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FEATURE STORY

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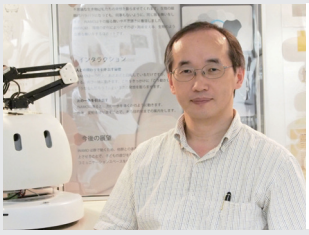
Research Highlights



Pick Up

Finding Near Optimal Solutions for Complex Real-world Problems

Toshihiro Fujito

Professor Fujito's work involves designing algorithms to solve discrete optimization problems. The term "discrete" holds the opposite meaning to "continuous", and refers to an enumerable or a finite number of things. In practical terms, its subjects range from the alignment of data to the optimization of various real world problems, such as production design, delivery routes, resource allocation, and the reliability of communication networks. Professor Fujito aims to establish a design theory of algorithms for such problems, while exploring the algorithms or methods to compute effective solutions for them.

Interview and report by Madoka Tainaka

Many real-world problems cannot be solved exactly, even with the use of high-performance computers

Professor Fujito explains that "the use of computers is essential for processing large amounts of data and for solving complex real-world problems. However, in reality, there exists a division between problems that can and cannot be easily solved using computers. When a problem is sufficiently complex, it cannot be solved, even over the course of several years, no matter how powerful the computer used. In fact, countless examples of real-world problems exist that do not yield such simple solutions. In practice, there is no alternative but to adopt a method of providing a solution that is close to the correct one, using approximations. This essentially consists of solving an optimization problem."

Although the operating capacity of computers has improved exponentially in recent years, these kinds of problems cannot be solved by making ordinary improvements to existing computing capabilities.

A well-known classic problem is the "traveling salesman problem (TSP)". This is the problem of finding the shortest route that a salesman can take to visit each of his target customers and return to his company. As long as the number of customers is small, this does not pose any difficulty. However, if the number of visits to be made increases to a few hundred, the number of combinations becomes very large, resulting in an enormous number of calculations. In such cases, the problem becomes unsolvable.

According to Professor Fujito, "a similar problem involves the search for the best product delivery route for convenience stores. Since the products required for each store are different, and the applicable conditions vary, calculations that are much more complex than those of the traveling salesman problem must be solved. Although some industries have already introduced computers in response to these problems, many still rely only on experience. If an optimal solution can be derived with regard to these various problems, the required cost, time, and energy can all be optimized. We have worked on the design of algorithms for such problems."

In 2005, a group of professors from Carnegie Mellon University who drew up the game schedule for the American Major League created a sensation by significantly reducing the travel distance. Sports scheduling is beset with difficult conditions, such as the need to combine home and away games in the most unbiased manner. Nowadays, computers have been introduced in other sports as well, such as football, because they are able to contribute to the efficiency, while clearly incorporating the various conditions of optimization.

"For example, the task we are currently working on in our laboratory concerns the scheduling of nurses in a hospital. We are trying to create a work schedule that, while incorporating the shift system, provides the best possible combination of veteran and young nurses, and ensures that everyone is able to work without being burdened. Again, this is a discrete optimization problem. In this manner, we are exploring the methodology every day to derive better solutions by utilizing mathematics," says Professor Fujito.

Formulating and adopting linear programming for NP-hard problems

The origin of the study of discrete optimization problems dates back to World War II, when "Operations Research" was successfully used. This is a research area that was embarked upon in order to improve the efficiency of "logistics," such as the movement of military troops or distribution of supplies. One of its core

techniques is that of "linear programming."

Professor Fujito describes: "Linear programming is an algorithm that is used to tackle the problem of representing both the objective function and the constraints as linear equations, and is very effective as a framework for formulating optimization problems. Because the input and output are in a linear relationship, or in other words are proportional to each other, the problem is easy to handle mathematically, and a quick and efficient solution can be obtained.

On the other hand, optimization problems, such as the aforementioned traveling salesman problem, are said to be "NP (Non-deterministic Polynomial time) hard" problems, for which a polynomial time (realistic time) algorithm is not likely to be found, and hence they are considered to be difficult to solve. Our aim is somehow to derive an accurate solution, while knowing that this is difficult to achieve. Therefore, we have set our sights on linear programming. In other words, the difficult problem is replaced with a linear programming problem, and a reasonably accurate approximate solution is obtained."

However, the solution obtained through linear programming is not a discrete solution. As this is a continuous solution, it must be replaced once again with a solution to the discrete optimization problem. The design of algorithms for this step is where the skills of Professor Fujito come into play. He explains "Besides linear programming, probability theory and fields of discrete mathematics are also used as tools for the design of algorithms. The fields include graph theory, which deals with graphs consisting of sets of vertices and edges; matroids; and submodularity properties of functions,.

"As a result, quite some time ago in 1999, we designed an algorithm for the NP-hard problem of graph theory known as "the Feedback Vertex Set Problem". By using this algorithm, it became possible to obtain an approximate solution at a fast rate, within the factor of two from the minimum solution, even in the case of a large graph.

