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Department of computer science

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Associate Professor

Runhe HUANG

Publications (January 2002 ~ December 2002)

1. Tao Huang, Runhe Huang, and Jianhua Ma, *A Hybrid Negotiation Model for an E-trading System*, Journal of Three Dimensional Images, Vol.16, No.1, pp90-95, 2002.

Abstract — In this paper, a new negotiation model, called a hybrid negotiation model, is proposed. The hybrid negotiation model is a combination of an extended Bazaar model (a sequential decision making based Bayesian learning model) and a "lose bounded" Nash bargaining solution. With the proposed negotiation model, agents that represent buyers and sellers in the real-life can negotiate in an intelligent way to effectively and efficiently reach agreement and optimize their individual utility function, respectively, in a trading business. How learning in negotiations is proceeding and how common knowledge and public information are employed to make initial strategies of negotiations are described in details.

2. Runhe Huang, Tao Huang, Jianhua Ma, Takeshi Yamazaki, and Minetada Osano, *An Enhanced Extended Bazaar Model Based E-shopping System*, Journal of Three Dimensional Images, Vol.16, No.1, pp96-101, 2002.

Abstract — Currently, most online shopping systems are still limited to provide customers online access to a list of products, take customers' order and deal payments electronically online. Negotiations are not taken place among buyers, sellers, even wholesalers and vendors. However, negotiation modeling has been receiving increasing attentions from researchers in the fields of game theory, AI and distributed AI. With a reasonable negotiation model, shopping agents can negotiate intelligently on behalf of real-world's users to find a solution that maximizes the utility for all users. This paper presents an enhanced extended Bazaar model that is as a basis for shopping agents in negotiation process. It also demonstrates how a shopping agent negotiates intelligently with counter party regarding a product on behalf of a user it represents.

3. Y. Arai and Runhe Huang, *Agent Embedded in Distance Education System for General Learners VS Disabled Learners*, In the Proceedings of the International Workshop on Multimedia Distance Education Systems and Technologies (MDEST2002), pp444-451, USA, 2002.

Abstract — This paper focuses on the aspect of distance education system for all types of people that are including the disability learners. For the distance education system over the net to become one of the major learning systems, the area of education system provided for the disabled learners through this system should be focused on as well as

general learners. In this paper it proposes a system by spotlighting the idea of enhancing the brain hemisphere functions. The analysis of the brain usage level and the suitable training/lessons to enhance the unutilized area of the brain are incorporated to the existing distance education system.

4. R. Huang, T. Yamazaki and H. Ouchiyama, *Intelligent Shopping Negotiation Agents that can Adapt to User Preferences*, In the Proceedings of the 2002 U.K. Workshop on Computational Intelligence, pp74-80, September, UK. 2002.

Abstract — This paper presents intelligent shopping negotiation agents that can generate different negotiation model objects and adapts to different user preferences. First, user preferences should be acquired by any means and processed to be a set of parameters. Then the obtained user preference parameters are passed to the negotiation model object when the object is generated. Thus with different user preference parameters we can generate different negotiation models for different shopping agents that represents users in the real world.

5. H. Ouchiyama, T. Yamazaki and Runhe Huang, *An E-shopping System with Different Negotiation Models*, in the Proceedings of the first International Symposium on Cyber World (CW2002), pp311-317, November, Japan, 2002.

Abstract — This paper presents five different negotiation models, a constraint based negotiation, a goal oriented negotiation, a counter party RP based negotiation – original Bazaar model, a third party information based negotiation – extended Bazaar model, and a common/public information based negotiation – enhanced extended Bazaar model. It also explains for different users how different models can be matched. Finally, an e-shopping system architecture is presented and how the e-shopping system works is demonstrated.

6. T. K. Shih, L. Y. Deng, T-S Huang, Jianhua Ma and Runhe Huang, *Maintaining Persistent Look-and-Feel for Roaming User with Mobile Agent in Distributed*, in Journal of Advanced Software Research, 14 pages, December, 2002.

Abstract — In this paper, we proposed a tracking and persistent agent-based mobility management system in case of distance learning. The main purpose of our system is addressed to achieve the universal access objective. In order to let the whole mobility management system full play, firstly, we proposed a mobile agent communication model and the mobile agent evolution states. Secondly, we encapsulate the utility tools to be a role-setting object, which is an application-driven component that can provide customization benefits for user and match the user's demands.

Professor

Satoru S. Kano

Publications (January 2002 ~ December 2002)

1. S. S. Kano, Y. Zempo, T. Kasuga, and Y. Oyanagi, "Computational Physics", Vol.1 (295 pages), Vol.2 (447 pages), Japanese translation of the book by R. H. Landau, Asakura Shoten, Tokyo, 2001.

   Abstract — Help students master real-world problems as they develop new insight into the physical sciences. Problems in the physical sciences that once baffled and frustrated scientists can now be solved easily with the aid of a computer. Computers can quickly complete complex calculations, provide numerical simulations of natural systems, and explore the unknown. Computational Physics shows students how to use computers to solve scientific problems and understand systems at a level previously possible only in a research environment. Adaptable to a ten-week class or a full-year course, it provides C and Fortran programs that can be modified and rewritten as needed to implement a wide range of computational projects.

2. S. S. Kano, H. Kano and M. Ichimura, "Basic Calculus," Part 1 (229 pages) and Part 2 (388 pages), Japanese translation of the book by A. J. Hahn, Springer-Verlag, Tokyo, 2001 and 2002.

   Abstract — The approach to basic calculus is driven by the responses of the masters of mathematics to the important problems of their day. Part I develops calculus along with the necessary trigonometry and analytic geometry within a historical context, while Part II looks at more rigorous constructs and shows how calculus informs and enlightens in today's world of science, engineering, and business. This text is most suitable for a modern calculus course of intellectual substance, or an Honors Calculus or History of Mathematics course.

3. A. Bandara, S. S. Kano, K. Onda, S. Katano, J. Kubota, K. Domen, C. Hirose, and A. Wada, "SFG spectroscopy of CO/Ni(111): UV pumping and the transient hot band transition of adsorbed CO", Bull. Chem. Soc. Jpn., Vol. 75, 1125-1132, 2002.

   Abstract — Picosecond transient sum-frequency generation spectra of CO/Ni(111) were observed under irradiation of 266 nm UV pulse. Transient hot band (ν CO = 2 ← 1) transition of adsorbed CO was found by analysis based on a dipole-dipole interaction model with the coherent potential approximation.

4. J. Kubota, A. Wada, K. Domen and S. S. Kano, "Transient response of SFG spectra of D2O-ice/CO/Pt(111) interface with irradiation of ultra-short NIR pump pulses", Chem. Phys. Lett., Vol. 362, 476-482, 2002.

Abstract — A transient response, followed by a near-IR (NIR) pump pulse of 35 ps, of 10 molecular layers of D2O ice on CO/Pt(111) at 130 K in ultrahigh vacuum was investigated by sum frequency generation (SFG) spectroscopy. The D2O ice crystalline phase changed, without desorption of D2O to the gas phase, to an amorphous or a liquid-like phase due to the pumping, and it recovered to the crystalline phase in a sub nanosecond time scale.

Professor

Nobuhiko KOIKE

Publications (January 2002 ~ December 2002)

1. N. Fujii and N. Koike, " The Development of a Distributed Object Environment for Parallel and Distributed Systems", Proc. 8th International Conference on Distributed Multimedia Systems (DMS2002), pp. 40-45, September 2002,

Abstract — The development and initial evaluation of a distributed object environment, are discussed. Parallel and distributed processing have become popular thanks to the wide spread of PC clusters, broad-band LANs and WANs. The system aims at achieving both high-performance and enhanced distributed functionality. The author proposes a distributed object environment, which can combine two technologies and can realize a flexible and easy to implement software development system. Users can develop applications applying both parallel and distributed processing technologies, using high-level language, namely JAVA. JAVA is employed, because it gives us network wide functionalities, such as RMI (Remote Method Invocation) and SOAP (Simple Object Access Protocol). It hides users from cumbersome network related details and overcome the fire-wall barriers to communicate. The experimental system has been constructed on an LAN connected PCs and Myrinet connected PC cluster. Initial evaluation results, running a parallel sorting, are given.

Professor

Yamin LI

Publications (January 2002 ~ December 2002)

1. Yamin Li, Shietung Peng, and Wanming Chu, ``Metacube -- A New Interconnection Network for Large Scale Parallel Systems", *Australian Computer Science Communications*, Vol.24, No.3, 2002, Australian Computer Society, pp29-36.

Abstract — The hypercube has been widely used as the interconnection network for parallel computers. However, in hypercubes, the number of communication links for each node is a logarithmic function of the total number of nodes. Therefore, the hypercube is not a good candidate for an interconnection network for a very large parallel computer that might contain hundreds of thousands of nodes due to IC technology and port number limitations. This paper introduces a new interconnection network for very large parallel computers called metacube (MC). An MC network has a 2-level cube structure. An MC(k,m) network can connect 2^{m2^k+k} nodes with $m+k$ links per node, where k is the dimension of the high-level cubes (classes) and m is the dimension of the low-level cubes (clusters). An MC network is a symmetric network with short diameter, easy and efficient routing and broadcasting similar to that of the hypercube. However, an MC network can connect millions of nodes with up to 6 links per node. An MC(2,3) with 5 links per node has 16,384 nodes and an MC(3,3) with 6 links per node has 134,217,728 nodes. We describe the MC network's structure, topological properties and routing and broadcasting algorithms.

2. Yamin Li, Shietung Peng, and Wanming Chu, ``Efficient Communication in Metacube: A New Interconnection Network", Proceedings of the International Symposium on Parallel Architectures, Algorithms and Networks (I-SPAN 2002), Manila, Philippines, May 2002, IEEE Computer Society Press, pp165-170.

Abstract — This paper introduces a new interconnection network for very large parallel computers called metacube (MC). An MC network has a 2-level cube structure. An MC(k,m) network connects 2^{m2^k+k} nodes with $m+k$ links per node, where k is the dimension of a high-level cube and m is the dimension of low-level cubes (clusters). An MC network is a symmetric network with short diameter, easy and efficient routing similar to that of hypercubes. However, an MC network can connect more than one hundred of millions of nodes with only 6 links per node. Design of efficient routing algorithms for collective communications is the key issue for any interconnection network. In this paper, we also show that total exchange (all-to-all personalized communication) can be done efficiently in metacube.

3. Yamin Li and Shietung Peng, ``Algorithms of Routing and Matrix Multiplication on Dualcube", Proceedings of the Second International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD01), Nagoya Institute of Technology, Japan, Aug., 2001, pp422-429.

