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## MEMORANDUM

**TO:** Prospective Ph.D. Students

**FROM:** Galip Ulsoy, Professor of Mechanical Engineering (ME)

**SUBJECT:** A Brief Introduction to the Ph.D. Program

Prospective graduate students should first visit the ME department's web-site for [prospective graduate students](#). Information for [current doctoral students](#) is also available on-line. Additional information is available in the ME Academic Services Office (ASO) in Room 2206 G.G. Brown Building. This document is intended to provide some general information for new, or prospective, Ph.D. students who may be considering working with me on their doctoral dissertation research. It provides only a brief summary of the Ph.D. program requirements. My expectations for Ph.D. students, and a brief description of my areas of interest for Ph.D. dissertation research are emphasized. Prospective Ph.D. students should not send an e-mail message to me, but apply directly for admission and financial aid to the graduate program through the [Mechanical Engineering Department](#). Please be advised that due to the large number of such inquiries I receive every day, I will not be able to respond to your message if you contact me directly.

### Comments on Program Requirements:

All Ph.D. students must take the ME Ph.D. **qualifying examination**, which involves taking graduate core courses in several subareas of mechanical engineering, an examination based on each of those courses, as well as a research presentation. Additional details are available from the ME ASO.

Upon successful completion of the qualifying exam a student should be familiar with the faculty members and research projects in the areas of research interest. Meet with these faculty members, get to know them and their interests before selecting an advisor and a thesis topic. The completion of a Ph.D. dissertation typically requires 10-12 hour days for 2-3 years spent focused on a single topic and working closely with a faculty advisor. Consequently, it is very important for the student to select a topic of genuine interest, and an advisor with whom he/she can work effectively. All students who wish to work with me on their Ph.D. Dissertation research are advised to first meet with and talk to all other faculty who are working in similar areas before making a final decision.

Typically the first task after selection of a topic and an advisor is the undertaking of a complete **literature review**. I recommend the development, for the literature review, of a literature database by students working with me on their Ph.D. research. The literature review is a very important first step in the Ph.D. research, and is often done in conjunction with the completion of additional **coursework**

**required for the Ph.D. degree.** When the required coursework is completed, the literature review finished, and the dissertation problem statement formulated the student should work with her or his advisor to form a Ph.D. Dissertation Committee (consisting of at least four faculty members including the advisor, at least two of which must be from the ME department, and at least one member must be from outside ME).

The **Preliminary Examination** is the first meeting of the **Dissertation Committee**. A formal document called a **Thesis Proposal** is prepared and given to the committee members at least 1-2 weeks before this meeting. During the meeting the student makes a short oral presentation of the proposed doctoral dissertation research and the Committee Members ask questions to ascertain the suitability of the topic and the appropriateness of the student's background for performing the proposed research. The committee typically meets at least one more time for the final **thesis defense** after preparation of the written Ph.D. thesis.

Rackham permits several formats for the preparation of the dissertation. I recommend to all students working with me to select the format based upon a collection of manuscripts prepared for journal publication. Typically, 2 to 4 such manuscripts together with an Introduction (first chapter), Summary and Conclusions (final chapter), and Appendices form the dissertation. See the Rackham Dissertation Secretary for specific requirements, or visit the web site [http://www.rackham.umich.edu/doctoral\\_students/](http://www.rackham.umich.edu/doctoral_students/). The ME ASO also has additional information for Ph.D. students. Make sure that you get the latest versions.

#### Comments on my expectations:

The Ph.D. thesis must represent the student's **original and independent research**. That is, it must make an original contribution to the engineering literature in the area. The research must be conceived, performed, and reported by the student with the supervision of her or his thesis advisor and the approval of the dissertation committee members. The student is responsible for managing the research and making appropriate use of resources such as faculty, other students, libraries, courses, laboratories, staff, computers, seminars, etc. This is a strong departure from the typical engineering education at the B.S. level, and thus requires a responsible, independent, and professional outlook on the part of the student.

The **quality** of Ph.D. level work must be very high in every aspect (i.e, content as well as presentation). That is it must represent "A" work (just as "B" is the minimum acceptable grade for an M.S. and "C" for a B.S. degree). Consequently, Ph.D. level research is not easy and requires considerable motivation, dedication and determination. Because it is challenging, it is also very exciting and rewarding.

Ph.D. students are expected to become a part of the **professional community** in their area of interest. They would take or visit advanced courses in their field, attend and present seminars, participate in the activities of professional societies, interact with other researchers in related areas, work effectively with staff, interact with and assist less advanced students, participate in proposal writing and reviewing of papers, and also help to manage and maintain facilities for research.

#### Comments on Research Areas:

My research areas are in the dynamic modeling, analysis, and control of mechanical systems. I have been particularly interested in applications in manufacturing systems (e.g., capacity management, turning, milling, drilling, sawing, stamping, and robotics) and automotive systems (e.g., belt drives,

active suspensions, vehicle control, control of hybrid vehicles). I am also interested in other application areas (e.g., disk drives).

One area of basic research interest is in the dynamics, vibration, and control of axially translating and/or rotating elastic systems. These include bandsaws, power transmission belts and chains, shafts, drill bits, flexible robot arms, etc. These technologically diverse systems have some underlying mathematical similarities.

Another area of basic research interest is in design of control systems, particularly control of systems, which are difficult to model and control. Problems of adaptive control, on-line parameter estimation, state estimation, and control as applied to mechanical systems, particularly manufacturing systems, are of interest (e.g. dynamic modeling and control of machining processes such as turning, milling, drilling, sawing, stamping and their monitoring for tool wear and breakage). State derivative feedback, coupling between modeling and controller design problems, control of system with control input saturation and combined design of plants and controllers, time-delayed systems are some specific recent topics of interest.

My world wide web Home Page (<http://www-personal.engin.umich.edu/~ulsoy/>) provides more information about my research interests, and the interested student may want to obtain copies of and read some of the papers cited (some are available as pdf files) there to get a more detailed description of various research projects. Note that most of the research projects involve some combination of theoretical and experimental work.

Stop by to talk to me about new problem areas and potential topics for Ph.D. dissertation research during my office hours, or send me an e-mail to set up an appointment for such a discussion.

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