EEE6480

EEE660X
COM6915

Research techniques & thesis preparation

Poster /Oral Presentation

Experimental Uncertainty

Contents

- Giving a presentation
- Poster presentation
- Oral presentation
- Experimental uncertainty – instrumental, graphical, numerical

Giving any presentation

- **Formulate objectives**
  - What are the objectives of the presentation?
  - Which main points do I want to make?
  - Which core messages do I want people to remember?

  - Sketch the basic structure…..
  - Use key words, bullet points
  - Review – is it consistent and logical?
  - Is there extraneous, unnecessary info that can be omitted?

- **Identify audience**
  - How achieve objectives given knowledge of audience?
  - Don't tell everything you have done (→confusion)
  - Fill in main message with appropriate supportive details
  - Slides/posters should have minimum information necessary to get point across.

  - Posters often displayed throughout a meeting

    → self-explanatory, clearly stated intro, methods, results, conclusions
  - Should be able to go through it in < 5mins

Poster presentation

- Visual aid to present research findings to audience on 1 to 1 basis
- Not possible to include all details or data – be selective!
- Poster and you are used together to present research and answer Qs.
- Allow people time to read it. If they ask a Q, talk them through poster
- Limited space (A1) - make full use of it!

The University Of Sheffield.

M.Sc. Electronic Engineering Project 2009-10

Project Title

Student and Supervisor Names

Department of Electronic and Electrical Engineering

Poster Format

- Title, name at top
- Introduction (aims, objectives)
- Theory/methodology (techniques employed)
- Results (main analysed results)
- Conclusions
- Further work
- References/acknowledgements

Tips

- Don’t make title too long
- Make full use of space, but not crammed full of info
- Don’t cut and paste from dissertation
- Be concise (clear English). Big picture, selective results
- Be careful with colours
  - use to highlight, add interest
  - High contrast background/foreground

- Large text (read from ~2m away, e.g. 36pt)
- Titles/headings in larger text
- **Bold** or <u>underline</u> to add emphasis (don’t mix fonts)
- Standard fonts (not anything that may be difficult to read)
- Keep equations to a minimum – just important ones, large enough, state all variables
- Check spelling
- Maintain consistent style (captions, font size, headings etc)

- Arrangement to follow storyline
- Use relevant pictures to illustrate
- Graphs:
  - to be seen ~2m away (e.g. thick lines, legible annotations)
  - Don’t include too many data lines
  - Use same size/scale if comparing
- Relevant diagrams:
  - Label clearly
- Make drafts and review for style, mistakes, legibility

Oral presentation

- Rehearse out aloud – relaxed delivery
- Standard formula –
- Introduce yourself
    1. Tell audience what you’re going to tell them
    2. Tell them
    3. Tell them what you have told them

Oral presentation tips

- Don’t go over length (~2mins per slide)
- Less is more (e.g. next slide)
- Don’t go off at a tangent
- Use voice, facial expressions, body language
  - Speak clearly, project voice to back of room, don’t rush, vary pitch/speed of voice
  - Pause at key moments
  - Look at audience not at screen behind you!
  - Know when to move on/stop

Add a title here

Add a useful picture or graph here (remember font size on any axes)

- A few bullets of text
- Outline main points only
- Keep font size >28pt
- Don’t overcrowd

Oral presentation tips

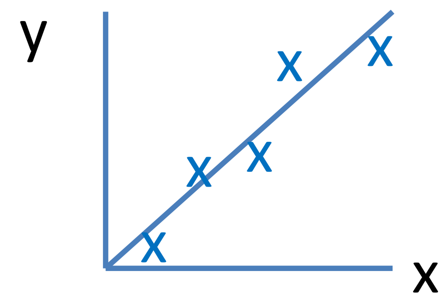
- Avoid
  - Blocking screen (poster) with body
  - Excessive gesturing or pacing about
  - Reading from slides word for word

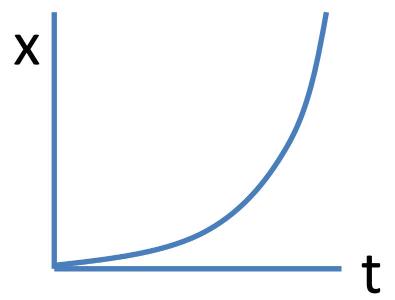
- Good (interpretable, simple) visual aids – helps convey complex technical data.
- 1 figure per slide, a few bullet points, minimum 28pt text
- Be careful with colour reproduction from projector (use obvious colour schemes)

