Gunn Diode Oscillator Minutes

David Headland

2003-10-02 14:00

Attendance

- Fourth year students
  - MP Gaskill
  - DP Headland
  - JM Higginbotham
  - RE Irwin
  - AJ Nelms
  - R Wan
- UMIST staff
  - WS Truscott
  - R Sloan

Introduction

All students and the two project directors were introduced to each other.

Web site

- Suggested to set the site up on familiar web space (winterwolf.co.uk is available for this purpose), and link to it from the UMIST web space.

- The HOTFET project used pages on CUS' server.
- Photographs, student biographies and information relevant to the project should be placed here.
- It will be marked aspects such as:
  - Professional appearance
  - Hyperlinking accurately
  - Being up-to-date
  - Accuracy
- It should advertise the quality of the fourth year.
- Could be linked to, for example, on CVs.

Question

Question: Should the site be informative or technical [R Irwin]

- It should be part of each. There should be an interesting and informative at the top level, with links to pages containing more detailed, technical information so the reader can access exactly the information they require.
- A top-down approach should be taken, looking from a system point of view.
- Any interesting and clever aspects should be explained on separate pages, concentrating in why they're particularly clever.
- It should show competence.
- The level of detail should be judged by the group members.

Swipe card lab access

It was suggested that swipe card access to the lab should be set up later that afternoon.

Prizes

- There will be at least two prizes relevant to the project
- Prize from Accenture Consulting for the best links with the industrial collaborator.
  - Suggestion to present information to e2v Technologies at the site visit in November.
- Teamwork prize from UMIST to be announced in early 2004.

Records

- Record keeping is important to provide documentation for prizes, management marking, presentations, etc.
- Accumulate documents to present as the project:
  - The final report, which should not be longer than required to explain the concepts.
  - Appendices containing supporting documentation, so that parties interested in certain aspects can find the correct section quickly.

Appointed positions

- Manager, secretary and auditor positions were announced to the project directors.
- Previous projects required flexibility at certain times as the workload fluctuated. This is also likely to be the case for this project.

Questions

Question: Clarify the target frequency. [R Irwin]

- The target frequency will be 87 GHz.

- Designs for these types of oscillator are often practically lower than in theory, so tuning may be required.
- Designing initially for 96 GHz was suggested, then parameters can be adjusted.

Question: Will we be manufacturing the Gunn diodes? [J Higginbotham]

- Not necessarily. This choice is up to the group.
- If a new packaging method is designed to allow multiple diodes in one package without causing overheating, we can manufacture.
- Existing single devices could be used.

Question: Will e2v help with fabrication?

- They will help with some of the machining if required.
- e2v will prefer planar circuits because of ease of manufacture.
- If new methods, eg. gold plating pasta shells, is found to be better than other methods, it can be considered.

Multiple possibilities

- All possible methods of reaching the goal should be considered.
- Include documentation even for systems that will not be used as proof of consideration.

Recommended research

- Use the first few weeks as time for information pursuit.
- Useful information should be distributed.
  - By hard copy at meeting.
  - In PDF format to the mailing lists.

  - Copyright was considered, but as this is student research this type of pooling would be considered acceptable.

- IEEE Xplore is suggested as a useful source of information. It categorises and allows searches through all IEEE journals, then retrieval of PDF copies.
- Electronic journals are available in the library.
  - IEEE "Electronic Devices" was suggested as a good source of relevant information.
- Will need to know the basic operation of Gunn diodes, but not too in-depth.
- Oscillation circuits are important.
  - How to get it to oscillate at the correct frequency.
  - How to combine multiple oscillators.
  - Why they don't oscillate at different frequencies.
  - How do you get them to oscillate coherently.
- Don't limit research to microwaves. All oscillators are similar.
- Look for synchronisation methods, possibly even down to the level of the National Grid.
- Injection locking, for example for phase locked loops.
- Summary: Although the context is specialised, the methods used could be applicable to many situations.

Help from the directors

- The project directors feel that students researching for themselves is more beneficial then lecturing.
- They will answer any relevant questions presented to them.
- Reverse engineering current solutions is a good idea, but they should not be considered to be the only solution.

- Although other diode types can be used, it's probably useful to stick to Gunns for this project.
- Use IEEE Xplore and look for more generalised papers, such as "The Gunn-diode: Fundamentals and Fabrication".

Overall project aim

- To engineer a solution to a project, to gain skills that can be used throughout life.

Wave guide circuits were shown to the group as a physical example of similar systems.

Project marks

- The constitution of individual and team marks was discussed.
  - A project mark is awarded for overall work.
  - This is multiplied by a number based on individual input to give a student's individual mark.
- Input from students on individual contributions will be taken into account.
- The team can present information on how the group is working at any time.
- It is preferable to sort out our own management, conflict, etc. problems, as we will be credited for that.

Accommodation

- Few people are willing to give fourth year project students lab space.
- The lab next to the coffee room on C floor is available for use.
- Swipe card access will be arranged soon.

- Work will start in there, but there is the possibility of moving elsewhere if required.
- Books available in the coffee room are available for use. Several were suggested.

Question

Question: What is negative differential resistance? [R Irwin]

- Pushing a box over was given as an example. The box resists positively as the centre of mass lies within the base. After this point, the box resists negatively, pulling your hand down with it.
- In an electronic context, as potential is increased, current flow decreases in negative resistance.
- Current will π^{c} out of phase with negative resistance.

Safety

- A safety audit will be required.
- One consideration is cooking eyeballs, as there is no means for them to distribute heat through the blood system.
- Never look down a waveguide, even if it appears to be off.

Timetabling

- Timetabled slots were discussed.
- If the directors are required on a Tuesday, appointments can be arranged by email for 11:00.
- Directors will be present at the 14:00 meetings on Thursdays.

Workspace

- Swipe card system installation was suggested, but Ian Hawkings could not be found, so this was deferred.
- The labs were shown to us, and a workspace was assigned within the lab.
- E16 will also be available for use when it is not otherwise required.

Welcome party

- This is a welcome party for postgraduates tomorrow at 16:00. The group has been invited to attend if desired.

Objectives

DP Headland	Create a further mailing list for just the students and the directors.
MP Gaskill	Research safety with a view to creating the safety audit.
All	Read the provided copy of "The Gunn-diode: Fundamentals and Fabrication" provided by W Truscott.
All	Research any information for relevant to the project. Information should be pooled either in hard copy, or in PDF format on the mailing list. Useful links should be sent to the mailing list, and an online copy will be created and maintained by category. Information on which papers are being research should be posted to the list to reduce duplicated efforts.

Next meeting

Time	Tuesday, 7 October 2003, 09:00
Place	D-floor coffee room

Meeting adjourned, 16:00.