Abstract — Dualcube is an interconnection networks that has hypercube-like structure with the capacity to hold much more nodes than the conventional hypercube with the same number of links per node. The motivation of using dualcube as an interconnection network is to mitigate the problem of increasing the number of links in the large-scale hypercube network while keeps most of the topological properties of the hypercube network. In this paper, we focus on the design of efficient algorithms for routing and numerical operations on dualcube such as prefix computation, vector-matrix and matrix-matrix multiplications. Our results show that the routing and the basic numerical computations can be done on dualcube almost as fast as those on hypercube.

4. Wanming Chu and Yamin Li, ``Performance Evaluation of a Multiple-Threaded Multiple-Pipelined Java Processor", Proceedings of the 6th World Multiconference on Systemics, Cybernetics and Informatics (SCI 2002), Orlando, USA, July 14-18, 2002, Vol. V, Computer Science I, pp281-286.

Abstract — Executing Java bytecodes natively by high-performance Java processors has been becoming more attractive as network computing gains importance. This paper proposes a multiple-threaded multiple-pipelined Java processor architecture and presents the design and implementation of a tracer which gathers desirable information on the behavior of Java programs and an architectural simulator which investigates Java bytecode instruction/thread level parallelism and predicts the performance of the proposed processor. We use multiple pipelined functional units (FUs) to execute multiple bytecodes in parallel in our processor model. The types of FUs and the number of each type of FUs needed for executing Java bytecodes are also investigated. Our simulation results show that a Java processor with two issuing slots could achieve an average 5.86 IPC (instructions per cycle) performance. The simulator also predicts the utilization of FUs with different processor configurations. Since the processor configurations can be changed easily just by changing a configuration file, this simulator and the simulation results can be helpful for turning the processor design decisions.

5. Yamin Li, Shietung Peng, and Wanming Chu, ``Fault-tolerant Routing in Metacube", Proceedings of the Third International Conference on Parallel and Distributed Computing, Applications and Technologies (PDCAT'02), Kanazawa Bunka Hall, Kanazawa, Japan, September 2002, pp343-350.

Abstract — A new interconnection network with low-degree for very large parallel computers called metacube (MC) has been introduced recently. The MC network has short

diameter similar to that of the hypercube. However, the degree of an MC network is much lower than that of a hypercube of the same size. More than one hundred of millions of nodes can be connected by an MC network with up to 6 links per node. % The MC network has 2-level cube structure. An MC(k,m) network that connects 2^{m2^k+k} nodes with $m+k$ links per node has two parameters, k and m, where k is the dimension of the high-level cubes (classes) and m is the dimension of the low-level cubes (clusters). % In this paper, we give an efficient algorithm for fault-tolerant routing in MC networks. The fault-tolerant routing problem in MC(k,m) is solved through a special structure in an MC network, called multi-channel cube. In order to construct k disjoint paths for each node pair in a multi-channel cube, an innovative technique, called signature, is introduced.

6. Yamin Li, Shietung Peng, and Wanming Chu, ``Hamiltonian Cycle Embedding for Fault Tolerance in Dual-cube", Proceedings of the IASTED International Conference on Networks, Parallel and Distributed Processing, and Applications (NPDPA 2002), Tsukuba, Japan, October 2002, pp1-6.

Abstract — The hypercube has been widely used as the interconnection network (IN) in parallel computers. However, the major drawback of the hypercube is the increase in the number of communication links for each node with the increase in the total number of nodes in the system. A dual-cube DC(m) has $m+1$ links per node where m is the degree of a cluster (m-cube), one more link is used for connecting to a node in another cluster. The dual-cube mitigates the problem of increasing number of links in the large-scale hypercube network while keeps most of the topological properties of the hypercube network. Embedding a linear array or a ring into interconnection networks even when faulty-links exit is an important issue for the design of INs. In this paper, we show that a hamiltonian cycle exists in a DC(m) with up to $m-1$ faulty links. This is optimal because the degree of a DC(m) is $m+1$. We also give efficient algorithms for constructing hamiltonian cycles in DC(m).

7. Yamin Li, Shietung Peng, and Wanming Chu, ``From Dual-cube to Metacube: Efficient Low-Degree Alternatives to Hypercube", Proceedings of the First International Symposium on Cyber Worlds: Theory and Practice (CW 2002), November 2002, Tokyo, Japan. IEEE Computer Society Press, pp85-94.

Abstract — The hypercube has been widely used as the interconnection network in parallel computers. However, when dealing with the parallel computers of very large scale, the port limitation due to the technology greatly forbid the use of hypercube networks. The hypercube-based SGI Origin2000, a newly developed multiprocessor system, tried to solve this problem by introducing a Cray router. In this paper, we first describe a hypercube-like network, called dual-cube, that was motivated by the structure of Origin2000. A dual-cube DC(m) has $m+1$ links per node where m is the degree of a cluster (m-cube), one more link is used for connecting to a node in another cluster. The dual-cube mitigates the problem of port limitation in the large-scale hypercube network

while keeps most of the topological properties of the hypercube network. Then, we describe an interconnection network that extends dual-cube into a more general network called metacube. The metacube has a two-level cube structure with two parameters representing the dimensions of the two-level cubes. Metacube is much more flexible than dual-cube and can solve the port limitation problem completely. The dual-cube and metacube networks can be applied to SGI Origin2000 to connect large number of processors without using Cray router.

Professor

Shaoying LIU

Publications (January 2002 ~ December 2002)

1. Shaoying Liu, "Developing Quality Software Systems Using the SOFL Formal Engineering Method", Proceedings of 4th International Conference on Formal Engineering Methods (ICFEM2002), LNCS2495 Springer-Verlag, Shanghai, China, October 21-25, 2002, pp.3-19 (**keynote speech paper**).

   Abstract — Formal Engineering Methods are a bridge from Formal Methods to industrial applications. Inthis paper I describe the relation between formal engineering methods and formal methods, and present a specific formal engineering method SOFL (Structured Object-Oriented Formal Language) for developing quality software systems. I explain how SOFL can be applied in practice through examples.

2. Shaoying Liu, "Capturing Complete and Accurate Requirements by Refinement", Proceedings of 8th IEEE International Conference on Engineering of Complex Computer Systems, IEEE Computer Society Press, Greenbelt, Maryland, USA, December 2-4, 2002, pp. 57-67.

   Abstract — Complete and accurate functional requirements are the foundation for valid specification refinement and correctness verification of implemented software systems when they are developed with a formal method. However, capturing quality requirements is a difficult task, and there is a lack of well-defined and effective technique that solves the problem as well. In this paper we argue that the refinement technique used in conventional formal methods for transforming formal specifications into programs is actually an effective technique for capturing the functional requirements. We define the completeness of formal specifications and explain by examples how it can be achieved.

3. Shaoying Liu, "A Simulation Approach to Verification and Validation of Formal Specifications", Proceedings of First International Conference on Cyber World: Theory and Practice, IEEE Computer Society Press, November 6-8, 2002, pp. 113-120.

   Abstract — Specification simulation is an approach to verifying and validating specifications by well-selected sample data. In this paper we put forward a technique for simulation of formal specifications in order to detect potential faults and validate their desired functions. The important benefit of this technique is to allow us to simulate implicit specifications, which are usually defined with a pair of pre and postconditions and may not be executable. We discuss the ways of simulation case generation, evaluation of logical expressions, and simulation result analysis, and demonstrate how they are

applied in practice by examples.

4. Shaoying Liu, "A Rigorous Approach to Reviewing Formal Specifications", Proceedings of 27th IEEE/NASA Software Engineering Workshop, IEEE Computer Society Press, December 4-6, 2002, 7 pages.

   Abstract — I put forward a new approach to rigorously reviewing formal specifications to ensure their internal consistency and validity. This approach includes four steps: (1) deriving properties as review targets based on the syntax and semantics of the specification, (2) building a review task tree to present all the necessary review tasks for each property, (3) carrying out reviews based on the review task tree, and (4) analyzing the review results to determine whether faults are detected or not. I apply this technique to the SOFL specification language, which is an integrated formalism of VDM, Petri Nets, and Data Flow Diagrams to discuss how each step is performed.

5. Shaoying Liu, "Formal Engineering Methods for Information Systems Development", Proceedings of Second International Conference on INFORMATION (INFORMATION2002), Beijing, July 24-27, 2002, pp. 148-154 (invited paper).

   Abstract — With the rapid growing of deployment of information systems in almost every domain of our society, their reliability and efficiency have become one of our greatest concerns. Since modern information systems become more and more complex, their developments have become so difficult that the delivery of final products often falls behind the schedule and the cost often exceeds the budget. To tackle these problems effectively, we have been working on the integration of mathematical notation and commonly used comprehensible notation over last ten years to design the SOFL (Structured Object-oriented Formal Language) specification language and method for information systems development. As a specification language, SOFL integrates VDM-SL, Data Flow Diagrams, and Petri nets to provide an intuitive, rigorous, and comprehensible formal notation for specification. As a method, it combines Structured Methods and Object-Oriented Methods, and advocates an evolutionary approach to constructing specifications; it integrates the idea of formal proof and commonly used verification and validation techniques, such as testing and reviews, to offer rigorous but practical verification techniques. In this paper I present a three-step approach to constructing formal specifications for information systems, and demonstrate its effectiveness with a case study.

6. Shaoying Liu, Jin Song Dong, "Extending SOFL to Support Both Top-Down and Bottom-Up Approaches", Proceedings of 2002 IEEE International Conference on Systems, Man, and Cybernetics (SMC 2002), IEEE Computer Society Press, Hammamet, Tunisia, October 6-9, 2002, WA1Q2.

Abstract — This paper presents an integrated approach to support both top-down and bottom-up design of software systems by combining UML (Unified Modeling Language) and the Formal Engineering Method SOFL (Structured Object-oriented Formal Language). We demonstrate by examples that the top-down principle used in conventional Structured Design can be effectively utilized to carry out Object-Oriented design that is usually seen as a way to suit bottom-up analysis and design. Furthermore, we also explain how the integrated approach helps to improve the preciseness and understandability of design documentations.

7. Jin Song Dong, Shaoying Liu, "The Semantics of Extended SOFL", Proceedings of 26th Annual International Software and Application Conference, IEEE Computer Society Press, Oxford, England, 26-29 August 2002, pp. 653 –658.