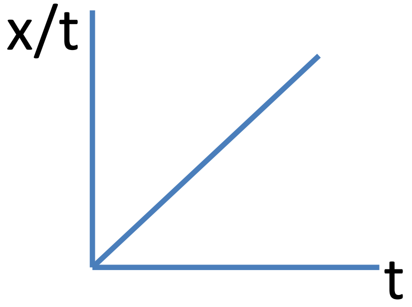
Measurements and errors

- Plot graph and fit *e.g.* straight line $y = mx + c$
- Automatic averaging, estimate of random errors, presence of systematic errors.
- Straight line easiest, usual to derive linear form of non linear fits, *e.g.* $x = ½gt^2$

→ $x/t = ½gt$, gradient = ½g







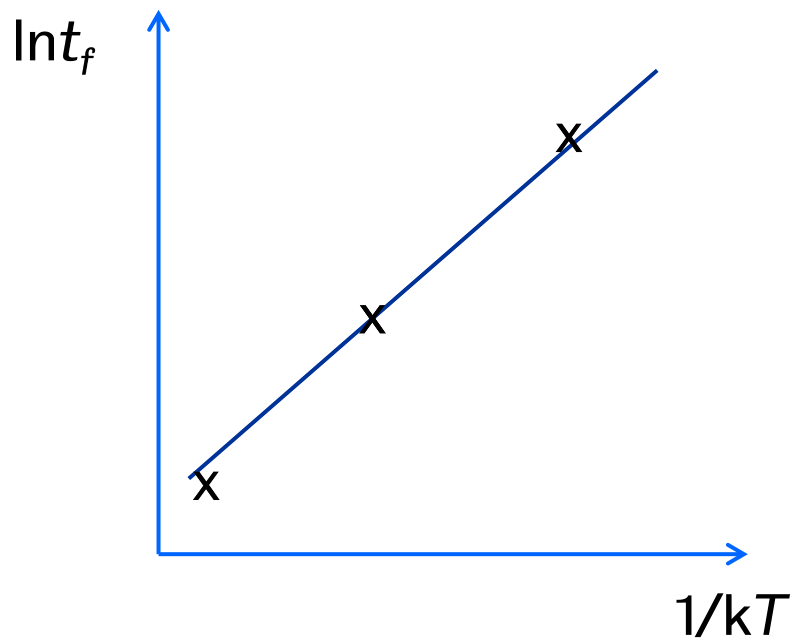
e.g. Arrhenius equation

$$MTTF(T) = A\exp\left(\frac{E_a}{kT}\right)$$

$$\ln t_f = E_a\left(\frac{1}{kT}\right) + \ln A$$

$$y = mx + c$$

Plot $\ln t_f$ *versus* $1/kT$



$$y = \ln t_f$$

$$x = \left(\tfrac{1}{kT}\right)$$

Slope, $m = E_a$

Intercept, $c = \ln A$

Errors

- Experiments measure a previously unknown quantity or test a theory. We cannot know for sure unless error (uncertainty) is known

e.g. Diameter of a rod fitting through a hole exactly 3cm diameter is measured as 2.99cm

If diameter is (2.99 ± 0.03) cm we are in trouble!

Error must be determined within experiment.

e.g. Don't say $R = (10.5 \pm 0.5)\ \Omega$ just because theory says $R = 10\ \Omega$.

- Error tells how reproducible results are (spread of values) – STATISTICAL ERROR
- Distinguished from SYSTEMATIC ERROR

- If many measurements, take σ of Gaussian spread of values
- Usually only need rough estimate:

1. Instrumental
2. Graphical
3. Numerical

1) Instrumental

- **Resolution based**

e.g.1. DVM res. = 0.1V so error is ± (½ least count) = 0.05V

e.g.2. Determined by number of counts that can be displayed, determined by the number of digits.

4 ½ digits means 4 digits with 0-9 variation and one leading digit which is 0 or ±1. Total of 20000 counts.

1	9	9	9	9

Resolution = smallest count / maximum count, *i.e. 1/20000 or ±0.005% for a 4 ½ display.*

e.g. Specification of ±(0.05% + 1 count) for a 4 ½ digit DMM reading 10.000 Volts, Corresponds to: ±0.05% of 10 Volts = ± 0.005V = ± 5mV, ±1 count of XX.XXX display = ± 0.001 V = ± 1mV

Total error of ± (5mV+1mV) = ± 6mV.

- **Accuracy** (how close to true value)
- e.g. ammeter with ± 5% reading 1A could be 0.95 to 1.05A
- Analogue meters – accuracy as % of f.s.d

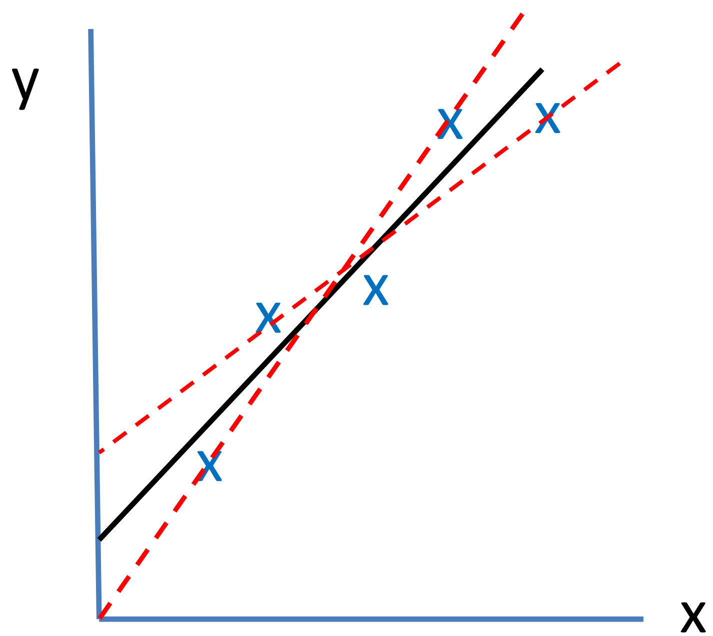
e.g. 1A measured on 3A fsd range with ±5% fsd accuracy → ± 0.15A

(so measuring 0.2A on this range is ± 75%!)

- Digital meters – accuracy as % of reading plus % of range

2) Graphical

- Draw best line through data
- For estimate of error on gradient, draw lines of max. and min. gradient



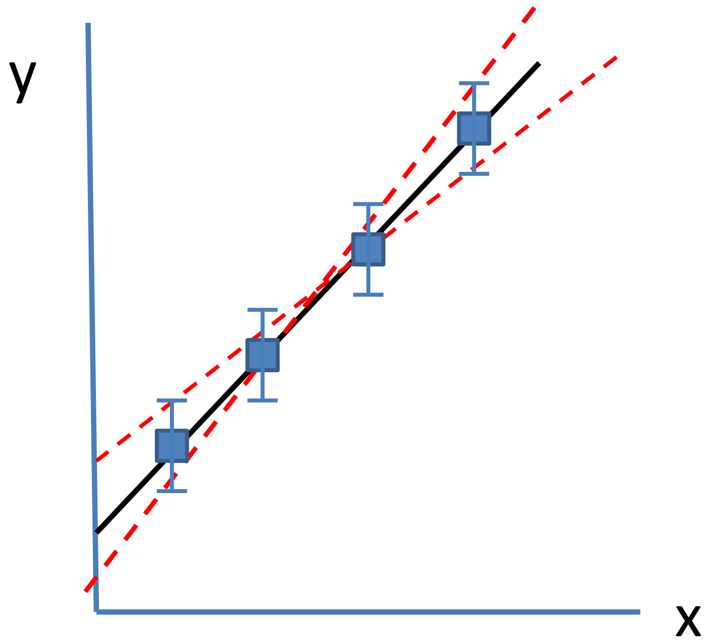
m = 10.7, 8.9, 11.9

So m = 10.7 ± 1.5

c = 6.9, 13, 0

So c = 7 ± 7

- When using error bars



Errors on individual measurements taken into account

3) Numerical method

- Uses mean, standard deviation

Errors on derived quantities

- Relate error on final result to error on measured quantities.

1. Constant factors –

e.g $r \pm \delta r$, $C = 2\pi r \pm 2\pi\delta r$ i.e. same fractional error

2) Powers-

e.g. if square has side $x \pm \delta x$, area = $(x \pm \delta x)^2$

so $x^2 \pm 2x\delta x$

3) Multiplication/division of independent measurements:

$$\frac{\delta A}{A} = \sqrt{\left(\frac{\delta L}{L}\right)^2 + \left(\frac{\delta w}{w}\right)^2}$$

4) Addition/subtraction: If L = a + b

$(\delta L)^2 = (\delta a)^2 + (\delta b)^2$

i.e. absolute error, not fractional error

- Finally.

Don’t double count errors -

errors on individual measurements are already included in errors on gradient or intercept. There is no need to add the individual errors to the errors on fitted results!

Errors - Further reading

“Experimental Methods”. L. Kirkup. John Wiley & Sons. 1994