges from several seconds to several hours. Furthermore, many combinations of the solution problem and algorithm reach the maximum number of iterations [11].
Provide information regarding the physical basis of the model represented by the system of equations, are also included as this can be helpful in verifying the physical validity of the	The test problem library which include categorization of the problems according to size, difficulty level, number of solutions and type of physical model, the convergence to infeasible solution, misidentification of

solution	false solutions, and initial estimate selection for various levels of difficulty [7].
Expanding Web-based simulation to include new capabilities beyond those found in conventional simulation technology. Providing the interoperability with other information processing technology being particularly promising [1].	the number of real applications and efficient tools for Web-based simulation is still very small [1]
Creating virtual environments to contribute to the selection of these collections, to channel the delivery of value-added services [3].	Graphical user interface limitation. The interface provided by the Web as opposed to desktop simulation tools is limited, although this is starting to change with the evolution of multimedia authoring tools for the Web [8].
Provide learning benefits that align with other simulation approaches and it augments face-to-face teaching [13]	Often ineffective, particularly in overcoming erroneous mental models and developing the problem solving skills and other capabilities needed to manage modern businesses and other organizations effectively [12].

However, the tightly coupled relationships among disciplines cause the organizational challenge is another key problem. Numerical models deal with huge amount of input and output data. The proper description of this data is essential to search and exchange of these data. Unfortunately, this essential part of data has been neglected in the numerical modelling community in the past. A very few cases have been found where numerical model uses metadata or supports metadata creation tools. Metadata should be based on certain standard so that it is possible for the users to understand and share metadata among the users. There are several metadata standards or initiatives currently exist. The selection of a certain metadata standard, which better fit the need of the numerical model, is necessary. At present, there are no such suitable guidelines exist to create metadata based on any particular standard for engineering models. (Khazaal et al., 2014).

To make the modelling numerical algorithm operating platform independent all development will be done in Java language. Java, in conjunction with a web-browser, like Windows Explorer or Netscape, allows for a system that is portable without problems and can be given a level of functionality. Various classes that come with Java JDK 1.4,

permit coding that can interface with legacy codes in C/C++ or FORTRAN (Java Native Language Interface, JNI). As a result, execution of models can be performed in various ways such as component based; client-server based, or distributed using Parallel and High Level Architecture (HLA). Java is also rich on classes that allow the development of high level graphical interfaces using the SWING classes (Java 2002). In addition, the possibility to include Applets into a regular HTML page permits a high level of functionality between the user and a powerful server (for number crunching purposes). The flexibility and power of Java for internet-capable software development is richly documented, in fact Java has become the globally accepted standard for applications that seek to utilize network capabilities. Therefore, all code development, in fact the entire modelling numerical algorithm, will be done in Java. (Khazaal et al., 2014).

CONCLUSION

In this new era, the web-based numerical libraries can act as information centres. It can be ensure that the users served quickly and effectively as possible by accessing the libraries. This web-based library for numerical algorithm must be held in a stable form so that the programmers can gain confidence form it and can rely to its availability. All of Malaysian university libraries have interactive web pages. As a university that always produce new technologies, Universiti Malaysia Perlis must have a system, or a library where all the engineers can refer the numerical programming in order to solve their problems and a place where all the programmers can stored their works. By building this numerical library, not only engineers, but also the students and educators can access the library and can be used to provide services anywhere at any time they want. The library will help the users to find and implement the numerical solutions to solve any complex problems or applications. Web services can empower libraries, offering more control and simpler system customization and integration [6]. The library websites can function as portals or gateways to an integrated and varied collection of information resources and as sophisticated guidance systems which support users across a wide spectrum of information seeking behaviors-from goal-directed search to wayward browsing [3].

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