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# Embedded Control of Flux Pumps

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**Abstract**

Flux pumps are devices used to wirelessly power High-Temperature Superconductor (HTS) electromagnets, which are useful for creating very strong magnetic fields. For these flux pumps to be a viable commercial product, the control

To help commercialize these flux pumps, I will implement a control scheme for two flux pumps on a TI C2000 microcontroller.

# 1 Introduction

In this section you should include a very brief introduction to the problem and the project.

Your project proposal should cover the following points:

- the engineering problem that you are going to solve;
- how you plan to solve your problem;
- how you intend to evaluate your solution; and
- any resource requirements for your project such as software, hardware or other resources that will be needed in the course of the project.

**Your proposal should be not more than than 8 pages long.**

# 2 The Problem

In this section you should give a clear and concise description of the problem itself. You want to briefly explain the problem, why it is important to solve the problem and define your project aims. After reading this section, the reader should understand why it is a problem, believe that it is important to solve and have a clear idea of the aims of your project.

When describing the aims of the project, you should avoid vague, unmeasurable words like 'analyse', 'investigate', 'describe', and use specific, measurable words like 'implement', 'demonstrate', 'show', 'prove'.

For example:

**Good** The aim of this project is to implement and evaluate a management system for network switches;

is much better than:

**Bad** The aim of this project is to investigate management systems for network switches.

In the second case there is no idea of how much work is involved, and you will never know whether you have finished. You and your supervisor (and the markers of your project) may have very different ideas about what such an 'investigation' involves. Of course, it is possible that the task you set yourself is not achievable, but if you are clear from the outset this is less likely, and will more easily be corrected.

# 3 Proposed Solution

In this section you will explain how you plan to solve the problem, that is, how you intend to carry the project out. At this early stage you need to be both clear about what you are going to do and flexible enough to adapt to changing circumstances. Making an early plan will not prevent you from running into trouble, but it will help you identify possible problems early. For example, if you intended to run an experiment in Human-Computer Interaction (HCI), you might realise early on that there would be problems gathering sufficient data to get reliable results, and that you should re-design your experiment.

Part of the planning process involves producing a timetable for when the work is actually going to be done.

Each part of the project should produce some output. For example you might plan on spending two weeks on background reading: the output of this will be a bibliography, and a possibly a literature survey for your report. Indeed, if you take the advice given above about having specific, measurable goals, you should describe this part of your project as:

**Good** Produce bibliography (est: 2 weeks)

rather than

**Bad** Background reading (est: 2 weeks)

Note that the methodology you outline here is dependent upon the type of project and engineering area. You must talk to your supervisor about this.

# 4 Evaluating your Solution

In this section you will explain how you will evaluate your solution once you have built it. The method of evaluation will be domain specific. Your supervisor should provide guidance as to what is an appropriate form of evaluation. For example, user testing for a HCI project or performance measurement for a Network Engineering project.

# 5 Resourcing and Ethics

In this section you will detail any resource requirements such as hardware, software or access. You should address each of these points, even if only to indicate that they are not of particular concern to your project.

## 5.1 Hardware

Discuss the hardware components that your project will be using. You need not include the computers that you will be using to carry out the development, unless your project requires specialised computer hardware to do this part. Example hardware components are machines, lab instruments, musical instruments, robots, drones, servers, mobile devices, single-board computers, sensors, actuators, circuits and circuit components, network equipment, solar panels, batteries, enclosures, mounting poles, etc.

## 5.2 Software, Datasets and Models

Discuss the specialised software (applications, compilers, libraries, development kits, simulators, solvers, etc) to be used. You need not include common desktop software such as browsers, office applications, IDEs, and editors. This is also the place to mention datasets and models that you plan to use.

## 5.3 Space, Virtual Resources and Access

Discuss the space (for instance labs or specialised rooms, outdoor fields) and resources that can be accessed virtually (for instance computing grid, virtual machines, network testbeds) that your project will use, and how you plan to obtain access them.

### 5.4 Budget

Provide an estimate of the budget for the project. If the budget is more than $500 you should indicate any sources of funding outside the normal ENGR 489 budget. The purchase of special tools or software etc. may not need to be included in your $500 limit, however, if something is necessary for your project you should definitely list it here.

Do not pad the budget to get it up to $500.

### 5.5 Ethics

Are there ethical considerations with the design or the evaluation of your work? For example, there may be constraints on the possible set of solutions that you could explore. If you want to undertake user testing of your system, then you will need human ethics approval.

### 5.6 Safety

Discuss key health and safety aspects of your project. Note that you will still need to fill up the appropriate Health and Safety documents.

### 5.7 Intellectual Property

Discuss intellectual property with potential commercial value that might be developed in the project. See the Handbook for more information regarding IP agreements.

## References

[1] KNUTH, D. E. *The Art of Computer Programming: Fundamental Algorithms, volume 1*. Addison-Wesley Professional, 1997.

When listing references, follow an appropriate citation or bibliography format. For engineering and computer science, the most appropriate formats are from the Association for Computing Machinery (ACM) and Institute of Electrical and Electronics Engineers (IEEE). Example citation: [1].