REPORT:

EU/JAPAN
EXCHANGE PROGRAM

by Jan Piot

Home university: *K.U.Leuven*
Host university: *Keio University*
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1. PERSONAL DATA

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2. EXECUTIVE SUMMARY

The goal of my study in Japan was to take seven classes for one semester (Spring semester). During these classes, I came in contact with Japanese students, as well as students from Europe or America, who participate in a three year master course at Keio. Because of the groupworks for each lecture, I had the opportunity to work together with students from different nations around the world.

Even though I was in Japan for taking classes, I also was appointed to a laboratory. This is not surprising, as the laboratory is a central part of the student life in Japan. Even in lectures, a student is identified with his name *and* his laboratory and research topic. During some lectures, the professor gave an assignment, which has some kind of relation with the student's research.
My lab's professor gave me an assignment to work on. This laboratory work has been especially valuable for me, as it's research field is the same as for my master thesis in my last year (2005-2006).

In order to get to know Japanese life and culture, I visited different places. In the first months, I expored Yokohama as well as Tokyo and it's area. The last month, I went to Kyoto, Osaka and Nara. These cities are known for their legacy of Japanese culture. I also visited Oita and Usuki (Kyushyu). Here, one can find a place in Japan where nature is still very much present.

Daily life in Japan is a little difficult, especially the first weeks after arrival. One is confronted with the fact that most Japanese (outside of the university), don't speak English. It takes some time to get the necessary experience for undrstanding the people, or how to express what you want.
Even a normal thing like buying a cellphone can be very hard. In most cases, it is better to ask the labmembers, who can speak English, for help.
Generally, Japanese people are very friendly. If a Japanese person can't help you, he will stay with you and find someone who *can* help you.

During my time in Japan, I had the chance to get in touch with Japanese people, life and culture. I had the challenge of living in an environment that was different from the one I used to live in. I got to work together with students from different countries all over the world and I gained technical experience during the lectures and the labwork.

5. TRAVEL SCHEDULE

March 31:

Arrival in Japan.

April:

Exploring the Tokyo and Yokohama area. I also went on a daytrip to Kamakura. Kamakura is a city were some famous temples (e.g. the Buddha temple) and shrines are located.

July 23-24:

Climbing Mt. Fuji. Mt. Fuji is a non-active volcano. The top is the highest in Japan (about 4000 m).

August 7-10:

Trip to Kyoto, Osaka and Nara. Kyoto and Nara are former capitals of Japan. They hold a legacy of Japanese history. One can visit many temples and palaces in these cities.

It is interesting to see that traditional buildings are located inside the cities. Modern life and tradition seem to go hand in hand in Japanese daily life.

August 13-16:

Murakami Laboratory organized a lab camp in the Tateshina area. During this camp, Bachelor students gave a presentation about a topic related to the lab's research. It was also a good time for all lab members to get to know each other. Next to studying, the students had the opportunity to do some sports.

August 26-28:

I went on a trip to Usuki, located on the island Kyushyu. In this area, a lot of nature has been preserved over the years. Also, it is a place of many traditions. One can find traditional Japanese houses and ancient temples. The environment is totally different from the big cities.

September 1:

Return to Belgium.

6. LECTURES AND LABWORK

6.1 LECTURES

During my time in Japan, I took the following courses:

1. Computer Architecture
2. Computational Structural Mechanics
3. Advanced Design and Production System
4. Computer Simulation
5. Aerospace Propulsion
6. Advanced Course on Digital Communication Theory
7. Information Optics and Optical Measurements

The following will give a brief overview of the activities in the different courses:

Computer Architecture:

Memory-Processor-I/O interaction is described in this course. The focus is parallel computer architectures and parallel programming. Topics are: the different parallel architectures, the memory allocation and networks. During the classes, exercises are given. In the final class, an assignment is given in the form of a contest (Parallel Programming Contest, language is C).

Computational Structural Mechanics:

This course introduces linear and nonlinear finite element method. Every class, an assignment is given (exercises or computer calculations using MARC).

Advanced Design and Production System:

This course is divided into two subsections. The first subsection is tribology. The second is Multivariate Analysis in the design of systems. For the first section, a presentation is required about the influence and origin of friction in the student's research field. For the second section, a report is required about the different methods described during the lectures.

Computer Simulation:

In this course, the concept of parallel simulations is taught. The first two assignments are applications about the theory seen in the lectures (modeling of systems). The last assignment is a simulation of the RoboCup soccer contest. Here, students form teams, who build up their own virtual soccer team (in Java). In the final presentation, the teams are confronted with each other.

