

Gunn Diode Oscillator Minutes

David Headland

2003-11-20 14:00

Attendance

- Fourth year students
 - DP Headland
 - AJ Nelms
 - RE Irwin
 - R Wan
 - JM Higginbotham
 - MP Gaskill

- UMIST staff
 - WS Truscott
 - R Sloan

Approvals

- The minutes from the previous meeting were approved.

Bias choke operation

- R Sloan draw pictures to demonstrate the bias choke in a waveguide.
- The thick sections are equivalent to parallel capacitances to ground.
- The thin sections are equivalent to serial inductances.
- The DC bias is supplied from the far end of the arrangement.
- DC passes through to the diode.
- Higher frequencies are attenuated.
- For further information, a book on filters by Matthaei, Young and Jones (1956) was suggested.

Resonant caps

- No formula for calculation is available.
- All current work is empirical.
- Concentrate on the choke design.
- Empirical work is okay for this project report, as it demonstrates work within current engineering standards.
- JM Higginbotham and RE Irwin pooled information.
- Research matched Philip Norton's suggestions.
- The plan is to make several chokes or various coarse measurements and see which work best.
- The best designs can then be tuned.
- Simulation in HFSS will be carried out.
- A fixed wall to screw into the waveguide could be made to house the choke.
- This would allow different sized chokes to be used in one waveguide.
- A solid dielectric could be used around the choke.

Team meal

- The possibility of a subsidised team meal was mentioned.
- It could be set up as a team-building exercise.
- R Sloan thinks this is a good idea.
- WS Truscott suggested an Indian buffet near Levenshulme.
- The evening of Thursday 11 December was suggested.
- We should mail the supervisors to arrange this.

HFSS simulations

- An email should be sent to R Sloan to organise this.
- He will then arrange a suitable time and material for tuition.

Report task split

- This was discussed with WS Truscott.
- We may have to re-shuffle sections as the report progresses.
- This project can not be split to one person per module.
- It was suggested that we may want to have a keep the read material separate from planned and completed work in the report.
- Question: Should we have sections for research, completed work and planned work?
 - It doesn't matter.
 - Make it easy for the reader to see what we have done.
 - If you don't do this, the information can easily get lost.
 - Organise the report for impact.
- Contents pages can be submitted to the supervisors so they can check the structure.
- There probably won't be time for them to check the document itself.

Presentation

- We tried to present ourselves to e2v — this worked well.
- We may not want to do individual introductions at the formal presentation in February.
- Check the mark scheme.
- All presentation rules must be adhered to.
- Our presentation to e2v was well matched to the situation.
- Most of the marks for the formal presentation are for preparation and delivery.
- Technical content is worth only 20%.
- It was suggested that 2–3 people talk in February.
- All people must be prepared to answer questions.
- Questions will be asked of everyone.
- Question handling is worth 20%.
- It is suggested that at the end of the report, people’s knowledge areas are summarised to allow people asking questions to target them to balance the load.
- More diagrams might be useful.
- The room at e2v was small — we may need to project our voices more at UMIST.
- Checking the room before the presentation is advisable.
- Time keeping is very important.
- People who will be present:
 - All project teams.
 - All project supervisors.
 - Two independent markers.
 - Industry representatives.

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- If we have a waveguide it is suggested that we pass it around.
 - This would help to give an idea of the size we are working at.

Mark scheme

- The mark scheme was discussed.
- The HOTFET team left some things quite late.
- Forward planning would be very helpful.

Bias choke manufacture

- Manufacturing can be done at UMIST.
- The control systems workshop is the best place.
- How long it takes will depend on the workshop's workload.
- The workshop is on F floor above the tomography department.
- Roy Moody does the supervising there.
- We must check all work to make sure it matches the specification.
- We will need tools for accurate measuring.

Waveguide design

- Both rectangular and circular back shorts will be made.
- When the back short is in the correct position it will be glued into place.
- For the guide wavelength (for the second harmonic):

$$\begin{aligned}a &= 2.54 \text{ mm} \\b &= 1.27 \text{ mm} \\ \lambda_c &= \frac{1}{\sqrt{\left(\frac{m}{2a}\right)^2 + \left(\frac{n}{2b}\right)^2}}\end{aligned}$$

For TE_{10} (dominant mode), $m = 1$, $n = 0$:

$$\begin{aligned}\lambda_c &= \frac{1}{\sqrt{\left(\frac{1}{5.08}\right)^2}} \\ f_c &= \frac{c}{\lambda_c} \\ &= \frac{3 \times 10^8}{5.08 \times 10^{-3}} \\ &= 59.1 \text{ GHz} \\ \lambda_G &= \frac{\lambda_0}{\sqrt{1 - \left(\frac{\lambda_0}{\lambda_c}\right)^2}} \\ \lambda_0 &= \frac{c}{f_0} \\ &= \frac{3 \times 10^8}{87 \times 10^9} \\ &= 3.45 \text{ mm} \\ \lambda_G &= \frac{3.54}{\sqrt{1 - \left(\frac{3.45}{5.08}\right)^2}} \\ &= 4.70 \text{ mm}\end{aligned}$$

Postgraduate passes

- A risk assessment must be produced.
- Since lab access is not likely, base it on the computer use assessment.

Proposed actions

DP Headland	Create an out-of-hours working risk assessment.
RE Irwin	Return the microwave bible on Monday.
All	Continue working on your own task sections.
All	Start work on the interim report.
JM Higginbotham	Mail R Sloan or WS Truscott regarding workshop access.

JM Higginbotham Mail R Sloan to arrange HFSS tuition times.

DP Headland Mail the supervisors to arrange team building meal.

Next meeting

Time Tuesday 25 November 2003, 10:00.

Place D floor coffee room.

Meeting adjourned, 16:12.