"In fact, I did not realize at first that this approach is equivalent to using the primal dual method, which is a type of linear programming. However, other researchers pointed out that this can be explained by the mechanism of the primal dual method. Since then, this paper has been cited by many researchers."

Areas where young researchers can play an active role

Indeed, the vast experience of seasoned researchers has been indispensable, even in coming up with the idea of using linear programming to solve discrete optimization problems. However, a "spark" is also necessary, and the credit for this goes to Professor Fujito. How does this spark occur?

"Individual effort undoubtedly plays a large role in theoretical research, but there are also many occasions when ideas are generated through discussions. Collaborative work between teachers with experience and young researchers is in particular very effective. Ideas emerge from the combination of rich experience and young flexible thinking. Mathematics is an area where young researchers particularly can play an active role. Because the design of algorithms is becoming increasingly important, I would like to see more and more students becoming interested in this world of mathematics," opines Professor Fujito.

However, not content with merely designing individual algorithms, Professor Fujito mentions that his vision is to continue to focus on the theory of designing algorithms.

Reporter's Note

Professor Fujito actually graduated from the Department of Mechanical Engineering. Being fascinated by computers, he decided to undertake his Master's in Computer Science at an American university.

"While mathematics, which is the foundation of engineering, consists of calculus, linear algebra, complex analysis, etc., the mathematics used in the field of computer science mainly consists of discrete mathematics and probability theory. Subjects such as graph theory are simple but very profound, a very interesting world," he says, his eyes shining.

The fields of discrete mathematics and applied mathematics, although not very well known in Japan, are essential and cutting-edge fields, whether dealing with big data or on the contrary, predicting future events from small data. The studies of Professor Fujito will become increasingly relevant in this context.

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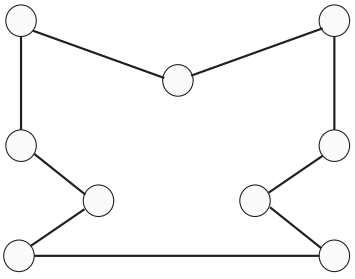
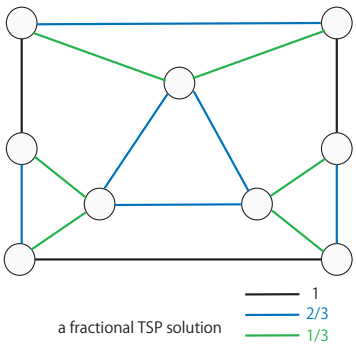


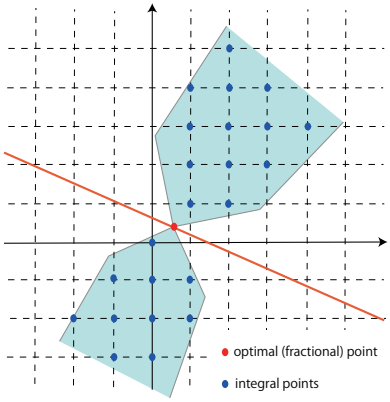
a TSP solution

A TSP solution is constrained to have exactly 2 edges among those incident to each node.



a fractional TSP solution

When the constrains in TSP (i.e., exactly 2 incident edges per node) are relaxed such that the total value associated with edges incident to each node must equal to 2, a solution such as the above can be easily computed as an LP solution.



A combinatorial optimization solution must be integral in general. On the other hand, an optimal solution (the red point) is not integral in a general LP problem, and hence, it has to be somehow rounded to nearby integral solutions (blue points).

現実の複雑な問題に、最適な解を与えるために

藤戸教授が手掛けるのは、離散最適化問題を解くためのアルゴリズムの設計である。「離散」とは、連続に対応する概念で、一つ、二つ、三つと数え上げられる数や有限の数のこと。具体的には、データの整列から、生産設計、配送経路、資源配分、乗員スケジューリング、通信ネットワークの信頼性に至るまで、現実のさまざまな問題の最適化が対象となる。藤戸教授は、それらの問題に対し、効率よく解を与えるためのアルゴリズム、すなわち計算方法を探究しつつ、アルゴリズムの設計論の確立をめざしている。

現実の多くの問題は、高性能なコンピュータでも解けない

「実社会にある大量のデータや複雑な問題を解くには、コンピュータの活用が不可欠です。しかし現実には、コンピュータで解きやすい問題とそうでない問題が存在します。難しい問題となると、どんなにパワフルなコンピュータを使ったとしても、何年かかっても解くことができません。実は、実社会には、そういった容易には解くことができない問題が無数にあります。現実的には、近似的に解くことで正解に近い解を与える、という方法を取るしかない。それが最適化問題を解くということになります」と藤戸教授は説明する。

