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Book review

Building Product Models: Computer Environments Supporting Design and Construction

Charles M. Eastman, 1999, CRC Press.

Up until now, anyone working in the area of building modeling must have been frustrated by the lack of adequate literature in the field, apart from individual research papers published in diverse sources. There were no books to turn to for an overview of the field, for the historical perspective, or even an understanding of the basics. That scenario has fortunately changed with the recent publication of the book. “Building Product Models: Computer Environments Supporting Design and Construction,” authored by one of the most noted authorities in this field, Charles M. Eastman.

“Building Product Models” is an extensive compilation and discussion of the concepts, technologies, standards, and projects that have been developed so far in defining computational data models for supporting varied aspects of building design, engineering, and construction. The book is organized into three main sections, respectively focusing on the historical perspective, current work in building modeling, and research issues still to be tackled. Each section comprises several chapters on specific topics, each of which is highly detailed and constitutes a mini-volume in itself. As the book has been written not just for reference by researchers but also for graduate-level instruction at universities, each chapter concludes with a summary, suggestions for further reading, as well as relevant study questions.

The first section of the book explores the context and history of building models. Why is a building product model needed in the first place? Eastman provides a lucid explanation, by discussing current practices in design and construction, the information flows that are involved, the computer applications that are used, and the problems caused by data exchange in the absence of a common digital representation of the building project. The evolution of CAD is presented,

starting from the historic “Sketchpad” by Ivan Sutherland in 1963, to modern CAD systems that include solid modeling and parametric modeling. In contrast to these systems with their focus on geometric editing, Eastman then moves on to describe some early efforts to develop CAD systems of a different kind, such as SSHA Housing System, OXSYS, GLIDE, and CAEADS, that were based on a single building model and integrated a suite of applications. The concluding chapter in the first section discusses data exchange and the limitations of neutral file formats such as DXF and IGES, and their inadequacy in providing support for higher-level applications dealing with building components or design knowledge.

The second section, which is the longest, is devoted to current work in building and product models. It starts with a useful overview of modern programming concepts, notably object-oriented programming, abstractions, relations, and information modeling. A detailed review of STEP follows, covering its organization, motivation, information technologies, and some modeling schemas, along with a discussion of the NIAM, EXPRESS, and EXPRESS-G modeling languages. Subsequent chapters are devoted to covering other building modeling efforts such as CIMsteel, COMBINE, RATAS, BCCM, and finally, the most recent effort, IFC, undertaken by the International Alliance for Interoperability (IAI). The section concludes with a review of the current capabilities of building models, nicely putting into perspective what they can do and what they are not able to do.

The last section of the book attempts to distill, from the material presented in the first two sections, the main research issues that are still unresolved and remain to be addressed in the field of building modeling. Eastman sees these issues as falling into

two categories. The first category, more theoretical, is that of information exchange, which deals with issues such as the direction of the information flows between the different building design professionals, the consistency of the data as it is exchanged, the feasibility of a single building model versus multiple coordinated models, and data exchange in a distributed work environment. The second category, more related to the implementation of building models, deals with modeling language issues, and more specifically, the limitations of EXPRESS and its use within the STEP system architecture.

Eastman has been an expert in the field of building modeling for a large number of years, and readers of this book can benefit not just from the detailed discussion of what has happened and what is happening in this field, but also from his insights and critical commentary that come from first-hand knowledge and work at developing building modeling systems. As such, therefore, I recommend this book as an invaluable resource for anyone working in the field of building modeling, whether in a university on a research project, or in the industry on a commercial application.

I do have some minor criticisms, though, which should not in any way detract from the usefulness or importance of this book. The basic problem in the field of building modeling, as I perceive it, is complexity—complexity of the domain as well as the issues involved. The book does not help to explain the field in simplified terms; it is a complex book on a complex subject. The individual chapters are meticulously detailed, with a large number of illustrations and schema diagrams of building models. What is missing is an introductory chapter that provides a complete overview of the field, highlighting what building modeling is all about and what the current state of the art is. Currently, you have to read the entire book to arrive at that, and it is by no means an

easy read. Possibly, better solutions to building modeling would be developed if the fundamentals were absolutely clear to those striving to find such solutions.

Also, there are two areas of discussion that are not covered in the book, but which would be of interest. First, a better explanation of the difficulties involved in developing building product models would have been very useful. There are references to such difficulties throughout the book, but there is no chapter or sub-section that summarizes them or deals specifically with this aspect. Second, I would have been interested to know more about modeling strategies in commercial software in addition to the research efforts being conducted at universities that are covered in the book. For instance, Autodesk has their Autodesk Foundation Classes (AFC); how different are these from the IFC being developed by the IAI? Or what about Graphisoft's Virtual Building Model that presumably integrates their design and construction, facilities management, and other applications? Needless to say, all this might well be proprietary information which the individual companies might not be willing to disclose. Still, some kind of information about the current state of the art of building modeling in commercial applications would have been insightful.

Despite these minor criticisms, I would conclude that "Building Product Models" is an excellent book. It makes an invaluable contribution to the field of building modeling, by formalizing it as a subject that can be taught and learnt, and giving it a foundation and a structure. Anyone working in this field should have this book.

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