   Abstract — Recently SOFL (Structured-Object-based-Formal Language) has been extended to a formal object-oriented language and method while keeping its structured features. This extension allows powerful object-oriented reuse mechanisms, such as class inheritance and object composition, to be utilized in the early design phases. This paper presents the semantics for this extended SOFL and further demonstrates the extendibility and reusability of the object-oriented approach to specifying the semantics of computer languages.

8. Shaoying Liu, "Integrating UML and SOFL for Object-Oriented Design", Proceedings of The Third International Conference on Computer and Information Technology(CIT2002), Aizu-Wakamatsu City, Japan, September 11 - 14, 2002, pp. 92-98.

   Abstract — This paper presents a decompositional approach to object-oriented design of software systems using a notation resulting from combination of UML (Unified Modeling Language) and SOFL (Structured Object-oriented Formal Language). We use examples and case studies to explain how traditional Structured Design can be effectively applied to carry out object-oriented design that is usually seen as a way to support bottom-up analysis and design.

9. Shaoying Liu, "An Approach to Transforming Visual Formal Specifications to Java Programs", Proceedings of The Third International Conference on Computer and Information Technology (CIT2002), Aizu-Wakamatsu City, Japan, September 11 - 14, 2002, pp. 116-123.

   Abstract — Condition Data Flow Diagrams is a formalized notation used in SOFL (Structured Object-Oriented Formal Language) for systems specification. It was developed by integrating conventional Data Flow Diagrams, Petri Nets, and pre-post notation. In this paper we describe a method for transformation of Condition Data Flow

Diagrams into Java programs by defining transformation strategy and rules, and discuss their applications with examples.

10. Shaoying Liu, "A Top-Down Approach to Identifying and Defining Words for Lyee Using Condition Data Flow Diagrams", Proceedings of 2002 Lyee International Workshop (Lyee-W02), IOS international publisher, Paris, France, October 3- 5, 2002, pp. 75-87.

Abstract — We present a top-down approach to identifying and defining words for the Lyee system using the visual formalism known as Condition Data Flow Diagram used in the SOFL (Structured Object-Oriented Formal Language) formal engineering method. The proposed technique can facilitate the analyst to effectively identify the necessary words as outputs of operations in a structured manner and to represent the relations among words in a visual formalism.

Associate Professor

Michael McDONALD

Publications (January 2002 ~ December 2002)

1. M. McDonald, "English Training for IT Researchers and Students in Japan," *Journal of the IEICE*, Vol. J85, No. 9, pp. 696-699, September 2002.

Abstract — Technical English education in Japan often fails to prepare students adequately for the tasks they face in their professional careers. Some of the reasons for this lie in the Japanese approach to education as a whole, while others are more specific, such as a lack of good technical English study materials and a lack of focus on the features of technical genres. A satisfactory technical English education should be (1) focused on the students' needs, (2) at their level, (3) stimulating, (4) in English, and (5) aimed at learning through English, not about English. The author describes how he has attempted to meet these aims in teaching English to researchers, advanced undergraduates, and freshmen undergraduates in a computer science research laboratory and computer science departments at two universities.

Professor

Tetsuo MIZOGUCHI

Publications (January 2002 ~ December 2002)

1. T. Mizoguchi, 'Routing Policy (IDRP; Inter-Domain Routing Protocol)', ICAO Asia/Pacific Fourth ATN Transition Task Force meeting, Mumbai, India, 8-12,Apr., 2002

   Abstract — For the future Aeronautical Telecommunication Network, the Routing Policy among the routers of the Ground networks in the Asia/Pacific Region plays the important role. The paper proposed the criteria to be implemented for the routing policy within the Backbone BIS as well as the Non-Backbone and End BIS.

2. T. Mizoguchi, 'Technical Documents for ATN Performance', ICAO Asia/Pacific Fourth ATN Transition Task Force meeting, Mumbai, India, 8-12,Apr., 2002

   Abstract — The Performance issue has the tremendous impacts on the implementation of any information systems. The paper addresses the importance of the establishment of Operational Performance Requirements and proposes the first cut of Performance Parameters Values for the Air-Ground Operational Performance.

3. T. Mizoguchi, 'Technical Documents for ATN Performance', ICAO Asia/Pacific Twelfth ATS/AIS/SAR Sub-Group meeting, Bangkok, Thailand, 24-28,Jun., 2002

   Abstract – Since the paper of the same title presented at the ATN Transition Task Force Meeting, it is proposed to present the paper with the modification for ATS (Air Traffic Services) to ATS related meeting. The paper emphasizes the Operational Performance Requirements and the urgent needs to establish them before any implementations.

4. T. Mizoguchi, 'Technical Documents for ATN Performance', ICAO Asia/Pacific Sixth CNS/MET Sub-Group meeting, Bangkok, Thailand, 15-19,July, 2002

   Abstract — Since the paper of the same title presented at the ATN Transition Task Force Meeting, it is proposed to present the paper with the modification for Communication to CNS related meeting. The paper emphasizes the Operational Performance Requirements and the urgent needs to establish them before any implementations.

5. T. Mizoguchi, 'Progress Report for ATN Performance', ICAO Asia/Pacific ATN Transition Task Force Working-Group meeting, Canberra, Australia, 18-22, Nov., 2002

   Abstract — The current activities related to the Performance issues among various organizations are summarized and the paper shows the progress on documenting the Technical Materials on Performance.

Professor

Ikuo NAKATA

Publication (January 2002 ~ December 2002)

1. H. Itoga, T. HARAIKAWA, Y. YAMASHITA, and I. NAKATA "Register Allocation Methods of Improved Software Pipelining for Loops with Conditional Branches," *The Transactions of the Institute of Electronics, Information and Communication Engineers D-I*, Vol. J85-D-I No. 1, pp. 31-39, January 2002.

Abstract — The code of improved software pipelining for loops with conditional branches usually becomes large and complex. The register interference graph for such a code also becomes large and complex. To reduce the complexity of register allocation problem for such a code, and to reduce the time for register allocation, we proposed the method to combine interference graphs of similar program segments and showed the effectiveness of our methods.

Professor

Kenji OHMORI

Publications (January 2002 ~ December 2002)

1. W. Li and K.Ohmori. "Hierarchical Visualization of 3-Dimensional Objects Using Cellular Structured Spaces", *Workshop on ITS and Image Processing*, Sapporo Japan, pp239-244, January 2002 (in Japanese)

   Abstract — Three-dimensional computer graphics is currently visualized on a computer display, using the technology of polygonization modeling with a single layer structure. However, characteristic properties of objects cannot be preserved by a single layer structure. Therefore, this paper describes how to build data structure of objects with multiple-layered structure. Cell structured spaces give means of a cell model for representing abstract classes of an object, and are helpful as effective tools for expressing the abstract model of visualization.

2. Kenji Ohmori and W. Li. "Shape Modeling Using Cellular Structured Spaces", International Symposium on Cyber Worlds: Theories and Practices, Tokyo Japan, pp447-454, November 2002

   Abstract — Abstraction is one of the most important concepts in computer science. It has been realized in object oriented programming as the form of class hierarchy. In this paper, new abstraction levels are introduced. This abstraction level can be applied in many fields of computer science, including computer graphics, image processing, database systems and design automation. In this paper the new abstraction level consists of homotopy, topological spaces, cellular structured spaces and Euclidean spaces. A teacup is used as an example of shape modeling using these abstraction levels.

Professor

Akira K. ONOMA

Publications (January 2002 ~ December 2002)

1. George T. Wang, F. Xie, F. Tsunoda, H. Maezawa and A. K. Onoma, "Web Search with Personalization and Knowledge," Proceeding of IEEE Fourth International Symposium on Multimedia Software Engineering, MSE2002, 11-13 December 2002, Newport Beach, California, USA. pp.90-97, IEEE Computer Society, Los Alamitos CA., December 2002

Abstract — Although many search engines provide relevantly good search results to the users, they do not consider personal, domain-specific preferences in their searching or ranking algorithms. In an intranet environment we could collect the background information about the users such as their expertise. If we can accumulate, categorize and personalize web usage information, it can be used to help the user search web pages efficiently and effectively. Data analysis and mining can further facilitate web searching in an intelligent way. This paper describes Internet Search Advisor (ISA), a personalized, knowledge-driven search system that helps the user find the informative web sits. The ISA supports multi-dimensional data analysis and data mining based on association rules and sequential patterns.

2. Akira K. Onoma and Tsuneo Yamaura, "University Software Education matched to Social Requests," Proceeding of IEEE 1st International Symposium on Cyber Worlds (CW2002), 11/6-8, Tokyo Japan, pp.331-336, IEEE Computer Society, Los Alamitos CA. November 2002

Abstract — We raised issues of how the software education matching to a social request should be carried out in universities in this cyber-world era.

In the high-tech era, it is unavoidable that almost all the high-tech products are provided as black-box. For this reason, it, too, is unavoidable that the education in high-tech era will, in stead of extracting the befit of the high-tech stuff, force us to memorize the ``manners" which were institutionalized by a few high-tech gurus.

As basic tools, everybody has to learn word processors, such as Word and Ichitaro, PowerPoint and Excel, and LaTeX including tgif. On the other hand, special subjects, such as programming languages, programming language theory, compiler theory, OS theory, DBMS, Internet technology, business models, and software engineering are needed when becoming a software specialist. Mathematics, such as differentiation integral calculus, and physics, such as general dynamics must be also required as liberal arts of software science. The laws related to the patent, copyright, and accountancy for a floatation, and the logical thinking method are the subjects which should be studied as an application subject.

In order to prepare the educational environment to study this wide scope of subjects,

we must tackle the issues such as restriction of the number of credits and maintenance a lecturer's staff. Such issues may be solved by applying less strict criteria when hiring lecturers, reexamining of the whole curriculum, or changing the system of company examination when employing new hires. This paper shows some proposals and remedies applicable to the universities in Japan.

3. Akira K. Onoma, Wei-Tek Tsai and Tsuneo Yamaura, "Hypothesis Testing for Module Test in Software Development," Proceeding 26th Annual International Computer Software and Applications Conference (COMPSAC02), 8/26-29, 2002, Oxford UK, pp. 829--834, IEEE Computer Society, Los Alamitos CA. August 2002

Abstract — One of the most important issues in the software development is how to guarantee that the software satisfies the quality defined in the requirement specification. This paper proposes that the issue can be solved, first the number of test cases is statistically calculated from the failure density defined in the requirement specification, then the selected test cases are executed basing on the hypothesis testing.

This paper also presents how our method can be used for debugging. When the number of the test cases is calculated, we applied the statistical behavior of the software quality to the integration testing. We, however, did not consider the ripple effect since it is unable to measure.

In order to guarantee the quality of 4 sigma and 5 sigma, we found that many more test cases are needed than is previously believed enough.

4. Ohara, S., F. Tsunoda, H. Maezawa, A. K. Onoma, M. Hui, T. Wang, P.C-Y. Sheu, and R. Paul, "A Software Test and Evaluation Environment on Longitudinal Database", International Journal of Software Engineering and Knowledge Engineering 12(3), pp.223-244, June 2002

Abstract — To assure the quality of software by running test cases and evaluating the results is one of the difficult parts of the entire software development project. The difficulty usually comes from the lack of appropriate supporting tools and the complexity of the software. In the past ad hock supporting tools were made for each project and test results were usually not used across projects. This conventional way of test and evaluation (T&E) is time consuming, and the most importance decision "When is this software ready to ship?" is left to the engineers depending on their experiences. Our object snapshots and other information are accumulated in a database. These longitudinal data can be automatically tracked and analyzed to provide decision support information. As a results, test results can be reviewed repeatedly and software quality can be assured by analyzing these data from various perspectives.

Professor

Shietung PENG

Publications (January 2002 ~ December 2002)

1. Y. Li, S. Peng, and W. Chu, "A New Interconnection Network for Large Scale Parallel Systems," Australian Computer Science Communications, Vol.24, No.3, page 29 - 36, Jan. 2002

Abstract — & The hypercube has been widely used as the interconnection network for parallel computers. However, in hypercubes, the number of communication links for each node is a logarithmic function of the total number of nodes.

Therefore, the hypercube is not a good candidate for an interconnection network for a very large parallel computer that might contain hundreds of thousands of nodes due to IC technology and port number limitations. This paper introduces a new nterconnection network for very large parallel computers called metacube (MC). An MC network has a 2-level cube structure. An MC network is a symmetric network with short diameter, easy and efficient routing and broadcasting similar to that of the hypercube. However, an MC network can connect millions of nodes with up to 6 links per node. An MC(2,3) with 5 links per node has 16,384 nodes and an MC (3,3) with 6 links per node has 134,217,728 nodes. We describe the MC network's structure, topological properties and routing and broadcasting algorithms.

2. Y. Li, S. Peng and W. Chu , "Efficient Communication in Metacube: A New Interconnection Network," Proceedings of the International Symposium on Parallel Architectures, Algorithms and Networks (I-SPAN 2002), IEEE Computer Society Press, page 165 - 170, May 2002.

Abstract — This paper introduces a new interconnection network for very large parallel computers called metacube (MC). An MC network is a symmetric network with short diameter, easy and efficient routing similar to that of hypercubes. However, an MC network can connect more than one hundred of millions of nodes with only 6 links per node. Design of efficient routing algorithms for collective communications is the key issue for any interconnection network. In this paper, we also show that total exchange (all-to-all personalized communication) can be done efficiently in metacube.

3. Y. Li, S. Peng, "Multinode Broadcasting in Metacube", the 3rd ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD'02), page 401 - 408, May 2002, Madrid, Spain

Abstract — A new interconnection network for very large parallel systems called

metacube (MC) has been introduced recently. An MC(k,m) network has 2^{m2^k+k} nodes with $m+k$ links per node, where k is the dimension of the high-level cubes and m is the dimension of the low-level cubes.For example, an MC (3,3) with 6 links per node can connect more than one hundred of millions of nodes, extremely larger than that of hypercube. Meanwhile, the MC network is a symmetric network and retains the main structures and desirable properties of the hypercube. In this paper, we give efficient algorithms for multimode broadcasting in MC networks. The time complexities of the routing and broadcasting algorithms are analyzed and compared with that of hypercube algorithms. Our results show that the routing and multimode broadcasting can be done efficiently in MC networks.

4. Y. Li, S. Peng, W. Chu, "Fault-tolerant Routing in Metacube", the Third International Conference on Parallel and Distributed Computing, Applications and Technologies (PDCAT'02), page 343 - 350, Sept. 2002, Kanazawa Bunka Hall, Kanazawa, Japan

Abstract — A new interconnection network with low-degree for very large parallel computers called metacube (MC) has been introduced recently. The MC network has short diameter similar to that of the hypercube. However, the degree of an MC network is much lower than that of a hypercube of the same size. More than one hundred of millions of nodes can be connected by an MC network with up to 6 links per node. The MC network has 2-level cube structure. An MC(k,m) network that connects 2^{m2^k+k} nodes with $m+k$ links per node has two parameters, k and m, where k is the dimension of the high-level cubes (classes) and m is the dimension of the low-level cubes (clusters). In this paper, we give an efficient algorithm for fault-tolerant routing in MC networks. The fault-tolerant routing problem in MC(k,m) is solved through a special structure in an MC network, called multi-channel cube. In order to construct k disjoint paths for each node pair in a multi-channel cube, an innovative technique, called signature, is introduced.

5. Y. Li, S. Peng, W. Chu, S. Li, "Hamiltonian Cycle Embedding for Fault Tolerance in Dual-cube", the IASTED International Conference on Networks, Parallel and Distributed Processing, and Applications (NPDPA 2002), page 1 - 6, October 2002, Tsukuba, Japan

Abstract — The hypercube has been widely used as the interconnection network (IN) in parallel computers. However, the major drawback of the hypercube is the increase in the number of communication links for each node with the increase in the total number of nodes in the system. A dual-cube DC(m) has $m+1$ links per node where m is the degree of a cluster (m-cube), one more link is used for connecting to a node in another cluster. The dual-cube mitigates the problem of increasing number of links in the large-scale hypercube network while keeps most of the topological properties of the hypercube network. Embedding a linear array or a ring into interconnection networks even when faulty-links exit is an important issue for the design of INs. In this paper, we show that a

hamiltonian cycle exists in a DC(m) with up to $m-1$ faulty links. This is optimal because the degree of a DC(m) is $m+1$. We also give efficient algorithms for constructing hamiltonian cycles in DC(m).

6. Y. Li, S. Peng, and W. Chu, "From Dual-cube to Metacube: Efficient Low-Degree Alternatives to Hypercube", The First International Symposium on Cyber Worlds: Theory and Practice (CW 2002), page 85 - 94, November 2002, Tokyo, Japan

Abstract — The hypercube has been widely used as the interconnection network in parallel computers. However, when dealing with the parallel computers of very large scale, the port limitation due to the technology greatly forbid the use of hypercube networks. The hypercube-based SGI Origin2000, a newly developed multiprocessor system, tried to solve this problem by introducing a Cray router. In this paper, we first describe a hypercube－like network, called dual－cube that was motivated by the structure of Origin2000. A dual-cube DC(m) has $m+1$ links per node where m is the degree of a cluster (m-cube), one more link is used for connecting to a node in another cluster. The dual-cube mitigates the problem of port limitation in the large-scale hypercube network while keeps most of the topological properties of the hypercube network. Then, we describe an interconnection network that extends dual-cube into a more general network called metacube. The metacube has a two-level cube structure with two parameters representing the dimensions of the two-level cubes. Metacube is much more flexible than dual-cube and can solve the port limitation problem completely. The dual-cube and metacube networks can be applied to SGI Origin2000 to connect large number of processors without using Cray router.

Professor

Yuji SATO

Publications (January 2002 ~ December 2002)

1. Y. Sato, "Proposal for a Field-evolvable Hardware Based on a Microprocessor Incorporated with Flash Memory," *IPSJ Transactions on Mathematical Modeling and Its Applications*, Vol. 43 No. SIG 10 (TOM 7), pp. 70-77, November 2002. (in Japanese)

   Abstract — A new idea for evolvable hardware based on a microprocessor is proposed. In recent years, there has been much research using Programmable Logic Devices (PLD) and Field Programmable Gate Arrays (FPGA). In particular, the application of digital circuit evolution to engineering fields has already begun. On the other hand, long learning time, difficulty to predict when an effective capability will appear, large chip size and other such problems have hindered progress in diffusion into engineering fields. Here, we propose register transfer level evolution performed on a microprocessor as a means of addressing these problems.

2. K. Kobayashi, Y. Satou, H. Kurata, K. Katayama, T. Kawahara "Nonvolatile Semiconductor Memory and Method for Managing Information in Information Distribution System," *Taiwan Patent* 90111842 (WO 01/95115 A1), Field May 17, 2001, Issued October 7, 2002.

   Abstract — A semiconductor memory in which an area where an authentication key is stored and an access limitation is placed is resettable and an information distribution system including the same and having a high-degree security function are disclosed. Information about an area where an authentication key is stored and an access limitation is placed is stored in a part of a storage area of the semiconductor memory. Alternatively, an authentication key is stored for each unit of data to be authenticated and an access limitation on stored information is placed. By such a method, encrypted information is stored in an area where access limitation is placed, thereby realizing double information protection.

3. Y. Sato, "Voice Conversion Using Interactive Evolution of Prosodic Control", *Proc. of the 2002 Genetic and Evolutionary Computation Conference*, Morgan Kaufmann Publishers, pp. 1204-1211, New York, USA, July 2002.

   Abstract — This paper proposes the application of evolutionary computation, a stochastic search technique that parallels the evolution of living organisms, to parameter adjustment for voice conversion, and reports on several experimental results applicable to the fitting of prosodic coefficients. Here, because of the difficulty involved in providing a

clear fitness function for evaluating evolutionary computation, we adopt a system of interactive evolution in which genetic manipulation is repeated while evaluation is performed subjectively based on human feelings. It was found that the use of evolutionary computation achieves voice conversion closer to the target in question than parameter adjustment based on designer experience or trial and error, and that degradation in sound quality is relatively small giving no impression of a processed voice.

This research was introduced in the British Science Magazine New Scientist, in July 20, 2002. (http://www.newscientist.com/news/news.jsp?id=ns99992560)

4. R. Goto and Y. Sato, "Application of Genetic Algorithms to Motion Analysis of a Moving Object", *Proc. of the 2002 Congress on Evolutionary Computation*, IEEE Press, pp. 765-770, Honolulu, Hawaii, May 2002.

Abstract — In a previous report, we demonstrated the effectiveness of genetic algorithms in tracking a moving object with a destination as it attempts to camouflage its movement to avoid pursuit or attack. In this paper, we take up more complex object motion and show that a system that applies genetic algorithms has a high possibility of obtaining solutions with good accuracy compared to the conventional system.

Professor

Hiroshi HANAIZUMI

Publications (January 2002 ~ December 2002)

1. H.Hanaizumi, and K. Ohmori, "Development of A 3D Skeletonizing Algorithm and Its Applicaiton," Technical report of IEICE, MI2001-73, pp. 89-94, January 2002.

Abstract — In order to construct a screening system in which multitemporal 3D helical CT data are registered and shape changes of vessels during the period are detected, we propose an algorithm using Homotopy for recognizing vessels and bronchus in lung. This algorithm is one of region growing algorithms and we call it as successive region growing (SRG). The algorithm successively expands cross sections from the start point to end of vessels and skeleton of the vessel is obtained as trace of gravity centers of each cross section. Since SRG is very sensitive, it may yield false branches for a noisy surface. These false branches are successfully removed by using an index Significance of the branch. In the case of bronchus recognition, terminal point of its small branch may connect to outer lung in terms of boxel density and the connection causes mis-recognition of branches. For avoiding the mis-recognition, SRG automatically detects the connection and stops itself. In this paper, we describe the principle and the procedure of SRG. The application results of SRG to actual multitemporal 3D CT images are also shown.

Professor

Munetake ICHIMURA

Publications (January 2002 ~ December 2002)

1. M. Ichimura and K. Kawahigashi, "Pionic Modes Studied by Quasielastic (p,n) Reactions," *Challenge of Nuclear Structure*, (World Scientific Publishing Co. Singapole, 2002), pp.531-538

Abstract — It has long been expected that the pionic modes show some collective phenomena such as the pion condensation in the high density nuclear matter and its precursor phenomena in the ordinary nuclei. Here we show an evidence of the precursor observed in the isovector spin longitudinal cross sections ID_q of the quasielastic 12C, 40Ca (p, n) reactions at T_p = 346 and 494MeV with the momentum transfer q = 1.7fm^{-1}. Another aim of this report is to evaluate the three kinds of Landau-Migdal parameters at the large momentum region from these reactions. We obtained g'_{NN} = 0.6-0.7, g'_{NΔ} = 0.3-0.4. The results are consistent with those at the small momentum region, which are obtained from the Gamov-Teller strength distribution.

2. M. Ichimura and K. Kawahigashi, "Enhancement of Pionic Modes in the Quasielastic Region," *Heavy Ion Physics*, Vol. 16 (2002) pp45-52.

Abstract — We found an evidence for the precursor phenomena of the pion condensation in the enhancement of the spin longitudinal cross sections of the quasielastic region. They are observed by 12C, 40Ca(p, n) quasielastic scatterings at the incident energy 494 and 346MeV around transferred momentum close to the critical one of the pion condensation.We utilized the distorted wave impulse approximation incorporated with the continuum random phase approximation. We adjusted the Landau-Migdal parameters and obtained g'_{NN} = 0.6-0.7 and g'_{NΔ} = 0.3-0.4, which are consistent with those obtained from the energy of the Gamov-Teller giant resonance and the quenching factor of the Gamov-Teller sum rule.

Professor

Tsuneo IKEDO

Publications (January 2002 ~ December 2002)

1. T. Ikedo, "A Single Chip Graphics Processor of a Billion Polygons Performance", Proceedings of An International Symposium on Low-Power and High-Speed Chips, Cool Chips V., Vol.1 (IEICE, IEEE, ACM Corporations), pp.319 – 326, April, 2002

   Abstract — Multimedia systems supporting integration of multimodal, synthetic imagery with digital audio and video data streams require multigranular, parallel processing to meet growing demands on the performance of such systems. Multimedia environments that include realistic scenes will depend upon advanced realtime graphic rendering technology that is currently unavailable, but will soon be possible using ULSI with 10s of millions of gates. This paper describes various modules of graphics functions embedded within a single chip.

2. T. Ikedo, "A Realtime Anti-Aliased Soft-Shadow Casting Renderer", Internet Journal of 'Computer Graphics & Geometry' Vol.4, No.2, Consortium "Geometrical Education in New Information Technologies" http://www.ogg.ru/, 22 pages, Oct. 2002

   Abstract — A renderer for realtime soft shadow casting on the basis of a two-pass z buffer (shadow mapping) has been developed, embedded within an ASIC. Functions for erosive and penumbra effects, along with a filtering method for shadow polygons to generate soft shadows and shadows from transparent objects, are newly defined. The renderer consists purely of hardware modules, including multiple shadow buffers, bi-directional IIR filters, and intensity modulation circuits, involving textured and bump-mapped light-reflection shaders. It produces a shadowed pixel at 0.8ns per pixel (1.2 billion pixels), comprising a fully unidirectional pipeline architecture.

3. T. Ikedo, "Technologies for Creating Realistic Sights in Future Multimedia Systems" Journal of IEEE Multimedia, Vol.9, N0.4, pp.56 – 72, Oct-Dec., 2002

   Abstract — The heaviest workload of Multimedia system has been considered on the medium and fine-grain processing for sight and audio rendering. One of the solutions to get both realtime and reality in this area is how to cooperate the software and hardware technologies. The paper describes focusing on the hardware algorithms and architectures of light-reflection shading, shadow casting, antialiasing and amorphous object rendering, in order to obtain a realtime augmented reality environments in future multimedia system. These modules perform rendering speed of a billion polygons per second.

Professor

Tosiyasu L. KUNII

Publications (January 2002 ~ December 2002)

1. Masayuki Hisada, Alexander G. Belyaev, and Tosiyasu L. Kunii, "Towards A Singularity-Based Shape Language: Ridges, Ravines, and Skeletons for Polygonal Surfaces", *Soft Computing*, Vol. 7, No. 1, 2002, pp. 45-52, Springer-Verlag, Heidelberg, Germany.

Abstract — High demands on digital contents have posing strong needs on visual languages on three-dimensional (3D) shapes for improved human communication. For a visual language to effectively communicate essential 3D shape information, shape features defined in terms of singularity signs have been recognized as key shape descriptors. In this paper, we study salient shape features defined via distance function singularities: ridges, ravines, and a skeleton. We propose a method for robust extraction of the 3D skeleton of a polygonal surface and detection of salient surface features, ridges and ravines, corresponding to the skeletal edges. The method adapts the three-dimensional Voronoi diagram technique for skeleton extraction, explores singularity theory for ridge and ravine detection, and combines several filtering methods for skeleton denoising and for selecting perceptually salient ridges and ravines. We demonstrate that the ridges and ravines convey important shape information and, in particular, can be used for face recognition purposes.
Key words and phrases: Polygonal surface, 3D Voronoi diagram, Skeleton, Ridges and ravines.

2. Yoshihisa Shinagawa, Ryoji Kawamichi, Tosiyasu L. Kunii and Shegeru Ohwada, "Developing Surfaces", Proceedings of the International Conference on Shape Modeling and Applications, May 17-22, 2002, Banff, Canada}, pp.253-260, IEEE Computer Society Press, Los Alamitos, California, May 2002.

Abstract — To transform a three-dimensional object or to map texture to its surface, it is necessary to introduce a coordinate system. If the surface can be cut and developed, it is easy to identify each point on the surface with the coordinate values. According to a theory in topology, any closed polygonalized two-dimensional surface can be represented by a canonical development. However, no efficient algorithm to actually develop a given surface has been presented, and theory sounds abstract. This paper proposes a method to develop an arbitrary polygonal closed surface and to establish the correspondence between each point on the surface and a point on a regular polygon. Educational software is developed using the algorithm that visualizes the coordinate system by texture mapping or by allowing a user to paint on the surface.

Key words and phrases: development, algebraic topology, groups, homology, texture mapping, transformation.

3. Galina Pasko, Alexander Pasko, Makoto Ikeda and Tosiyasu L. Kunii, "Bound Blending Operations", Proceedings of the International Conference on Shape Modeling and Applications, May 17-22, 2002, Banff, Canada, pp.95-103, IEEE Computer Society Press, Los Alamitos, California, May 2002.

Abstract — New analytical formulations of bounded blending for functionally defined set-theoretic operations are proposed. The blending set operations are defined using R-functions and displacement functions with localized area of influence. The shape and location of the blend is defined by control points on the surfaces of two solids or by an additional bounding solid. The proposed blending using a bounding solid can be applied to a single selected edge or vertex. We introduce new types of blends such as a multiple blend with the disconnected bounding solid and a partial edge blend.

4. Noriko Kitani and Tosiyasu L. Kunii, "Web-based Design Databases", Proceedings of NICOGRAPH International 2002, May 30, 2002, Tokyo, Japan, pp.103-114, The Society for Art and Science, May 2002.

Abstract — A new flexible and well-defined method was developed to turn objects in the real world, designed to satisfy users' taste, into reusable design resources on the Web by virtually decomposing the original design into parts. We show that we can repeat design processes efficiently by storing the information on part cell attachment as design information as well as by making the cell design processes of the parts homotopically equivalent. We then show the possibility of a new architecture of Web-based design databases management systems to support flexible design and redesign. To demonstrate the power of the new method, bag design is selected as an example
Key words and phrases: Web-based design databases, cell model, cell attachment, cell decomposition, homotopy equivalence, redesign.

5. Valery Adzhiev, Elena Katasheva, Tosiyasu L. Kunii, Alexander Pasko and Benjamin Schmitt, "Cellular-Functional Modeling of Heterogeneous Objects", Proceedings of 7th ACM Symposium on Solid Modeling and Applications, June 17-21, 2002, pp. 192-203, ACM Press, 1515 Broadway, New York, NY, 10036, USA.

Abstract — The paper presents an approach to modeling heterogeneous objects as multidimensional point sets with multiple attributes (hypervolumes). A theoretical framework is based on a hybrid model of hypervolumes combining a cellular representation and a constructive representation using real-valued functions. This model allows for independent but unifying representation of geometry and attributes, and makes it possible to represent dimensionally non-homogeneous entities and their cellular

decompositions. Hypervolume model components such as objects, operations and relations are introduced and outlined. The framework's inherent multidimensionality allowing, in particular, to deal naturally with time dependence promises to model complex dynamic objects composed of different. Attributes given at each point can represent properties of arbitrary nature (material, photometric, physical, statistical, etc.). To demonstrate a particular application of the proposed framework, we present an example of multimaterial modeling – the multilayer geological structure with cavities and wells. Another example illustrating the treatment of attributes other than material distributions is concerned with time-dependent adaptive mesh generation where the function representation is used to describe object geometry and density of elements in the cellular model of the mesh. The examples have been implemented with using a specialized modeling language and software tools being developed by the authors.
Key words and phrases: Multidimensional point sets, attributes, heterogeneous models, function representation, cellular representation, volume modeling.

6. Toshio Kodama and Tosiyasu L. Kunii, "Homotopic Database Animation", Proceedings of Computer Animation 2002 (June 19-21, 2002, Geneva, Switzerland) pp. 89-97, IEEE Computer Society Press, Los Alamitos, California, U. S. A.

Abstract — Very large databases on the Web have been changing dynamically and have become complicated today. This research aims at helping users' understanding of database changes by database animation. As a case study, animating budget management of one company is researched. It shows clearly that database animation help understand the flow of plans and the distribution of the whole budget. Furthermore, it has shown that reverse animation by preserved homotopy realizes the effective reuse of databases.
Key words and phrases: database animation, cellular databases, homotopic animation, homotopy, cellular model.

7. Tosiyasu L. Kunii, "Cyber Graphics", Proceedings of the First International Symposium on Cyber Worlds (CW2002), November 6-8 2002 Tokyo, Japan, pp. 3-7, IEEE Computer Society Press, Los Alamitos, California, November 2002.

Abstract — Cyber graphics as an emerging technology has been playing key roles as human interfaces of cyber worlds. With the ever increasing roles of cyber worlds in the real world, as seen in e-financial trading that deals GDP-equivalent in a day, understanding of cyber graphics is becoming essential. To this end, scientific research has been conducted to grasp the foundation as invariants. Cellular modeling has been found to be of key importance. The adjunction spaces and cell attaching functions of cyber graphics are investigated through varieties of examples to find out the invariants successfully.
Key words and phrases: adjunction spaces, cell attaching functions, a hierarchy of invariants, cellular spatial structures.

8. Pizzanu Kanonchoiyos, Tomoyuki Nishita, Yoshihisa Shinagawa, and Tosiyasu L. Kunii, "Topological Morphing Using Reeb Graphs", Proceedings of the First International Symposium on Cyber Worlds (CW2002), November 6-8 2002 Tokyo, Japan, pp. 465-471, IEEE Computer Society Press, Los Alamitos, California, November 2002.

Abstract — Metamorphosis between 3D objects is often the transformation between a pair of shapes that have the same topology. This paper presents a new model using Reeb graphs and their contours to create morphing between 3D objects having different topology. The proposed method specifies the correspondence between of the input objects by using the graph isomorphic theory. Then the super Reeb graph, which has the equivalent topological information to the Reeb graphs of the two input objects, is constructed and used to conduct the sequence of the morphing. The evolutions of the topology that occur during the morph can be specified by the transformation of the Reeb graphs and their contours of the input objects. Reeb graph-based modeling allows the users precisely and intuitively control the morph because the topological information of the objects, represented by the structures of the Reeb graphs, is explicit and easy to understand. Moreover, the contours of the Reeb graphs also represent the geometrical information of the objects. The examples of morphing between different topological shapes are demonstrated.
Key words and phrases: 3D morphing, topological evolutions, Reeb graphs.

9. Kazuteru Matsumoto and Tosiyasu L. Kunii, "A Cellular Design System for Soft- and Varied Sized- Objects", Proceedings of the First International Symposium on Cyber Worlds (CW2002), November 6-8 2002 Tokyo, Japan, pp. 386-393, IEEE Computer Society Press, Los Alamitos, California, November 2002.

Abstract — After we sketch the design of a product on the Web, we can obtain each part of the product applying a cell decomposition to the sketched design based on the cellular model operations and then applying the homotopy theory to it. When we perform cell decomposition, we can specify the manufacturing procedures of a product as homotopy invariants based on the homotopy theory. Using the parts and the manufacturing procedures of a product, and cell attaching functions accumulated in the cellular design database while these procedures are applied, we show first that we can perform the real design of soft objects, the shapes of which are constantly changing. We then show that the cellular model also can uniformly specify varied sizes. Thus, the cellular model is far more powerful than existing geometric models. The design of bags is taken as an example of soft object and varied sized object design.
Key words and phrases: 3D morphing, topological evolutions, Reeb graphs.

10. Masayuki Hisada, Alexander G. Belyaev, Tosiyasu L. Kunii, "A Skeleton-based Approach for Detection of Perceptually Salient Features on

Polygonal Surfaces," *Computer Graphics Forum*, Vol. 21, No. 4, pp. 1-12, 2002.

Abstract —The paper presents a skeleton-based approach for robust detection of perceptually salient shape features. Given a shape approximated by a polygonal surface, its skeleton is extracted using a three-dimensional Voronoi diagram technique proposed recently by Amenta et al. 3. Shape creases, ridges and ravines, are detected as curves corresponding to skeletal edges. Salient shape regions are extracted via skeleton decomposition into patches. The approach explores the singularity theory for ridge and ravine detection, combines several filtering methods for skeleton denoising and for selecting perceptually important ridges and ravines, and uses a topological analysis of the skeleton for detection of salient shape regions.

11. Tosiyasu L. Kunii, "Web Information Modeling: The Adjunction Space Model", Proceedings of the 2nd International Workshop on Databases in Networked Information Systems (DNIS 2002), pp. 58-63, The University of Aizu, Japan, December 16-18, 2002, Lecture Notes in Computer Science, Subhash Bhalla, Ed., Springer-Verlag, December, 2002.

Abstract —The nature of Web information is clarified and modeled as the adjunction space model. Practical Web information management requires Web information to be modeled in such a way that the model captures the dynamic changes, present the dynamism visually, and validate the results formally. As the mathematical ground of the model, we have adopted algebraic topology, cellular spatial structures in the homotopic framework and adjunction spaces in particular. The results have been applied successfully to typical Web information systems such e-finance and e-manufacturing to validate the advantages of our Web information modeling over the popular relational model, the entity relationship model, UML, and XML.

Associate Professor

Jianhua MA

Publications (January 2002 ~ December 2002)

1. Runhe Huang, Tao Huang, Jianhua Ma, T. Yamazaki, and M. Osano, "An Enhanced extended Bazaar Model Based E-shopping System", The Journal of Three Dimensional Images, pp96-101, Vol. 16, No. 1, 2002.

   Abstract — With a reasonable negotiation model, shopping agents can negotiate intelligently on behalf of real-world's users to find a solution that maximizes the utility for all users. This paper presents an online shopping system that includes shopping agents, such as buyer agents and seller agents, which are based on an enhanced extended Bazaar model and demonstrates how a shopping agent negotiates intelligently with counter party regarding a product on behalf of a user it represents.

2. Tao Huang, Runhe Huang, and Jianhua Ma, "A Hybrid Negotiation Model for an E-trading System", The Journal of Three Dimensional Images, pp90-95, Vol. 16, No. 1, 2002.

   Abstract — In this paper, a new negotiation model, called a hybrid negotiation model, is proposed. The hybrid negotiation model is a combination of an extended Bazaar model (a sequential decision making based Bayesian learning model) and a "lose bounded" Nash bargaining solution. With the proposed negotiation model, agents that represent buyers and sellers in the real-life can negotiate in an intelligent way to effectively and efficiently reach agreement and optimize their individual utility function, respectively, in a trading business. How learning in negotiations is proceeding and how common knowledge and public information are employed to make initial strategies of negotiations are described in details.

3. Q. Jin, T. Numata, S. Tekizawa, Z. Peng and Jianhua Ma, "A Pee-to-Peer Information Exchange and Sharing for Learning Communities", in Proceedings of the International Workshop on Multimedia Distance Education Software and Technology (MDEST'02), San Francisco, USA, September 2002.

   Abstract — Online learning communities are a promising paradigm for networked e-learning and distance education. We have proposed a conceptual framework for every-citizen online learning communities, to provide a virtual environment that widely opens to anyone who has the will to learn and to share knowledge with others. This study aims at exploring new ways of peer-to-peer e-learning. In this paper, we focus on discussing a new mechanism of peer-to-peer information exchange and sharing for online learning communities. We propose a person-to-person information exchange model that connects two learners based on peer-to-peer concepts, and develop a system that supports

more sophisticated matchmaking in a peer learner's encounter to discover a person across the peer-to-peer networks who may exchange information, share files, and collaborate each other. We further develop an improved peer-to-peer file sharing system with attribute descriptions in XML.

4. M. Nakamura and Jianhua Ma, "A Pee-to-Peer Shared Web Browser", in Proceedings of the International Conference on Distributed Multimedia System (DMS'02), San Francisco, USA, September 2002.

   Abstract — This paper presents design and implementation of a shared web browser system that enables multi-users to navigate on the Internet by synchronously sharing web documents. Different from other client/server based shared web browsers, our system is based on a pure peer-to-peer (P2P) architecture without using any server. It is implemented using JXTA protocols and Java programming language. Thus it is transport protocol independent and can be applied to any platform. It supports not only sharing a web document but also viewing the document and manipulating the browser synchronously. Some group users' awareness information like a user's moving a cursor, entering a new URL and clicking a hyperlink is also provided in the system. Its experimental environments and tested results are also described.

5. H. Koizumi and Jianhua Ma, "Design and Implementation of a Framework for Distributed Multi-Agent System", in Proceedings of the International Conference on Distributed Multimedia System (DMS'02), San Francisco, USA, September 2002.

   Abstract — This paper describes an application framework for distributed multi-agent systems developed and implemented. At this time, this framework defines a model of a single agent, which is an extension of the Sensor-Professor-Effector Model, and also defines the architecture of a multi-agent system and moreover, mainly focuses on the communications among multiple agents. Using this framework, high independence and interoperability of the agents can be realized, and then flexibility can be given to multi-agent systems developed with the framework. The feasibility of the framework was evaluated by implementing an arithmetic multi-agent system, which has a capability of calculating integral polynomials by interactions among multiple arithmetic agents.

6. Timothy K. Shih, Lawrence Y. Deng, Teh-Sheng Huang, Jianhua Ma and R. Huang, Journal of Advanced Software Research, 2002.

   Abstract — In this paper, we proposed a tracking and persistent agent-based mobility management system in case of distance learning. The main purpose of our system is addressed to achieve the universal access objective. In order to let the whole mobility management system full play, firstly, we proposed a mobile agent communication model and the mobile agent evolution states. Secondly, we encapsulate the utility tools to be a role-setting object, which is an application-driven component that can provide customization benefits for user and match the user's demands.

Professor

Toshihisa NISHIJIMA

Publications (January 2002 ~ December 2002)

1. T. Nishijima, "An Upper Bound on the Average Probability of an Undetected Error for the Ensemble of Binary Expansions of Generalized Reed-Solomon Codes," *IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences*, Vol. J85-A No. 1, pp. 137-140, January 2002.

Abstract — We derive an upper bound on the average probability of an undetected error for the ensemble of binary expansions of generalized Reed-Solomon codes and, from this bound, conclude that the ensemble satisfies, in average, the Varshamov - Gilbert bound as well as the expurgated bound asymptotically for large block lengths.

