MPSW 5013
Research Methodology

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A. DEFINING THE RESEARCH PROBLEM (2 hours)

1) Formation and formulation of research problem
2) Writing a problem statement
3) Developing research questions based on problem statement
4) Developing research hypotheses
5) Relationship between hypotheses and data analyses technique
6) Class exercise

B. CRITICAL REVIEW OF THE LITERATURE (2 hours)

1) Understanding literature search
2) Sources of literature search
3) Search techniques
4) What is a review of the literature?
5) Critical appraisal
6) Quoting, paraphrasing and summarizing
7) Referencing and citing references
8) Class exercise

Assignment 1: 10%

LEARNING OUTCOMES:

At the end of the lecture, the students should be:

1) able to define the research problem
2) able develop research hypotheses
3) able to review critically on the literature
4) able to quote, paraphrase, summarize and synthesizing literature
5) able to cite references

A. DEFINING THE RESEARCH PROBLEM

1) Formation and formulation of research problem

- A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the problem.

SELECTING THE PROBLEM

- The following points may be observed by a researcher in selecting a research problem or a subject for research:

SHOULD NOT

(i) Subject which **is overdone** should not be normally chosen, for it will be a difficult task to throw any new light in such a case.

(ii) **Controversial subject** should not become the choice of an average researcher.

(iii) **Too narrow** or too vague problems should be avoided.

SHOULD

(iv) The subject selected for research should be **familiar and feasible** so that the related research material or sources of research are within one's reach.

(v) The importance of the subject, the **qualifications** and the training of a researcher, the **costs** involved, the time factor are few other criteria that must also be considered in selecting a problem.

(vi) The selection of a problem must be preceded by a **preliminary study** when the field of inquiry is relatively new and does not have available a set of well developed techniques.

- Usually we say that a research problem does exist if the following conditions are met with [*Kothari*]:

(i) The individual or the organization, '*I*', occupies an environment, say '*N*', *which is defined by values of the uncontrolled variables, Yj.*

(ii) There must be at least two courses of action, say *C1 and C2, to be pursued.*

(iii) There must be at least two possible outcomes, say *O1 and O2, of the course of action, of* which one should be preferable to the other.

(iv) The courses of action available must provides some chance of obtaining the objective, but they cannot provide the same chance, otherwise the choice would not matter. Thus, if $P(O_j \mid I, C_j, N)$ *represents the probability that an outcome* O_j *will occur, if I select* C_j *in N,* then $P(O_1|I,C_1, N) \neq P(O_1|I,C_2, N)$ *. In simple words, we can say that the choices* must have unequal efficiencies for the desired outcomes.

- Thus, a research problem is one which requires a researcher to find out the best solution for the given problem, i.e., to find out by which course of action the objective can be attained optimally in the context of a given environment.

- Formulation of a problem is often more essential than its solution. It is only on careful detailing the research problem that we can work out the research design and can smoothly carry on all the consequential steps involved while doing research.

Every research study is unique

- So it is impossible to develop a set of rules that ensure a successful research program
- There's no such thing as "right" or "wrong" in formulating a research plan or in getting a "good" research question
- There are some useful guidelines, however

(i) Statement of the problem in a general way

- the supervisor puts forth the problem in general terms, and it is then up to the researcher to narrow it down and phrase the problem in operational terms.

(ii) Understanding the nature of the problem

- discuss with those who have a good knowledge of the problem concerned or similar other problems

(iii) Surveying the available literature

- the researcher must be well-conversant with relevant theories in the field, reports and records.
- know if there are certain gaps in the theories, or whether the existing theories are inconsistent with each other, or whether the findings of the different studies do not follow a pattern consistent with the theoretical expectations and so on.

(iv) Developing the ideas through discussions

- a researcher must discuss his problem with his colleagues and others who have enough experience in the same area or in working on similar problems.
- discussions with such persons should not only be confined to the formulation of the specific problem at hand, but should also be concerned with the general approach to the given problem

(v) Rephrasing the research problem

- Rephrasing the problem into analytical or operational terms
- the researcher puts the research problem in as specific terms as possible so that it may become operationally viable and may help in the development of working hypotheses.