コンピュータの演算能力は現在まで、それこそ指数関数的に向上してきたが、こうした問題は、少々計算能力が上がったくらいでは太刀打ちできないのだという。

その代表的な問題として有名なのが、「巡回セールスマン問題」だ。これは、あるセールスマンが担当するすべての顧客先を1軒ずつ回って会社に戻る場合に、移動距離が一番短いルートを検索する、というもの。巡回する顧客先が数軒なら問題はないが、訪問先が数百に増えた途端、組み合わせが膨大になり、計算量が爆発して、問題を解くことができなくなる。

「同様の問題に、コンビニの商品配送ルートの探索があります。店ごとに必要な商品は違いますし、さまざまな条件も加わることから、巡回セールスマン問題よりもさらに複雑な計算を解かなければなりません。こうした問題に対して、すでにコンピュータを導入している業界もありますが、多くは経験に頼っている状態です。もし、さまざまな問題に対して最適な解が導き出せれば、コストも時間もエネルギーも大幅に効率化できるでしょう。私たちは、そのためのアルゴリズムの設計を手掛けているのです」

2005年、アメリカの大リーグでは試合のスケジューリングをカーネギーメロン大学の教授グループが作成し、移動距離を大幅に削減できたとして話題を呼んだ。スポーツのスケジューリングは、ホームゲーム、アウェイゲームをできる限り公正に組み合わせるなど、難しい条件がつきまとう。現在では、最適化によりさまざまな条件をクリアしつつ、効率化に貢献できるとして、サッカーなど他の競技でもコンピュータの導入が始まっている。

「例えば、私たちの研究室で現在取り組んでいるのは、病院のナースのスケジューリングです。交代制に対応しつつ、ベテランと若手看護士をうまく組み合わせ、皆ができるだけ負担のないように働ける勤務表を作成しています。これも離散最適化問題の一つ。このように、数学を活用することで、よりよい解を導き出すための方法論を日々、探っているのです」と藤戸教授は語る。

NP困難な問題に、線形計画法を採用して定式化する

そもそも離散最適化問題研究の端緒は、第二次世界大戦で成果をあげた「オペレーションズ・リサーチ」まで遡る。これは、軍の部隊の移動、物資の配給など「兵站」の効率化を図るために始まった研究分野で、その手法の一つに「線形計画法」がある。

「線形計画法とは、目的関数と制約条件がともに一次式で表現できる問題に対するアルゴリズムで、最適化問題を定式化できる枠組みとして大変有効です。線形、すなわち入出力が比例関係にあるため、数学的に扱いやすく、高速に効率よく問題を解くことができるのです。

一方、先述の巡回セールスマン問題のような最適化問題は、『NP（Non-deterministic Polynomial time）困難』と呼ばれ、多項式時間（現実的な時間）アルゴリズムが見つかりそうにない、解くことが困難な問題とみなされています。難しいことは承知の上で、なんとか精度のいい答えを見つけたい、というのが私たちの狙いです。そこで目をつけたのが、線形計画法でした。つまり、難しい問題を線形計画問題に置き換えて、精度のいい近似解を得ようとているのです」ただし、線形計画法で得られた解は、離散的ではない。連続的な数のため、それをふたたび離散最適化問題の答えとして置き換えてやる必要がある。そのためのアルゴリズムの設計こそ、藤戸教授らの腕の見せ所となる。

「そのほかにも、離散数学の一分野で、頂点と辺の集合で構成されるグラフを扱うグラフ理論や、マトロイド、劣モジュラ性などといった関数に関する性質、確率論などを、アルゴリズムの設計のための道具立てとして使います。

成果としては、1999年と少々古いものになりますが、『フィードバック独立点集合問題（Feedback Vertex Set Problem）』というグラフ理論に関するNP完全問題（NP困難と同等に難しい問題）に対して、たとえグラフが大きくなったとしても、最小解の2倍以下の精度で高速に近似解を求めることができるアルゴリズムを設計しました。

実は、最初はこの手法が線形計画法の一種である主双対法を用いた手法と同等であることに気づいていなかったのです。ところが、他の研究者により、それが主双対法のメカニズムで説明できることが示されました。以後、この論文は非常に多くの研究者に引用されています」と、藤戸教授は自負する。

若い研究者が活躍できる分野

離散最適化問題の解法に線形計画法をどのように用いるかといった着想には、研究者としての経験の積み重ねが不可欠だが、一方で、「ひらめき」も欠かせないと藤戸教授。いかにして、ひらめきを呼び込むことができるのだろうか。

「理論研究の世界では、やはり個人の力が大きいと思いますが、一方で、ディスカッションの中からアイディアが生み出されることも少なくありません。なかでも、経験のある教員と若手研究者による共同作業はとても有効です。豊かな経験と若い柔軟な発想の組み合わせにより創発されるのです。とくに数学の分野は若手研究者が活躍できる分野です。アルゴリズムの設計は今後ますます重要になりますから、ぜひ、多くの学生に、この世界の面白さに触れてもらいたいですね」と、藤戸教授。