2. T. Nishijima, "On the Probability of an Undetected Error for Binary Expansions of Concatenated Codes with Generalized Reed-Solomon Outer Codes," *IEICE Technical Report*, IT-2002-1, pp.1-6, May 2002.

Abstract — Concatenated codes given by G. D. Forney, Jr. are very important codes from practical and theoretical viewpoint. It can be shown that binary concatenated codes exist in this class which asymptotically meet the Varshamov - Gilbert bound. The constructive concatenated codes are the first asymptotically good codes. However the probability of an undetected error for binary expansion of concatenated codes is not discussed in the literature from both practical and theoretical viewpoints. As the first step, by utilizing the characteristic structure of concatenated codes, an approximately good computation method of the probability of an undetected error without knowing weight distributions of concatenated codes is proposed in this paper. Since the computational complexity of the method is at the most $O(n)$, it is an efficient method when investigating the capability of error detection for a code from practical and theoretical viewpoint. By comparing exact values with approximate value in some examples of the codes, which are small enough for their weight distributions to be found by computer search, we show the efficiency of the approximate values by the proposed method. Their values also is compared with a upper bound on the average probability of an undetected error for the ensemble of those codes.

Professor

Alexander PASKO

Publications (January 2002 ~ December 2002)

1. B. Schmitt, A. Pasko, V. Adzhiev, C. Schlick, Constructive texturing based on hypervolume modeling, Journal of Visualization and Computer Animation, vol. 12, No. 5, 2001, pp. 297-310 (published in June 2002).

Abstract — The concept of solid texturing is extended in two directions: constructive modeling of space partitions for texturing and modeling of multidimensional textured objects called hypervolumes. A hypervolume is considered as a point set with attributes of both physical (density, temperature, etc.) and photometric (color, transparency, diffuse and specular reflections, etc.) nature. The point set geometry and attributes are modeled independently using real-valued scalar functions of several variables. The concept of constructive hypervolume textures is independent of the geometry representation. We provide examples of textured Frep and BRep objects as illustrations.

2. A. Pasko, V. Adzhiev, B. Schmitt, C. Schlick, Constructive hypervolume modeling, Graphical Models, special issue on Volume Modeling, vol. 63, No. 6, November 2001, pp. 413-442 (published in August 2002).

Abstract — In this paper, we deal with modeling point sets with attributes. A point set in a geometric space of an arbitrary dimension is a geometric model of a real/abstract object or process under consideration. An attribute is a mathematical model of an object property of arbitrary nature (material, photometric, physical, statistical, etc.) defined at any point of the point set. We provide a brief survey of different modeling techniques related to point sets with attributes. It spans such different areas as solid modeling, heterogeneous objects modeling, scalar fields or "implicit surface" modeling, and volume graphics. Then, on the basis of this survey we formulate requirements to a general model of hypervolumes (multidimensional point sets with multiple attributes). A general hypervolume model and its components such as objects, operations, and relations are introduced and discussed. A function representation (FRep) is used as the basic model for the point set geometry and attributes represented independently using real-valued scalar functions of several variables. Each function defining the geometry or an attribute is evaluated at the given point by a procedure traversing a constructive tree structure with primitives in the leaves and operations in the nodes of the tree. This reflects the constructive nature of the symmetric approach to modeling geometry and associated attributes in multidimensional space. To demonstrate a particular application of the proposed general model, we consider in detail the problem of texturing, introduce a model of constructive hypervolume texture, and then discuss its implementation, as well as the special modeling language we used for modeling hypervolume objects.

3. G. Pasko, A. Pasko, M. Ikeda, T. Kunii, Bounded blending operations, Shape Modeling International 2002, Banff (Canada, May 17-22), IEEE Computer Society, 2002, pp. 95-103.

Abstract — New analytical formulations of bounded blending for functionally defined set-theoretic operations are proposed. The blending set operations are defined using R-functions and displacement functions with the localized area of influence. The shape and location of the blend is defined by control points on the surfaces of two solids or by an additional bounding solid. The proposed blending using a bounding solid can be applied to a single selected edge or a vertex. We introduce new types of blends such as a multiple blend with the disconnected bounding solid and a partial edge blend. It is shown to have versatile applications in interactive design.

4. V. Adzhiev, E. Kartasheva, T. Kunii, A. Pasko, B. Schmitt, Cellular-functional modeling of heterogeneous objects, Proc. 7th ACM Symposium on Solid Modeling and Applications, Saarbrucken, Germany (June 17 - 21, 2002), Konwoo Lee and N.M. Patrikalakis (Eds.), ACM Press, 2002, pp. 192-203.

Abstract — The paper presents an approach to modeling heterogeneous objects as multidimensional point sets with multiple attributes (hypervolumes). A theoretical framework is based on a hybrid model of hypervolumes combining a cellular representation and a constructive representation using real-valued functions. This model allows for independent but unifying representation of geometry and attributes, and makes it possible to represent dimensionally non-homogeneous entities and their cellular decompositions. Hypervolume model components such as objects, operations and relations are introduced and outlined. The framework's inherent multidimensionality allowing, in particular, to deal naturally with time dependence promises to model complex dynamic objects composed of different materials with constructive building of their geometry and attributes. Attributes given at each point can represent properties of arbitrary nature (material, photometric, physical, statistical, etc.). To demonstrate a particular application of the proposed framework, we present an example of multimaterial modeling – a multilayer geological structure with cavities and wells. Another example illustrating the treatment of attributes other than material distributions is concerned with time-dependent adaptive mesh generation where function representation is used to describe object geometry and density of elements in the cellular model of the mesh. The examples have been implemented by using a specialized modeling language and software tools being developed by the authors.

5. R. Cartwright, V. Adzhiev, A. Pasko, Y. Goto, T. L. Kunii, Web-based shape modeling with HyperFun, Technical Report HCIS-2002-02, Hosei University, Tokyo, Japan, 2002, 16 p.

Abstract — We present an approach to collaborative Web based modeling using functionally defined shapes specified in the high level language HyperFun. The EmpiricalHyperFun shape modeling system based on Empirical Modeling principles provides users with an unusual degree of mutual interaction through the Web.

Professor

Yukiko SASAKI ALAM

Publications (January 2002 ~ December 2002)

1. Y. Sasaki Alam, S. Alam, "Lexicons in an Object-Oriented Grammatical Model For Universal Grammar-Based Machine Translation (UGBMT)," *Proceedings of The First Global WordNet Conference*, pp. 260-265, January 2002.

   Abstract — This paper describes an ongoing work on building the lexicons for an object-oriented model for Universal Grammar-based machine translation. By incorporating the premise that in spite of idiosyncrasies exhibited in individual languages, there are uniformities of universal scope, the model houses information common to all languages in Universal Grammar components. The Lexicon in Universal Grammar and the lexicons in individual grammars differ in many respects. While the indexes of the lexicons of individual languages are lists of surface forms of words, the index of the Lexicon in Universal Grammar is a list of meanings or senses.

2. Y. Sasaki Alam, "Object-Oriented Universal Grammar-Based Machine Translation (UGBMT)," *Proceedings of the International Conference on Universal Knowledge and Language (ICUKL) - 2002*, 12 pages (on CD), November 2002.

   Abstract — This paper presents an object-oriented model for machine translation based on Universal Grammar, the Universal Lexicon and language-specific grammars and the lexicons, and demonstrates the internal structures of these linguistic constructs by following a step-by-step process of English to Japanese translation. It elucidates what elements are required in the Universal Lexicon and the lexicons of individual languages. The present model parses and generates sentences at three levels of structures: S-structure (Surface Structure), I-structure (Intermediary Structure) and U-Structure (Universal Structure). The present paper demonstrates the interaction of the three levels of structures in the process of translation, showing how economy and efficiency are achieved by incorporating the modules of Universal Grammar and the Universal Lexicon into the model of machine translation. This design makes each language grammar slim, distinguishing idiosyncrasies from elements of universal nature.

Professor

Vladimir SAVCHENKO

Publications (January 2002 ~ December 2002)

International Journals and Chapters in edited books:

1. Nikita Kojekine, Vladimir Savchenko, Michail Senin, Ichiro Hagiwara, "A prototype System for Character Animation Based on Real-time Deformations", *The Journal of Three Dimensional Images*, Vol. 16, No. 4 (2002/12), 91-95.

   Abstract — We present an approach for real time animation of deformable objects and also report on the progress of our software system, providing an editor that assists in the design of animated objects and present examples of animation and speed benchmarks.

2. Nikita Kojekine, Ichiro Hagiwara, Vladimir Savchenko, Software Tools Using CSRBFs for Processing Scattered Data, *International journal "Computers & Graphics"* published by Elsevier Science, (to appear)

   Abstract — In this paper, we describe the use of compactly-supported radial basis functions for surface reconstruction. To solve the problem concerning reconstruction or generating volume data we are employing the specially designed software. The method, time performance of the algorithm and numerical error estimation of the reconstruction are described. Thanks to the efficient octree algorithm used in this study, the resulting matrix is a band diagonal matrix that reduces computational cost and permits handling large data sets.

3. Vladimir Savchenko and Nikita Kojekine, An Approach to Blend Surfaces, *Advances in Modeling, Animation and Rendering*, J. Vince and R. Earnshaw (eds), Springer, pp. 139-150, 2002. (This paper was presented at the Computer Graphics International CGI2002 conference, organized by Computer Graphics Society (CGS), in Bradford, UK, 1 - 5 July, 2002).

   Abstract — We present an application of a space mapping technique for surface reconstruction (more precisely: reconstruction of missing parts of a real geometric object represented by volume data). Using a space mapping technique, the surface of a given model, in particular tooth shape is fitted by a shape transformation to extrapolate the remaining surface of a patient's tooth with occurring damage such as a "drill hole." The genetic algorithm minimizes the error of the approximation by optimizing a set of control points that determine the coefficients for spline functions, which in turn define a space transformation. The fitness function to be minimized consists of two components. First one is the error between the blended surface of an object and the surface of the object to be blended in some predefined points. The second is a component that is responsible for the

bending energy being minimized.

4. Nikita Kojekine, Vladimir Savchenko, Ichiro Hagiwara, Surface Reconstruction Based on Compactly Supported Radial Basis Functions in *"Geometric Modeling: Techniques, Applications, Systems and Tools"*, M. Sarfraz (editor) , Kluwer Science, (to appear)

Abstract — In this paper, we describe the use of compactly-supported radial basis functions for surface reconstruction and for combined 3D metamorphosis. (An extended version of our Hawaii'2002 conference paper, accepted for this book as one of the best papers selected from three events: CAGD Symposium in the International Conference on "Information Visualization" (IV'2001), London, UK, Special Session on Geometric Design and Modeling (GDAM) - CGIM'2001, Hawaii. USA, and Graphical Models And Imaging (GMAI) - (CISST'2001), Las Vegas, USA).