A. DEFINING THE RESEARCH PROBLEM

2) Writing a problem statement

- In addition to what has been stated above, the following points must also be observed while defining a research problem:

(a) **Technical terms** and words or phrases, with special meanings used in the statement of the problem, should be clearly defined.

(b) Basic **assumptions** or postulates (if any) relating to the research problem should be clearly stated.

(c) A straight forward statement of the value of the investigation (i.e., the **criteria** for the selection of the problem) should be provided.

(d) The suitability of the **time-period** and the **sources** of data available must also be considered by the researcher in defining the problem.

(e) The **scope** of the investigation or the limits within which the problem is to be studied must be mentioned explicitly.

Example

Towards a piezoelectric vibration-powered microgenerator

P.Glynne-Jones, S.P.Beeby and N.M.White

Abstract: As MEMS and Smart Material technologies advance, embedded and remote applications are becoming more widespread. Powering these systems can be a significant engineering problem, as traditional solutions such as batteries are not always appropriate. An inertial generator is developed that uses thick-film piezoelectric technologies to produce electrical power from vibrations in the environment of the device. The device validates the concept, and produces an output of 3μW. Predictions show that orders of magnitude increase in power output are possible.

1 Introduction

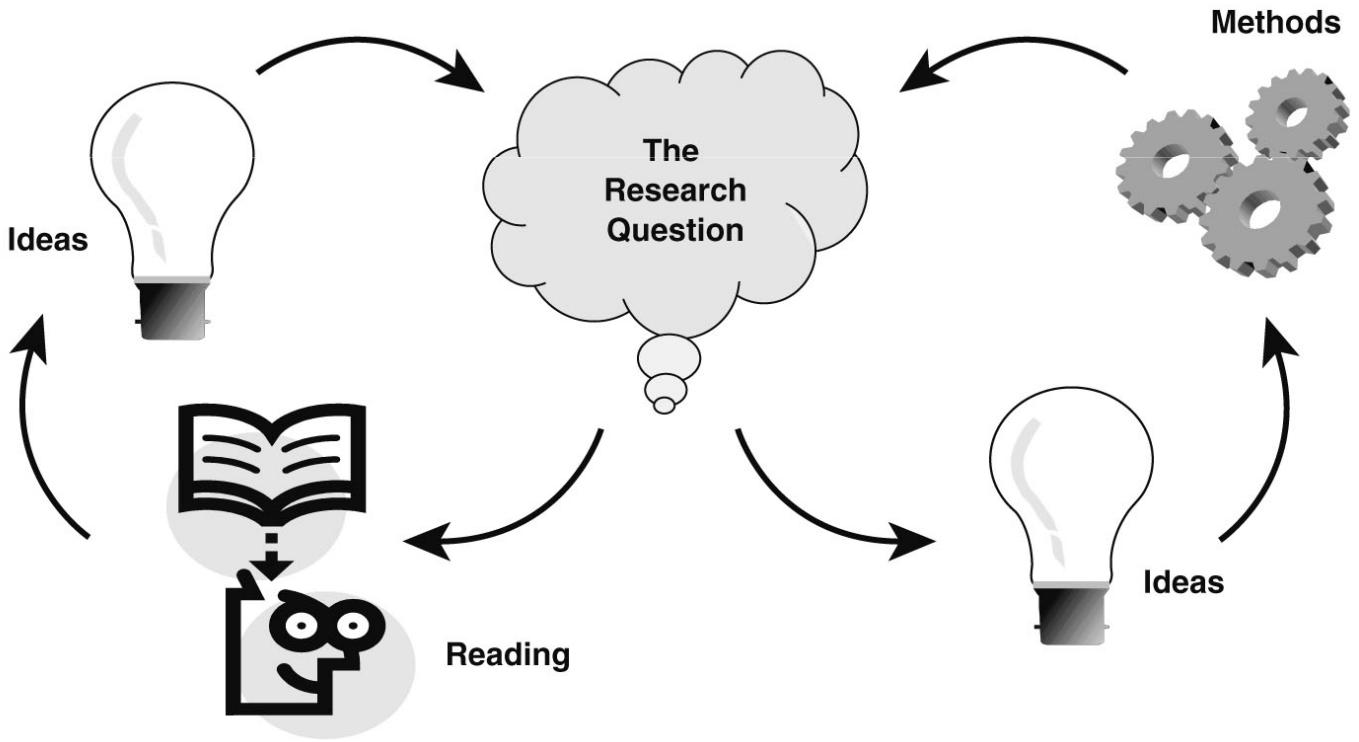
As MEMS and Smart Material technologies mature, embedded and remote systems are becoming more attractive. In applications such as medical implants and struc-