Aerospace Propulsion:

The basic topics of this course are: nozzle theory and design in propulsive systems, chemical combustion and trajectory calculation of rocket systems.
During the year, an assignment about chemical combustion has been given. With the help of the software package CEA, the initial and end composition of combustile mixtures had to be found.
In the last class is an examination.

Advanced Course on Digital Communication Theory:

The accent of this course lies on the digital technology used in wireless communications. In the lectures, modulation techniques, Multiple Access Techniques (CDMA,W-CDMA,...) and multiplexing techniques are introduced. For evaluation, the student can choose: either make a presentation about a recent topic in digital wireless communication technology, or write a report about wireless communication. I decided to write a report about Multiple Access Techniques and the capacity it induces for cellular systems (maximum number of channels or users in a fixed frequency band).

Information Optics and Optical Measurements:

The basic topics of this course are: geometric optics, wave optics (interference, Doppler effect, ...), coherence and applications in measurement systems. The last class, an examination is held.

Generally, self study is important. Some lectures give an introduction of methods or techniques. Then, for writing the reports, it is necessary to make use of the campus library or the lab libraries.

6.2 LABWORK:

Comparison between an IPD and a PID controller for Trajectory Control of an Electric Bicycle

6.2.1   Introduction:

Murakami Lab does research in the human assist field of robotics. Over the years, the lab succeeded in stabilizing the posture of an electric bicycle, using steering control. Concretely, this means that, while driving the bicycle, no human intervention is needed to keep the bicycle in an upright position. This is done by changing the steering angle by means of an electrical motor.
However, if posture control is used, the bicycle deviates from a straight line tracking. To overcome this problem, trajectory control is introduced.

6.2.2 Assignment:

The goal of the labwork is to make a comparative study between an IPD and a PID controller for trajectory control. Important factors for evaluation are the response of the trajectory and the response of the posture angle (the camber angle).

6.2.3 Modeling:

Basic parameters for the bicycle are the steering angle ϕ, the camber angle ψ and the lateral displacement y of the bicycle (figure 1 and figure 2).
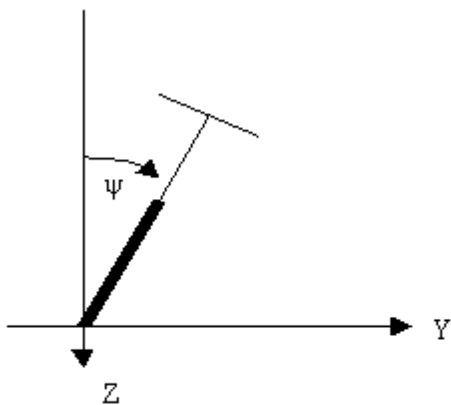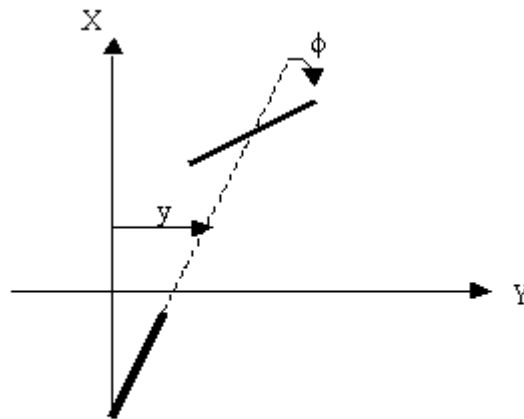

Figure 1: Back view of the bicycle   Figure 2: Top view of the bicycle

For posture control, the input to the posture controller is a desired camber angle ψ^{cmd} and the output is a steering angle ϕ.

The trajectory control is realized by giving a desired displacement y^{cmd} as input to the trajectory controller. This controller generates a desired camber angle ψ^{cmd} as input for the posture control.

The control scheme for trajectory control for both IPD and PID control is illustrated in resp. figures 3 and 4.
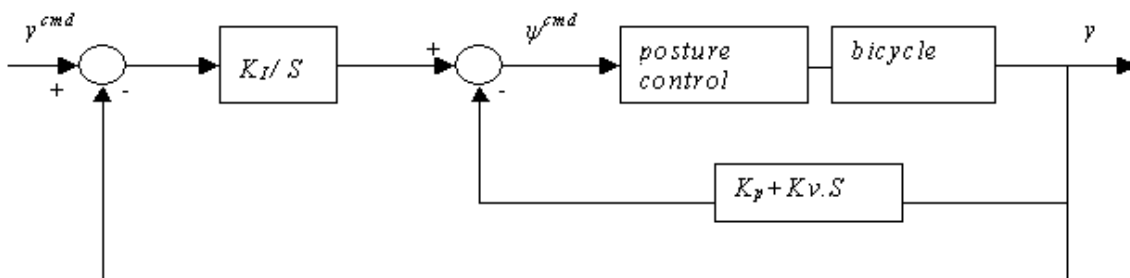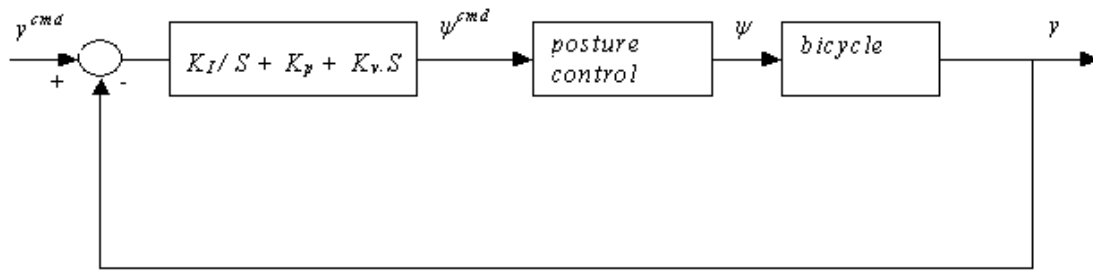

Figure 3

Figure 4

6.2.4 Simulation:

Because both camber angle and lateral displacement responses influence each other, a trade-off is needed between them.

For finding the gains for optimal trajectory control, a computer simulation is used.

6.2.5 Results:

A much faster y response is obtained for PID control (lower rise time and settling time).

For the camber angle, there is less overhoot for IPD control than for PID control. However, the camber angle moves faster to zero for PID control than for IPD control.

The results also conclude that for PID control, y is highly influenced by the posture control. For IPD control, this influence is not present. This is an important notice: the influence leads to nonlinear behavior. Nonlinear behavior has, for practical reasons, a bad influence on the stability of the system.

7. EXCHANGE STUDENT LIFE

Social life:

Finding your way around the first weeks can be tough. Luckily, it is not difficult to get in touch with many students around the campus and the dormitory. They can help you out, because most of them have been in Japan for some time and speak some Japanese. However, it is still necessary to find your way around, using your own expression skills. In this context, the ten day course of Japanese we took at the workshop in Delft has proven to be very useful. It also gives the necessary basis you need to start learning the language from interaction with the people you meet. After a while, it is possible to understand -to a certain extent- what some people are trying to tell you in Japanese.

At the dormitory, the students have the possibility to subscribe in a mailing list, provided by all international students. Here, you can find out what the different activities are for the next week or you can make a proposal yourself. This gives a good opportunity to make some friends.

If you are looking for a hobby, it is best that you get part of a circle. In Japan, it is custom to subscribe in a circle for doing some sport or other activities. It is almost impossible to find an activity without joining these circles.

In Tokyo, there are many places to go out. Very popular in Japan is karaoke. Almost everywhere you can find karaoke bars. When you go out with some friends, it is very likely you will sing karaoke.

If you are living in the vicinity of cities like Yokohama and Tokyo, you can find shops that are open all night. These are located in almost every street. They are very handy, as you can walk out in the middle of the night to get something to eat or drink. You needn't worry about the time.
Most other shops close around 9 o'clock.

Work:

Because I had seven classes, it was necessary to plan my time carefully. Most reports are due to the same date.

The duration of classes is 90 minutes. All classes end in July. Final reports are due to the end of July.
Classes and reports are in English, also for the Japanese students taking the course.
All Japanese students learned English, but almost never used it. They see talking to foreigners as an opportunity to practice their English.

Japanese students spend a lot of time in their laboratories. The lab members belong to a circle of close friends. The professor is at the head of this circle. He participates at the parties, organized by the students in his lab. This way, the students have a close relation to their professor.

8. SUMMARY

Although it might be difficult in the first weeks to find your way around and to communicate in Japanese, help is always at hand. One should never hesitate to ask for it.

It is really worthwhile to make a few trips in Japan. Japan is a large country, so there are many different surroundings and mentalities present.

Going to Japan has been a challenge to me. It has given me the opportunity to work and live in a totally different environment.