5. Pasko A., Okunev 0., Savchenko V., *"Minkowski Sums of Point Sets Defined by Inequalities"*, Computer and Mathematics with Applications, published by Elsevier Science, (to appear)

Abstract — The existing approaches support Minkowski sums for the boundary, set-theoretic and ray representations of solids. In this paper we consider the Minkowski sum operation in the context of geometric modeling using real functions. The problem is to find a real function *F3(X)* for the Minkowski sum of two objects defined by the inequalities *F1(X) >= 0* and *F2(X) >= 0*. We represent the Minkowski sum as composition of other operations: the Cartesian product, resulting in a higher dimensional object, and a mapping to the original space.

International Conference Proceedings:

6. Eisaku Ohbuchi and Vladimir Savchenko, "Java Distributed Processing of Implicitly Defined Geometric Objects", *Proceedings of The Eights International Conference on Distributed Multimedia Systems*, September 26-28, San Francisco, California, 52-59

Abstract — We study the possibility of using volume modeling in a distributed Java environment for simulation of dynamic interaction between rigid bodies with time-dependent implicitly defined surfaces in 3D space. In particular, Java classes and methods were developed and tested for simulation and visualization. Three types of implementation :standalone, Java RMI, and HORB are implemented and evaluated.

7. Nikita Kojekine, Vladimir Savchenko, Michail Senin, Ichiro Hagiwara, Real-time 3D Deformations by Means of Compactly Supported Radial Basis Functions, *Short papers proceedings of Eurographics EG2002*, ISSN

1017-4565, Germany, Saarbrucken, September 2-6, 35-43, 2002.

Abstract — We present an approach for real time animation of deformable objects. An optimization of software algorithms exploiting compactly supported radial basis functions allows us to generate deformations performed fast enough to be used in such real time applications as computer games. Algorithms described in detail in this paper allows to produce smooth local deformations of animation objects using space mapping technique by defining only a moderate number of control vectors. Radius of support as a main parameter used by the user allows defining locality of deformations. We also present examples of animation and speed benchmarks.

8. Vladimir Savchenko, Nikita Kojekine, and Hiroshi Unno, A Practical Image Retouching Method, *Proceedings of The First International IEEE Symposium on Cyber Worlds CW2002*, Japan, Tokyo, November 6-8, 480-487, 2002.

Abstract — In this paper, we present a novel fast algorithm for image retouching. A space-mapping technique is used to transform a missing (or damaged) part of a surface into a different shape in a continuous manner. Experimental results are included to demonstrate the feasibility of our approach. The proposed approach shows the obvious relationship between the surface retouching problem and image inpainting. We consider shape transformation as a general type of operation for restoring missing data, and attempt to approach the well-known problem of "fulfillment" of damaged or missing areas from a single point of view, namely, that of the space mapping technique.

9. Nikita Kojekine, Vladimir Savchenko, "Using CSRBFs for Surface Retouching", *Proceedings of The 2nd IASTED International Conference Visualization, Imaging and Image Processing VIIP2002*, Spain, Malaga, September 9-12, 613-618 , 2002.

Abstract — We present a novel fast algorithm for surface retouching of geometric objects. A space-mapping technique is used to transform a missing (or damaged) part of a surface into a different shape in a continuous manner. Experimental results are included to demonstrate the feasibility of our approach. The proposed approach shows the obvious relationship between the surface retouching problem and image inpainting.

10. Vladimir Savchenko, Hiroshi Unno, and Nikita Kojekine, Possible Techniques for Three Dimensional Hatching, *Proceedings of The First International IEEE Symposium on Cyber Worlds CW2002*, Japan, Tokyo, November 6-8, 515-520, 2002.

Abstract — This paper introduces a basic technique for drawing non-photo realistic images of volume models. The turtle graphics approach to imitate painting operations is implemented in 3D space. Objects are defined by sets of scattered range data. Analytically (that is; functionally represented) and procedurally defined geometric objects

can also be used. The proposed technique is described in detail and painting examples that demonstrate its applicability to non-photo realistic rendering or hatching are provided.

11. Nikita Kojekine, Vladimir Savchenko, Dmitrii Berzin, Ichiro Hagiwara, Software Tools for Compactly Supported Radial Basis Functions, *Proceedings of The 4-th Computer Graphics and Imaging International IASTED Conference CGIM2001*, ISBN 0-88986-303-2 (Hawaii, USA, August 13-16), 234-239, 2001.

Abstract — A set of PC-based software tools to process scattered data is proposed in this paper. To solve problems concerning processing of scattered data in such applications as reconstruction of implicitly defined geometric objects, surface retouching, and shape modifications, we employ a specially designed C++ software library. Thanks to the efficient octree algorithm used in this study, the resulting matrix is a band-diagonal matrix that permits handling of large data sets in a reasonable time. The method, classes of the software library, time performance of the algorithm, and various examples of the use of the software tools are discussed.

12. Nikita Kojekine, Vladimir Savchenko, Michail Senin, Ichiro Hagiwara, A Prototype System for Character Animation Based on Real-time Deformations, *Proceedings of The 5-th International Conference on Humans and Computers HC2002*, Aizu-Wakamatsu, Japan, September 11-14, 82-86 , 2002.

Abstract — We report on the progress of our software system, providing an editor that assists in the design of animated objects and present examples of animation and speed benchmarks.

13. Nikita Kojekine, Ichiro Hagiwara and Vladimir Savchenko, Effective application of CSRBF functions for Animation and Surface Retouching, *Proceedings of The 3-rd JSIAM · SIMAI Symposium, Session of Imaging*, (Italy, Chia Laguna, May 27-31, 2002).

Abstract — Radial basis functions were successfully applied to various applications in computer graphics area, which includes applications in implicit surface reconstruction, geometric modeling and animation. But even for small problems their application is quite computationally expensive. In this work we sum up our approach and highlight some effective applications. Computational complexity of the algorithms is investigated and various examples of applications are given.

Professor

Toru WAKAHARA

Publications (January 2002 ~ December 2002)

1. T. Wakahara, "Handwritten Japanese Character Recognition Using Adaptive Shape Normalization by Global Affine Transformation," *International Journal of Computer Processing of Oriental Languages*, Vol. 15, No. 2, pp. 117-131, June 2002.

Abstract — This paper describes a new, promising character recognition system with a category-dependent shape normalization technique that normalizes an input pattern against each reference pattern adaptively using global affine transformation (GAT) in order to compensate for linear shape distortion. The proposed system, our basic OCR linked to GAT adaptive normalization technique, is successfully applied to recognition of 28,694 newly gathered samples of totally unconstrained handwritten characters, including Kanji, Kana, and alphanumerics, written by 300 people, with substantial improvements in recognition accuracy.

Professor

Kenji YOSHIDA

Publications (January 2002 ~ December 2002)

1. K. Yoshida and C. Shin, "Dragon is back!!" CG world, Vol.44, pp.138-139, April 2002

   Abstract — Korean movies are getting popular in Japan. Mr. Choru Shin, the president of Shincine Communications Co., Ltd which is one of the famous movie production companies in Korea, and Mr. Kenji Yoshida, leader of CG industry, work together. The project is to let Bruce Lee come to life again. They discuss about the possibility and development of CG industry in Asia based on this project.

2. K. Yoshida, "Invitation to the University" University and college magazine 2002, page53, April 2002

   Abstract — It is a introduction about the facility of Computer and Information Sciences in Hosei University. Many kinds of industries are watching CG skills now because it can represent anything to exist but you cannot see or not exist. And based on above-mentioned, it is explained about what kind of skill is needed in CG industry and how you can study in this facility.

3. K. Yoshida and T. Shibayama, "CG is our "DOKODEMO-DOOR!"", CG world, Vol.48, pp.186-187, August 2002

   Abstract — Animation is 2D art that Japan is proud of. It is a talk with Mr. Shibayama who is one of the leaders in Animation industry in Japan. He has produced "DORAEMON Series" and "CHIBI MARUKO-CHAN", etc. They talked about characteristics and attractions about animation and CG. Furthermore, they pursued the possibility of both industries harmonizing.

Professor

Shuichi YUKITA

Publications (January 2002 ~ December 2002)

1. S. Yukita, "Design Patterns For Topological Modeling," *Cyberworld 2002, IEEE Computer Society Press*, pp. 455-462, November 2002.

   Abstract — Topological modeling is a research field that is still in its infant state even though theoretical frameworks are established and various potential applications are proposed. This is due to the lack of design patterns that are shared among researchers and developers of modeling tools. This paper presents some useful patterns derived from experience in developing interactive topological modeling tools, which will accelerate progress in this field.

2. A. Imai and S. Yukita, "HLPM - A High Level Protocol Monitoring Tool for Education," *Cyberworld 2002, IEEE Computer Society Press*, pp. 397-404, November 2002.

   Abstract — A high level protocol monitoring tool (HLPM) for education is presented. This tool provides an easy interface for learners who have little technical background to understand the design and implementation of Internet application protocols. Using this tool, learners can monitor, test and write interaction scenarios of an application level protocol. The tool incorporates the FESI Script (an interpreter language by Jean-Marc Luring) with which learners can design, implement, and test new network services. HLPM runs on any operating systems that run Java Virtual Machine. The learners can understand the mechanism of a high level protocol by monitoring, and testing the protocol messages. In addition, they can learn how to make the network services by describing the script related to the network. In a word, HLPM offers learners an active study environment of high level protocol by operating an actual network.

3. A. Imai and S. Yukita, "RDF Model and Relational Metadata," *Proceedings of the 5th International Conference on Human and Computer 2002*, pp. 277-282, Septemer 2002.

   Abstract — In this paper we propose a new metadata type "Relational Metadata" that contains the relational information for retrieving WEB contents. It is based on the eXtensible Markup Language (XML) and using E-R (Entity-Relationship) model of relational datadase (RDB). Relational Metadata is compatible with Resource Description Framework (RDF) through a translator program that can convert Relational Metadata to RDF. The goal of Relational Metadata is to provide the WEB contents creators with easy control over metadata and with automatic RDB integration. Using Relational Metadata, the user can search target information with RDB easily and efficiently. Its retrieval functions are easily customized and optimized according to the personal profile.

HOSEI