

FELLOW'S EXPERIENCE

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Grant: Postdoctoral Fellowships for Foreign Researchers (Short-term).

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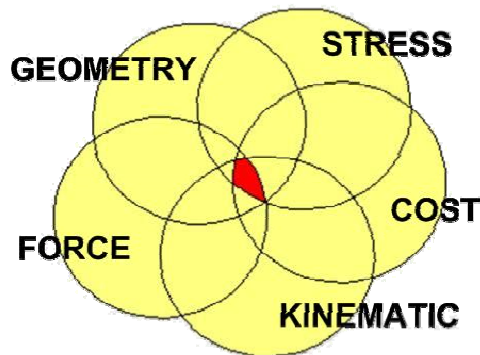
Hosts: Professor M. Yoshimura and Dr. K. Izui.

Department: Optimum System Design Engineering Laboratory.

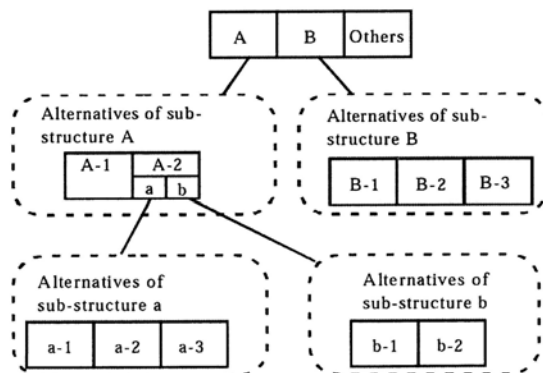
Institution: Kyoto University.

Research Plan Conducted:

My current research looks at “constraint-based design and optimization”. Constraint-based modelling sets the constraints on a system as optimization objectives. The search-space is narrowed such that satisfaction of all of the goals leads to an optimal configuration. This is done using “Constraint Modeller” software.



The intersection of the constraints gives a set of best compromise solutions.



Example of a hierarchical structure system for a machine.

Professor Yoshimura’s laboratory has been concerned with optimization of design of machine systems. Such systems are decomposed using a hierarchical strategy and optimized using a developed Hierarchical Genetic Algorithm (HGA). This has proved successful for a variety of problems.

Thanks to the JSPS, Dr Izui and I have a great understanding of each others research, sharing techniques and experience. By studying hierarchical problems using the Constraint Modeller, I realized the value of HGA – discrete, component based some problems are handled vastly better. Discrete problems particularly stretched the limits of the Constraint Modeller and this was a constructive outcome, as I was required to develop new techniques to solve these.



Kyoto University campus.



Making mochi (rice cake), a great way for the Japanese and foreign researchers to unite!

We jointly began to study a new research field – optimizing disassembly sequences – a prominent area of interest to industry due to economic and resource limitations. This is a non-trivial process due to decisions of complete/incomplete disassembly of the system.

Historically optimized using Linear Programming, this has the drawback of infeasible and cyclic paths appearing in the solution. By solving using constraints, solutions are as good/better, removing these issues. As these are discrete systems, expressible as hierarchical graphs however, using an adapted HGA code, which keeps the hierarchical structure and stops incorrect sequences, is obvious. Good progress was made to implement this.

My stay was cut to two months; hence we conducted a scoping study as to the feasibility of future collaboration. However, this gave a focus on obtaining positive results in the short time-scale and the whole experience was worthwhile and fruitful. We reached a point where we can work at separate institutions, but Dr. Izui and I will collaborate further with this research and publish the results.

Experiences/Recommendations:

To make the most of the research, communication is vital. Before writing the proposal it is useful to have built a good relationship. From this you understand the genuine grounds for collaboration and what is achievable during your stay (even if it short). You can also express your needs – always remember the scheme is beneficial for both parties.

I have been to Japan many times and it is a truly unique and wonderful country. Its beauty is breathtaking, both in architecture and landscape. It is worth seeing as much as you can. Try to integrate (speaking some of the language helps and is easier than you think), people can be reserved and there are many social conventions, but you are never expected to know these (although it is a lot of fun to try) and everyone is incredibly friendly. English is more widely spoken now and most signs are in English. Life, whilst interesting, is not difficult. The food is amazing, even for a vegetarian like me.



The Philosopher's Path – Kyoto is especially beautiful in autumn.



The river running through central Kyoto.