2 Vibration powered generators

Fig. 1 shows a first-order model of a resonant generator structure. A seismic mass, m, combines the effect of the actual mass in the system with any effective mass added by

A. DEFINING THE RESEARCH PROBLEM

3) Developing research questions based on problem statement



CYCLES OF RESEARCH QUESTION DEVELOPMENT

Questions like:

What data are to be collected?

What characteristics of data are relevant and need to be studied?

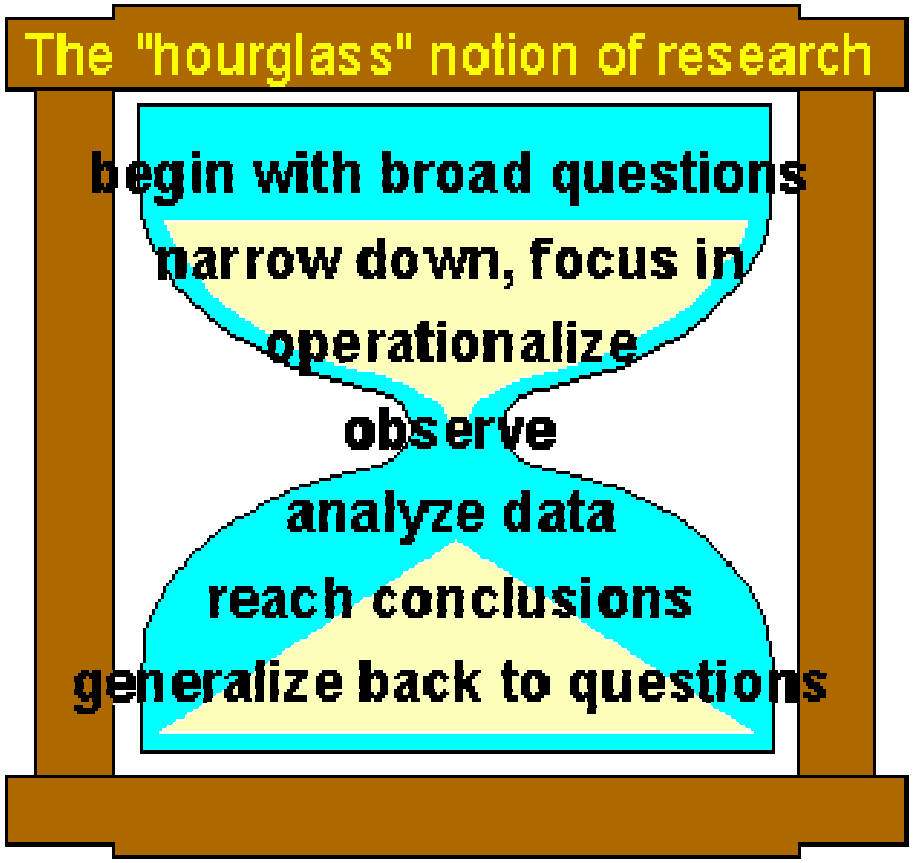
What relations are to be explored. What techniques are to be used for the purpose?

Use the problem solving logic of some Nobel Prize Winners

Steps to come up with "new knowledge" – our research question

1. Identify what is KNOWN
2. