WORLD WIDE WEB — THE GLOBAL LIBRARY: A COMPENDIUM OF KNOWLEDGE ABOUT BOND GRAPH RESEARCH

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ABSTRACT

This paper describes the design of an interactive compendium of Bond Graph research that has recently been added to the World Wide Web. It contains several different data bases relating to Bond Graph researchers as well as Bond Graph research. It should prove to be an excellent research tool for researchers interested in advancing the state–of–the–art of Bond Graph research. However, it will be difficult to keep the data bases up–to–date at all times. All Bond Graph researchers are therefore encouraged to check carefully their own entries in the data bases, and provide updates frequently by sending an e_mail message to the author of this article.

Keywords: Bond graphs, library research, world wide web, electronic publishing.

INTRODUCTION

In past years, several Bond Graph bibliographies have been published both in the *Journal of the Franklin Institute* [1,2,4] and in the *Transactions of the ASME, Journal of Dynamic Systems, Measurement and Control* [3]. These bibliographies were very useful at their times, and have been widely used by many Bond Graph researchers. However, they were not "browsable," and the users had to live with the literature classification schemes that the authors of these bibliographies found useful. Unfortunately, there does not exist a single classification scheme that is optimally suited for all purposes and all users.

The World Wide Web offers a forum that provides a more user–friendly and more highly interactive access to bibliographies. A browsable bibliography for Bond Graph research has been created by the author of this paper that supersedes the previously available bibliographies, because it contains all of their entries plus many newer ones more. Contrary to the previous bibliographies, it is basically unstructured, since any desirable structure can be dynamically created by applying appropriate search engines to the data base. The simplest way to use the data base is by using the search feature of the browser itself. In order to preserve this capability, the bibliographical data base was kept as one sequential large file (more than 1 megabyte), rather than splitting it up into subfiles. Contrary to the earlier bibliographies, this new bibliography is being updated constantly by the author of this paper, i.e., it will be always as much up–to–date as its users care to make it.

In addition to being useful as a tool for library research, the WWW–based Bond Graph bibliography can also be turned into an excellent tool for electronic publishing of Bond Graph articles, a topic to be dealt with in some detail in this paper. The *Bond Graph Digest* is a new electronic journal dedicated to Bond Graph research and applications. It offers both fully refereed archival publications and a place to publish quickly non–refereed temporary results and short notes for provoking feedback. Short notes relating to and discussing previously published articles are also highly encouraged.

THE BOND GRAPH COMPENDIUM

The top page of the *Bond Graph Compendium* presents itself currently in the following fashion:

THE BOND GRAPH COMPENDIUM
* **Bibliography** of bond graph research
* **Conferences** about bond graph modeling
* **Primer** on bond graphs from Twente
* **Researchers** working on bond graph modeling
* **Research Groups** working on bond graph modeling
* **Software** for bond graph modeling
* **The Bond Graph Digest** an electronic journal

It can be found at the URL:

http://www.ece.arizona.edu/~cellier/bg.html

It lists the various resources and data bases that are currently available within the Compendium.

The **Bibliography** is the by far most valuable of the data bases. It is also the longest one, currently a little over 1 Megabyte in size. It contains the entire list of Bond Graph references that the author of this paper was able to come across, about 1200 references at the time of writing this paper.

The **Conferences** page lists forthcoming conferences on Bond Graphs, or at least offering Bond Graph sessions. All Calls for Papers are placed on the Conferences page as early as possible to provide the Bond Graph researchers with as much time as possible for preparing their contributions.

The **Primer** page provides an introduction to Bond Graphs. It was placed here primarily to satisfy the curiosity of someone who may stumble upon the Compendium without knowing what Bond Graphs are all about.

The **Researchers** data base offers a list of all the researchers who have published papers on Bond Graphs in the past. It offers pointers to their current mail and e_mail addresses, as well as phone numbers, FAX numbers, and homepage addresses where applicable.

The **Research Groups** data base provides pointers to the homepages of the most active Bond Graph research groups around the globe.

The **Software** page provides a list of Bond Graph software tools for which descriptions are available on the WWW.

Finally, **The Bond Graph Digest** opens into a new electronic journal for Bond Graph researchers, where they can electronically publish their newest results on Bond Graph theory and practice.

THE RESEARCHERS DATA BASE

The *Researchers* data base provides a list of all the Bond Graph researchers who have published papers listed in the *Bibliography*. The beginning of the data base presents itself in the following way:

[A] [B] [C] [D] [E] [F] [G] [H] [I] [J] [K] [L] [M]
[N] [O] [P] [Q] [R] [S] [T] [U] [V] [W] [X] [Y] [Z]

* **[A]**

* **Vincent Abadie** (PSA - Peugeot/Citroën, France)
* **F. Abdullah** (City U. London, UK)
(F.Abdullah@City.AC.UK)
* **H. A. Abdullah** (U. of Glasgow, UK)
(H.Abdullah@Mech.Gla.AC.UK)
* L. Acuña (Oriente U., Cumona, Venezuela)
* **Vilmar Æsøy** (U. of Trondheim, Norway)
(Vilmar.Aesoy@IMM.UniT.NO)

Names that are high–lighted open up to an *Electronic Business Card*. Ultimately, all the names in the data base should be high–lighted, but until now, some addresses, such as that of *L. Acuña* in the above excerpt, have not been found yet. For example, the *Electronic Business Card* of the author would present itself as follows:

François E. Cellier, Ph.D.
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Electronic Mail: **Cellier@ECE.Arizona.Edu**
Personal Homepage: Click **here**

Specialty Area: Software, Thermodynamics, Hybrid Models, Nonlinear and Hierarchical Bondgraphs

Updated: October 1996

E_mail addresses are always high–lighted. Clicking on an e_mail address starts a protocol that allows the user to send out an e_mail message to the person in question without having to leave the Compendium first.

The *Electronic Business Cards* are organized into 26 separate pages, one for each character in the alphabet. Within a character, the user can scroll up and down through the stack of available business cards. Notice that the *Researchers* data base should not be downloaded without downloading the stacks of business cards as well into the same directory, since relative addresses are used to refer from the *Researchers* data base to the files with the stacks of business cards.

THE BIBLIOGRAPHY DATA BASE

The *Bibliography* data base consists of a single file referencing all the books, articles, reports, and theses related to Bond Graphs that the author was able to find through library research and by sending e_mail messages to various Bond Graph researchers. A typical entry might look as follows:

Peter J. Gawthrop, **Lorcan S. Smith** (1996)
Metamodelling: Bond Graphs and Dynamic Systems
Prentice Hall, Englewood Cliffs, N.J.

High–lighted names lead back to the stack of *Electronic Business Cards*, whereas high–lighted titles either open up to an abstract (an html file), or point at the full paper (a postscript file).

The implementation of the above entry in the *Bibliography* data base is as follows:

```
<a href="bg_g.html#Gawthrop">
   Peter J. Gawthrop</a>,
<a href="bg_s.html#LSmith">
   Lorcan S. Smith</a> (1996) <br>
<a href="http://www.mech.gla.ac.uk/~peterg
      /books/96/book_summary/book_summary.html">
Metamodelling: Bond Graphs and Dynamic Systems </a> <br>
Prentice Hall, Englewood Cliffs, N.J. <p>
```

Notice the relative addressing scheme used for the two pointers to the stacks of *Electronic Business Cards*, and the absolute address used to point to the abstract of the book that resides on the server of one of the books authors. The author of this paper is willing to provide space and access time to his server for the data base only, not for the articles themselves, or even for their abstracts. The disadvantage of this approach is evident: If a Bond Graph researcher moves his files around on his own server without informing the author of this paper as to what he or she is doing, then soon the data base will be full of pointers pointing at illegal file addresses. However, this is the only practical solution that allows to share the burden of providing space on the servers and access time on the Internet among all the participating Bond Graph researchers.

As of now, only few pointers have been programmed into the bibliography for articles other than those of the author of this paper. Readers are invited to provide the author by e_mail with URLs for those of their Bond Graph related papers and reports that they keep around on the web. Whether or not postscript files of published papers can be kept on the web without copyright infringement is a question that the judges have not finally and definitely answered yet. However, at least abstracts can be kept on the web without any problems, and there is no good reason for *not* doing at least this with all of one's papers.

THE RISE AND FALL OF THE TRADITIONAL JOURNALS

Publish or perish has been (and still is) the clear message that young faculty members receive at all U.S. universities when they begin their awkward and unnerving journey through their first six years of tenure track. Growing numbers of students led to an explosion in the number of research universities as well as to a legion of young professors all wanting to publish. The market reacted to this demand by spawning large numbers of new journals that were diligently acquired by all of the major university libraries around the country.

There seemed to be no end to this spiral of growth, although the university administrations complained, because their libraries needed more and more money to keep up with all the new research journals appearing left and right every year. The problems started around 1990, when the U.S. economy went into a deep recession, and when, for the first time, even libraries (hitherto the holy grails of every university) had to accept a cut–back of their budgets. They reacted in the only possible way: by cancelling the subscriptions to the most expensive and least often requested journals. The publishers hurt badly. They reacted in the only possible way as well: by raising their prices to compensate for their losses. Consequently, the universities found out one year later that they were paying exactly the same amount of money as the year before, but now for a much smaller number of journals. Thus, they had to cancel more subscriptions, and the prices went up once again. No end of this vicious cycle is in sight yet. Until now, the university libraries still live with the false illusion that one of these days they'll beat the odds, while the publishers are still hanging in there, living with the equally false illusion that somehow their business might survive.

It can be predicted that soon, the first publishers will start to default. Clearly, the market leaders will survive, but the newer and more esoteric journals will disappear as rapidly as they once were created. The publishers don't seem to know this yet, but it will inevitably happen. The consequence of this will be that the pipelines of the surviving journals, currently one to two years for most journals, will soon become twice as long, which is totally unacceptable to academia, taking into account the mercilessly ticking tenure clock of junior faculty.

THE BOND GRAPH DIGEST

What can be done about the aforementioned problem? Electronic publishing may be the only way out. In the past, journals and publishers were needed primarily for two reasons:

1. to typeset complicated formulae so that they should look nice, and
2. to distribute the finished papers among the community of researchers, primarily by selling their journals to research libraries.

The former reason for having publishers is already gone. Most researchers typeset their manuscripts by themselves, often even without the help of a secretary (another dying profession). For some time, they sent their manuscripts to the publishers on floppy disks. Meanwhile, many publishers prefer to received typeset manuscripts by e_mail (here goes another profession: the postal clerk). The latter reason is about to vanish also. As the WWW becomes more and more a *Global Library*, there is no reason anymore to have documents physically located at your site. Search engines can find documents on the Internet wherever they are, and it may even be more convenient to grab a document on the Internet and send it to the laser printer in one's own office, rather than having to walk across campus to fetch it at the local library (except for thick books, of course). Moreover, electronic publishing doesn't share one of the major drawbacks of traditional publishing: there is no pipeline, since there are no page limitations (there may be limitations imposed on the number of pages that individual articles may

occupy, but there is no limitation on the number of articles to be published per time unit).

One of the problems with electronic publishing, that hasn't been fully solved yet, is the problem of credibility. Will tenure–track faculty receive credit for publishing articles electronically? How can the quality of electronic publications be ensured? Are they counting as "fully refereed journal articles"? The answer to these questions is probably still a qualified *no*. It takes some time to educate university administrators about a changing world. Yet, this is the way of the future, and mechanisms can be put in place to guarantee that electronically published papers are as solid as the best among traditional archival publications.

The Bond Graph Digest is a step in this direction. It offers to publish articles in five categories:

Categories of Contributions
* **Journal Articles** (refereed)
* **Short Notes** (non–refereed)
* **Research Reports** (non–refereed)
* **Discussion of Articles** (non–refereed)
* **Book Reviews** (non–refereed)

The **Journal Articles** section offers fully refereed articles that should be of the same quality as any article published in any traditional journal. This is how it works.

An author who wishes to publish a journal article in *The Bond Graph Digest* should write and format the article in the same way as he or she would format an article published in any research journal. He or she should use a two–column format, together with the IEEE referencing style. Full papers should follow the normal conventions for journal papers w.r.t. size and style. After a paper has been completed, it should be placed on the WWW server *of its author*.

Once this has happened, the author(s) should send an e_mail message to the Editor of *The Bond Graph Digest* at: **Cellier@ECE.Arizona.Edu** containing the request to have the article reviewed. Authors should obstain from sending the articles themselves, since this will only clog the Internet and flood the Editor's mailbox. It is sufficient to provide the URL where the article has been stored.

Upon receipt of such a request, the Editor shall forward the e_mail message to two suitable reviewers among the set of current Bond Graphers, asking them to review the article. The reviewers shall communicate with the author by e_mail via the Editor. Once both reviewers have accepted the paper in its final form, the Editor shall include it in the bond graph bibliography, and add it to the table of contents of the next issue of *The Bond Graph Digest*. Notice that *The Bond Graph Digest* only consists of a table of contents (at least, this is the only portion thereof that gets deposited on the Editor's server). The articles themselves remain permanently on the servers of their authors.

Moreover, *The Bond Graph Digest* comes absolutely free, and it doesn't take any copyright, i.e., authors are allowed and even encouraged to republish their already reviewed articles in any traditional journals. However, the time from completion of a manuscript to its publication in *The Bond Graph Digest* can be reduced to a couple of months, on the average, thereby offering to potential authors a channel for fast publishing refereed journal articles without having to wait for the pipeline of a traditional journal to clear. For some junior faculty, this may make the difference between receiving tenure and being denied tenure.

The **Short Notes** category offers a channel for publishing short notes about any subject of relevance to the Bond Graph community. They correspond to the "Letters to the Editor" section of a traditional journal. Notes are non–refereed. However, they should be written and formatted with the same care as the refereed articles. The Editor reserves the right to reject short notes if they aren't appropriately written. The *Short Notes* section of *The Bond Graph Digest* is not a chat room. *Short Notes* should usually be limited to no more than two pages in length.

Research Reports can be formatted in any way the author deems suitable, and they can be of arbitrary length. *Research Reports* are the proper place for publishing Internal Reports, Software Manuals, MS Theses, Ph.D. Dissertations, etc. They are non–reviewed. Responsibility for their contents remain fully with their authors, and an appropriate disclaimer shall be placed within each issue of *The Bond Graph Digest* as to the contents of *Research Reports*. As soon as the Editor has been informed of the request to publish a *Research Report* in *The Bond Graph Digest*, he shall place the report in the bibliography, and add it to the table of contents of the next issue.

The **Discussion of Articles** category is a specialization of the *Short Notes* category previously discussed. Rather than discussing arbitrary topics of general interest, an author may wish to write a short essay relating to an article previously published in *The Bond Graph Digest*. If the Editor receives a request for publishing a discussion, he shall inform the author of the original article about this fact, to give him or her a chance for a rebuttal. If the original author chooses to write a rebuttal, the Editor shall delay publication of the discussion until the rebuttal has been written as well (assuming the rebuttal arrives within a reasonable time frame of one month).

A valuable special category of a *Short Note* is also the **Book Review**. All newly published books on Bond Graphs should be properly reviewed. When a new book comes out, it will be placed in the bibliography, and the *Book Review* section of the next issue of *The Bond Graph Digest* shall contain a "Call for Review" invitation. More than one review can be published for every new book appearing in press.

The Bond Graph Digest is not in competition with any of the traditional journals. It simply offers a forum for pre–

publication of archival material in a timely fashion. It complements the Bond Graph *Bibliography*. The *Index* section of each new journal issue shall list the new entries in the *Bibliography* data base, so that regular users of the *Bibliography* won't have to browse the *Bibliography* for newly published material.

CONCLUSIONS

In this paper, a newly created *Compendium of Bond Graph Knowledge* has been discussed. It offers a new framework to Bond Graphers around the globe for library research on Bond Graphs, and it offers a novel means to publish newly obtained Bond Graph results in a timely manner. In the author's eyes, the *Compendium* fills a definite need of the Bond Graph community.

The Bond Graphers have been surprisingly slow at embracing the new technologies spawned by the *Information Super–Highway*. As little as two years ago, the organizers of ICBGM'95 (including this author) still had difficulties communicating with a good number of highly active Bond Graph researchers by means of e_mail. This has drastically changed over the past two years. Even people working in industry are picking up quickly on the new technologies now. If we believe our president, in the year 2000, "every 12–year old will be on the Internet." This should include a large fraction of the Bond Graph community.

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AUTHOR'S BIOGRAPHY

Dr. Francois E. Cellier received his B.S. degree in Electrical Engineering from the Swiss Federal Institute of Technology (ETH) Zürich in 1972, his M.S. degree in Automatic Control in 1973, and his Ph.D. degree in Technical Sciences in 1979, all from the same university. Dr. Cellier joined the University of Arizona in 1984 as Associate Professor. His main scientific interests concern modeling and simulation methodologies, and the design of advanced software systems for simulation, computer–aided modeling, and computer–aided design. Dr. Cellier has authored or co–authored more than 100 technical publications, and he has edited four books. He recently published his first textbook on *Continuous System Modeling* (Springer–Verlag New York, 1991). He served as General Chairman or Program Chairman of many international conferences, most recently ICBGM'93 (SCS International Conference on Bond Graph Modeling, San Diego, January 1993), CACSD'94 (IEEE/IFAC Symposium on Computer–Aided Control System Design, Tucson, March 1994), ICQFN'94 (SCS International Conference on Qualitative Information, Fuzzy Techniques, and Neural Networks in Simulation, Barcelona, June 1994), ICBGM'95 (Las Vegas, January 1995), WMC'96 (SCS Western Simulation MultiConference, San Diego, January 1996), ICQFN'96 (Budapest, June 1996), WMC'97 (Phoenix, January 1997). He is Associate Editor of several simulation related journals including *Simulation* and the *Transactions of SCS*, and he served as vice–chairman on two committees for standardization of simulation and modeling software.