Gunn Diode Oscillator Minutes

David Headland

2003-11-11 10:00

Attendance

- Fourth year students
  - DP Headland
  - AJ Nelms
  - RE Irwin
  - R Wan
  - JM Higginbotham [arrived 10:10]
  - MP Gaskill
- UMIST staff (at various points during the meeting)
  - WS Truscott
  - R Sloan

Approvals

- The minutes from the previous meeting were approved.

Second harmonic operation

- R Sloan demonstrated fundamental frequency and second harmonic operation to the group.
- The example given was a string oscillating between two fixed points for fundamental frequency (f_0) operation.
- Second harmonic ($2f_0$) operation was demonstrated as the string oscillating with the centre fixed as well.
- Second harmonic operation of Gunn diode oscillators is possible because of the current spike in a Gunn diode being so tight.
- Second and higher harmonics will be high power if the spike is infinitely sharp (a comb).
- To select the second harmonic, a filter must be designed to reflect back all frequencies except the second harmonic.
- Sub-harmonic locking can be used.
  - This involves injection locking at a lower harmonic than the one used for power output.
  - R Sloan suggested not to complicate matters by trying this.

e2v presentation

- Overall, the group was pleased with the outcome.
- Mick was worried about part of his presentation.
  - Extra knowledge and professional response compensated for this.
- The buildings were not as expected for a high-tech plant.
- It was suggested that we ask to borrow the 1000× model of the Gunn diode for our presentation.

Points made by e2v

- The help on capacitance and resonant discs was very useful.
  - Trial and error will be required for final tuning.
- Simulation would be more useful in certain aspects of the project than others:
  - Injection locking
  - Power combining
- The biasing circuit is important.
  - A power supply with four tunable outputs will be required.
- MP Gaskill knows of a company that may be able to help with machining in an emergency.
- Circular waveguides were discussed
  - Can use used, but they are lossy.
  - The waves will propagate in any orientation.
  - Can be used as a backup idea.
  - Concentrate on rectangular waveguide.

New project aims

- Power combining.
- Use waveguide rather than planar circuits.
- Use the diodes in second harmonic mode.
- Use GaAs Gunn diodes.
- Aim for the highest achievable power and frequency without set limits.

New tasks

- Investigate the effects of varying the resonant caps.
- Investigate methods of combining the diodes
  - Four diodes in one waveguide.
  - Two waveguides with two diodes each and an overmoded waveguide.
  - Four single-diode waveguides and an overmoded waveguide.
  - One waveguide operating in fundamental mode and one at the second harmonic.

List of requests to e2v

- Example target specification.
- Provision of a ready-made Gunn diode oscillator.
- Provision of the Gunn diodes themselves.
- Ask about borrowing the scale model for the presentation in February 2004.
- Request photographs:
  - Model of the Gunn diode.
  - The semiconductor laboratories.
  - The lest lab with the electron microscope.
  - Philip Norton's test area.

Task assignment

- MP Gaskill presented a draft task split for the interim report.
- This was commented upon by the group.
- Specifications will be required to designs a single oscillator.

  - This should be discussed on Thursday.
  - This will require the diodes from e2v.

- The LyX CD was made available.

Proposed actions

RE Irwin	Bring the rough guide sketch to Thursday's meeting.
RE Irwin	Email our requests to e2v.
RE Irwin	Email the American company with a request for a sample of InP Gunn diodes.
All	Read all proposed papers by WS Truscott for Tuesday.
All	Look at the proposed task split in the report with a view to making changes and task assignment on Thursday.
MP Gaskill	Mail DP Headland with the interim report task split.
R Wan	Mail DP Headland with group photographs from Lincoln.
DP Headland	Place the task split and photographs on the web site.

Next meeting

Time	Thursday, 13 November 2003, 14:00
Place	D floor coffee room

Meeting adjourned, 11:43.