一方で、藤戸教授は、単に個々のアルゴリズムを設計するだけでなく、アルゴリズムを設計するための理論構築にも注力していきたいと展望を語った。

取材・文＝田井中麻都佳

取材後記

実は工学部機械工学科出身の藤戸教授。コンピュータの魅力に取り憑かれて、修士でコンピュータサイエンス学科のあるアメリカの大学へ留学することにしたという。

「工学部で基盤となる数学は、微積や線形代数、複素解析などですが、情報科学の分野では離散数学や確率論の方が主となります。グラフ理論など、シンプルだけどとても奥が深く、非常に面白い世界です」と、目を輝かせる。

日本でこそ、離散数学や応用数学の分野はあまり知られていないが、いまやビッグデータを扱うにしろ、逆に少ないデータから将来予測をするにしろ、必要不可欠かつ最先端の分野。今後、藤戸教授の研究はますます注目されることになるだろう。

Researcher Profile

Dr. Toshihiro Fujito received his B.E. and M.E. degrees in Mechanical Engineering from Kyoto University, in 1981 and 1983, respectively. He received his M.S. and Ph.D. degrees in Computer Science from Pennsylvania State University, in 1986 and 1994, respectively.
He joined Toyohashi University of Technology in 2004 after working at Hiroshima University and Nagoya University, and has been a professor in the Department of Computer Science and Engineering since then.
His research interests include design and analysis of algorithms, discrete structures, and combinatorial optimization.

Reporter Profile

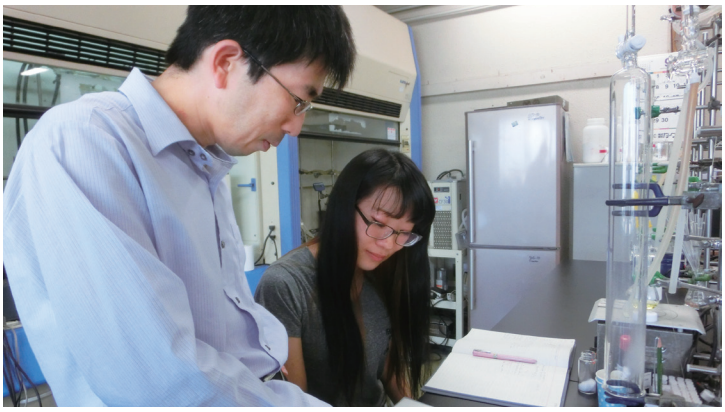
Madoka Tainaka is a freelance editor, writer and interpreter. She graduated from the Department of Law, Faculty of Law at Chuo University, Japan. She served as a chief editor of "Nature Interface" magazine, a committee for the promotion of Information and Science Technology at MEXT (Ministry of Education, Culture, Sports, Science and Technology).

New synthetic route to potential medicines for type 2 diabetes

Highly enantioselective synthesis of tertiary alkyl aryl ethers

By Kazutaka Shibatomi

Kazutaka Shibatomi and his colleagues have found that the SN2 reaction of α-chloro-β-keto esters with phenols proceeded smoothly despite the fact that the reaction occurred at a tertiary carbon. This method allows the highly enantioselective synthesis of α-aryloxy-β-keto esters for the first time. The resulting compounds can be converted into some biologically active compounds, such as a GPR119 agonist, for the potential treatment of type 2 diabetes.



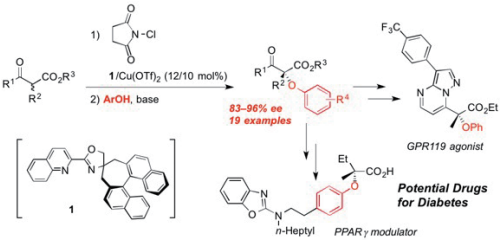
From left: Kazutaka Shibatomi and his student

Aryl alkyl ethers are important structural motifs found in many biologically active compounds. Therefore, stereoselective etherification is a highly important synthetic operation in the preparation of drug candidates. However, very few enantioselective methods have been described for the synthesis of chiral tertiary aryl ethers.

Kazutaka Shibatomi and his colleagues have found that the SN2 reaction of α-chloro-β-keto esters with phenols proceeded smoothly despite the fact that the reaction occurred at a tertiary carbon [1]. They previously reported the highly enantioselective chlorination of β-keto esters with a chiral Lewis acid catalyst [2]. Thus, in the two investigations, they have successfully demonstrated the enantioselective phenoxylation of β-keto esters. This novel method allows the synthesis of α-aryloxy-β-keto esters with high enantioselectivity.

"Etherification by the SN2 reaction is an older synthetic method called Williamson ether synthesis, but very few researchers have succeeded in conducting this reaction with tertiary halides," said Associate Professor Kazutaka Shibatomi. "This is the first example of the enantioselective synthesis of α-aryloxy-β-keto esters, which would be useful synthetic intermediates for new drug candidates."

Using this method, the researchers demonstrated the synthesis of some biologically active compounds, such as a GPR119 agonist and a PPARγ modulator, for the potential treatment of type 2 diabetes. The researchers expect that the present method will also be helpful in preparing other types of synthetic drugs.



Asymmetric synthesis of α-aryloxy-β-keto esters

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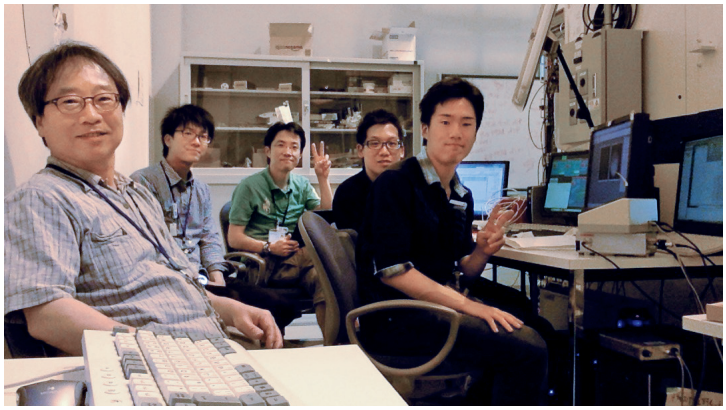
Finding a way to boost efficiency of CIGS solar cells

Immersion of zinc-based buffer layer in ammonia water doubles conversion efficiency

By Masanobu Izaki

Masanobu Izaki and his colleagues have revealed the structure of the buffer layer in a CIGS (copper-indium-gallium-selenide) solar cell at SPring8, the world's largest third-generation synchrotron radiation facility. They found that the buffer layer was composed of two layers: an upper Zn(OH)2 layer and a lower Zn(S, O) layer. By removing the upper Zn(OH)2 layer, the solar conversion efficiency was doubled.



From left: Masanobu Izaki and his students

CIGS (copper-indium-gallium-selenide) solar cells are compound thin-film solar cells and the most established alternative to silicon solar cells. Solar conversion efficiencies of over 20% have recently been achieved in CIGS solar cells.

One of the factors known to strongly affect the conversion efficiency is the buffer layer (see Figure 1). However, the structure of the buffer layer and its precise influence on the conversion efficiency have not been clarified. Professor Masanobu Izaki and his colleagues at Toyohashi University of Technology, in collaboration with researchers at the Research Center for Photovoltaic Technologies which belongs to the National Institute of Advanced Industrial Science and Technology, have analyzed the structure of a zinc-based buffer layer in a CIGS solar cell at SPring8 (the world's largest third-generation synchrotron radiation facility, located in Hyogo Prefecture, Japan).

"Performing structural analysis on very thin films is extremely difficult," Professor Izaki said.
The researchers revealed the structure of the buffer layer and identified a way to improve the conversion efficiency. The study was published online in Progress in Photovoltaics on August 17, 2015.
"We analyzed the structure of the buffer layer by X-ray photoelectron spectroscopy, transmission electron microscopy, and other techniques. We found that the buffer layer was composed of two layers: an upper Zn(OH)2 layer and a lower Zn(S, O) layer. Moreover, the conversion efficiency was improved from 6.8% to 13.7% by removing the upper Zn(OH)2 layer," Professor Izaki said.

In their article, the researchers described how to remove the upper Zn(OH)2 layer. The method is simple but highly effective: quick immersion of a 120-nm-thick film in ammonia led to a doubling of the solar conversion efficiency (see Figure 2).

This study reveals the importance of the buffer layer structure and composition, and is expected to be a valuable step for the development of next-generation CIGS solar cells. It is anticipated that once CIGS cells are able to be mass produced at a reduced cost, they will become a main player in the solar cell market.

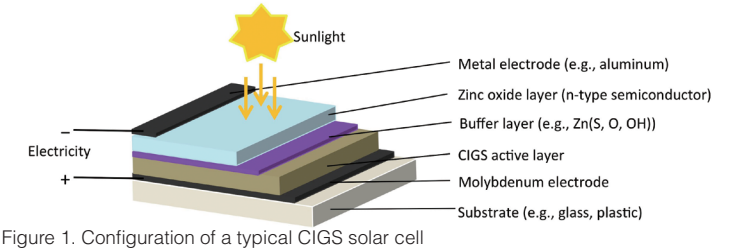


Figure 1. Configuration of a typical CIGS solar cell

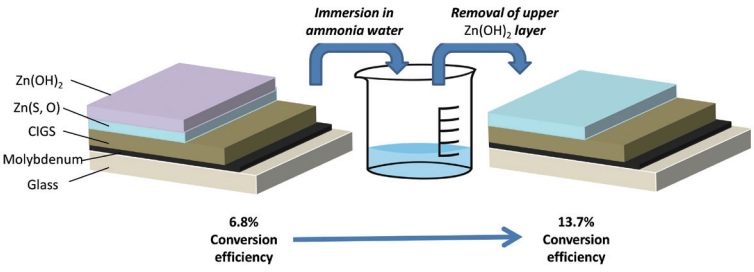


Figure 2. The deposited Zn(S, O, OH) buffer layer was found to consist of sublayers of Zn(S, O) and Zn(OH)2. Immersion in aqueous ammonia removed the topmost layer

Reference

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A new measure for wireless power transfer

Supporting the construction of highly efficient transfer links through a real-time kQ display.

By Takashi Ohira

Professor Takashi Ohira and the Anritsu Corporation have jointly developed a new measurement system to support the construction of highly efficient wireless power-transfer links. The system measures the kQ ("coupling coefficient k" and "quality factor") product in real-time, to make it possible to find the maximum transmission efficiency by changing the power transmission and reception positions. This measurement system accelerates the realization of wireless power-transfer applications, such as contactless powering, battery-free electric vehicles, and energy harvesting.

Wireless power transfer has many promising applications, such as contactless powering, electric vehicles, and energy harvesting. To construct a wireless power-transfer system, a "wireless transfer coupler" is necessary to deliver the energy from a high-frequency power source to a load, with no physical contact.

In the past, "coupling coefficient k" was used as an index of wireless-power-transfer efficiency. Since k decreased as the power-transfer distance increased, it was believed that the transmission efficiency would decline. In 2007, however, it was found that the transfer potential could increase, even over large distances, if the Q factor (quality factor) was high.

Professor Takashi Ohira, Director of the Research Center for Future Vehicle City at Toyohashi University of Technology, in cooperation with the Anritsu Corporation, has made it possible to measure the kQ product in real-time, based on Ohira's kQ theory. This software is installed in the ShockLine-series Vector Network Analyzers, models MS461xxA, MS463xxA, and MS465xxB.

"A function to simultaneously estimate and display the ηmax (maximum efficiency, see Reference 3) of a wireless transfer link from the kQ product using tan θ (the efficiency tangent) has also been realized," explains Professor Ohira. "Using this newly developed measurement system, it is possible to greatly improve prototypes and design high-efficiency couplers for wireless power transfers."

This system contributes to the construction of highly efficient wireless power-transfer systems by enabling the following.

- Finding the maximum transmission efficiency by changing (scanning) the power transmission and reception positions.
- Improving development speeds through the quick discovery of structures and dimensions.
- Rapidly discovering the dependency of the optimum transmission frequency on structural parameters.

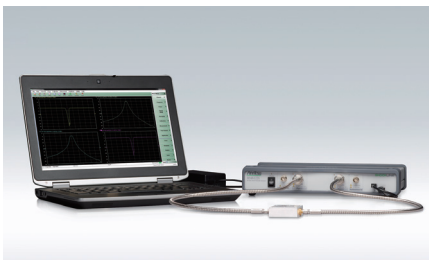
This newly developed "kQ measurement system" will accelerate the realization of various wireless power-transfer applications in our everyday lives; for example, contactless powering of home applications, battery-free electric vehicles, and energy harvesting.

This system was introduced at CEATEC JAPAN 2015 (Combined Exhibition of Advanced Technologies; Japan's largest IT and electronics exhibition), in Makuhari, Japan, October 7–10, 2015.

Further technical notes:
http://www.tut.ac.jp/english/introduction/docs/pr20151008_ohira.pdf

This study was supported by the SCOPE (Strategic Information and Communications R&D Promotion Programme) Project #01590001 of the Ministry of Internal Affairs and Communications.

Wireless power enables the electric vehicle to run without batteries onboard: This vehicle's wheels are powered by electric rails beneath the road. A miracle has come true, thanks to Ohira's kQ theory.



kQ measurement system: ShockLine-series Vector Network Analyzers Ohira's kQ theory.

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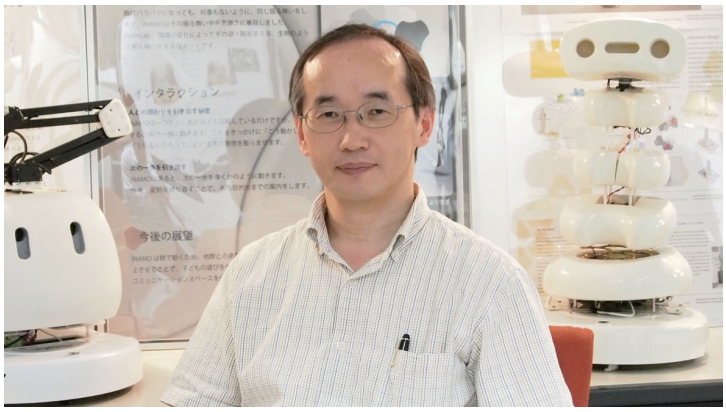
Robot's disfluent speaking just to get attention from you

Dynamically adapting robot's utterance and body language based on subtle human cues

By Michio Okada

Michio Okada and his colleagues have developed Talking-Ally, the novel robot that dynamically generate appropriate utterances and gestures based on the person's attention as indicated by his or her actions. The experiments show that this new communicative approach significantly enhances the attention engagement of interactive users.



Communication between humans is based on one another's words and body language. We can sense whether the other person is distracted, and we change the course of our conversation and our actions to regain their attention.

Most existing robots, however, still use monologue mechanisms, even when engaging in dialogue with a person. For example, they continue speaking in the same way, even if the person is not paying attention.

Researchers at the Interactions and Communication Design (ICD) Lab at Toyohashi University of Technology have devised a novel robotic communication approach that takes into account the listener's attention. The robot follows a person's gaze and determines if that person is distracted by, for instance, a sports event in the background or something in their surroundings. For example, the robot bends forward and nods if the person it is communicating with is watching television, similarly it turns its head and looks around if the person is looking elsewhere. These behaviors are accompanied by an appropriate utterance intended to regain the person's attention. Experiments have confirmed that these adaptive interactions considerably increase the level of the other party's attention focused toward the robot as compared with the case where the robot's gestures and speech are generated without considering the person's gaze.

"We have set up an environment to manipulate the person's attention with an engaging sports program broadcast simultaneously with the human-robot interaction. This allowed us to validate a suite of conversation situations and utterance-generation patterns," said Hitomi Matsushita, first author of the conference paper on the robot.

"Talking-Ally dynamically determines and synchronizes its body language, turn initials, and entrust behaviors of its speech, according to the person's attention coordinates," Professor Michio Okada, head of the ICD Lab, explained. "Our analysis shows that this is significantly more persuasive than generating these behaviors randomly."

The experimental results significantly contribute to the HRI community by confirming that adaptive communication is essential in acquiring and maintaining attention during conversation. Moreover, Talking-Ally demonstrates a specific communication protocol that is shown to successfully re-engage a distracted person. This is instrumental in achieving persuasive communication and convincing interaction with the robot. Such a platform can ultimately be tailored for use with any HRI application.

A user interacting with the Talking-Ally robot

Talking-Ally currently chooses its responsive gestures at random from a set that suitably corresponds to the person's level of attention. Future work on the project will include further customizing the robot's interaction to individuals by choosing a specific body language to use in each situation based on subtle cues from the other party.

This research has been supported by both Grant-in-Aid for scientific research of KIBAN-B (26280102) and Grant-in-Aid for scientific research for HOUGA (24650053) from the Japan Society for the Promotion of Science (JSPS).

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Pick Up

Promoting international exchange with Central Asia countries

As part of the ongoing expansion of our international exchange activities towards becoming one of the top global universities in Japan, Toyohashi Tech signed an agreement for collaborative research and education partnership with institutions in Mongolia and Uzbekistan.

Shine Mongol Academy (Mongolia)

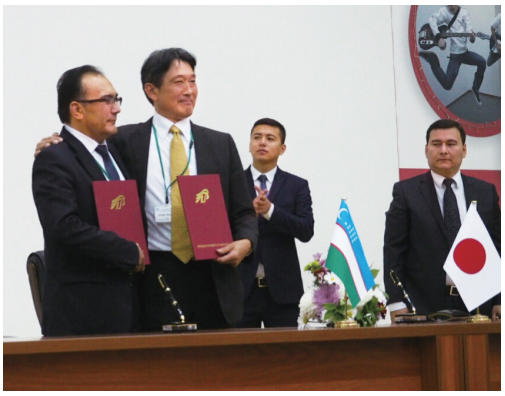
Shine Mongol Academy is a private educational institute consisting of Shine Mongol High School, New Mongol Technique Engineering College (Kosen) and New Mongol Institute of Technology. Shine Mongol High School, which was opened in 2000, was the first Mongolian high school to be modelled after the Japanese educational system. Similarly, the Technical Engineering College, which was established in 2014, pioneered the use of the unique engineering education system of Japan's Kosen in Mongolia. Thanks to Toyohashi Tech and Shine Mongol High School sharing the same educational system, and the long history of Toyohashi Tech accepting Shine Mongol High School students , both parties agreed on 5th October 2015, to sign an agreement to endeavor to carry out specific initiatives to further strengthen the partnership.

Signing ceremony

15th anniversary of Shine Mongol High School

Tashkent State Technical University (Uzbekistan)

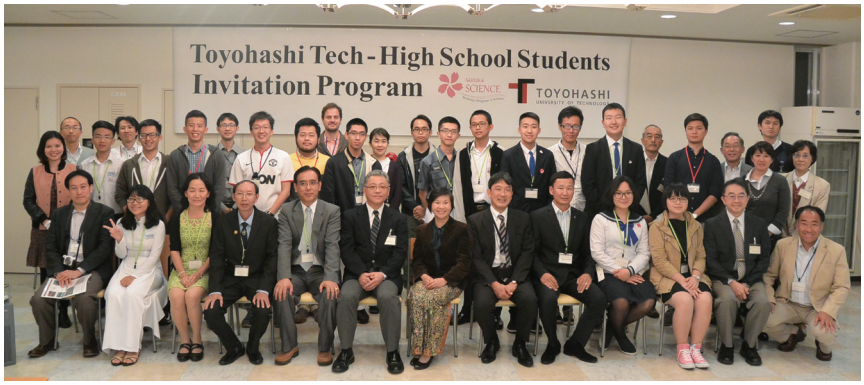
Tashkent State Technical University (TSTU) was established in 1929 in Uzbekistan, and is one of largest universities for technology in Central Asia. When Prime Minister Abe visited Uzbekistan on 24-26th October 2015, he welcomed Uzbekistan's suggestion to establish an Uzbekistan-Japan Youth Center for Innovation in TSTU. Between 2004 and 2008 Toyohashi Tech accepted 12 international students from Uzbekistan. Currently there is one student from TSTU enrolled in our doctoral program. Delegates from TSTU visited Toyohashi Tech on 9th September 2015, and both parties agreed to start discussions toward possible future collaboration. The Memorandum of Understanding to start this process was signed on 13th November 2015 in Uzbekistan at the Japan Rector's conference held in Tashkent.



Top high school students from Asia invited to Toyohashi Tech

10 high school students, representing 4 high schools from Malaysia, Vietnam and Mongolia were invited to join a program at Toyohashi Tech which ran from October 26th to October 30th. This kind of program, inviting high school students from Asian countries to visit our university in order to promote study abroad in Japan, represented a first for Toyohashi Tech. The schools we invited are all top-level high schools that typically send many graduates to study abroad. The students themselves were all candidates for the first crop of students to join our upcoming new “Global Technology Architect Course”, which launches in April 2018. They got to experience various lectures and experiments as well as visiting research centers and other university facilities. They had the chance to sample various aspects of Japanese technology and culture, such as Toyota Motor Corporation plant, Hamamatsu Science Museum, Okazaki castle and a writing-brush craft center. Toyohashi Tech will continue to enhance this program so as to promote our university in Asia, and to increase the intake of international high school graduates to study technology at Toyohashi Tech in Japan.

This program is supported by Japan-Asia Youth Exchange Program in Science (SAKURA Exchange Program in Science) 2015 of Japan Science and Technology Agency.



Participated to World Engineering Conference and Convention 2015 in Kyoto

Toyohashi Tech displayed its research results at the World Engineering Conference and Convention in Kyoto (WECC2015).

WECC is an international conference on all fields of engineering; it is held by the World Federation of Engineering Organizations (WFEO) every four years to discuss the progress of technology and social contribution. The Science Council of Japan and the Japan Federation of Engineering Societies invited the conference to Kyoto this year.

Dates: Sunday, 29th November – Wednesday, 2nd December
Venue:Kyoto International Conference Center (ICC Kyoto)

http://www.wecc2015.info/

Exhibition contents of Toyohashi Tech

- Introduction to the university
- AIST–TUT Advanced Sensor Collaborative Research Laboratory:Integrated Circuit and Sensor System Group
- Prof. Shimojo (Caltech)–TUT International Collaborative Research Laboratory:Mind & Brain Laboratory for Perceptual and Cognitive Processing

Upcoming events hosted by Toyohashi Tech

International Conference of Global Network for Innovative Technology - IGNITE 2016

Toyohashi Tech, in collaboration with University Sains Malaysia (USM), will jointly host the International Conference of Global Networks for Innovative Technology (IGNITE) 2016. The conference will take place from 27th to 29th January 2016 on Evergreen Laurel Hotel Penang, which is located in Penang, Malaysia. USM and TUT decided to hold IGNITE-2016 due to the success of the previous IGNITE Conference in 2014. This time however there will be a more specific theme, which is: Advanced Materials for Innovative Technologies. The conference welcomes researchers, scholars, scientists, and professionals to present their works and share on their recent findings. During the event, a series of workshops will also be conducted as all as tutorials.

http://ignite.eng.usm.my/

Schedule:

Date	27th – 29th January 2016
Place	Evergreen Laurel Hotel Penang

Toyohashi Tech Symposium: A challenge toward the future – stand on the next stage –

These are exciting times for researchers at Toyohashi Tech. Toyohashi Tech was selected by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as one of the universities to be involved in the prestigious “program for promoting the enhancement of research universities”. Toyohashi Tech’s research facility, Electronics Inspired-Interdisciplinary Research Institute (EIIRIS) has also been producing some unique results. Most recently, the “Mind & Brain Laboratory for Perceptual and Cognitive Processing” and “AIST-TUT Advanced Sensor Collaborative Research Laboratory” were established in Toyohashi Tech on July 1st 2015. The stated aim is to promote the advancement and diversification of Toyohashi Tech’s research by collaborating with world-leading global research institutions. The symposium, “A challenge toward the future”, will explore our leading research projects and consider their progress.

http://www.tut.ac.jp/event/160121-8581.html
(Japanese version only)

Schedule:

Date	21st January 2016
Time	10:30~17:00
Place	My Plaza Hall in Marunouchi, Tokyo

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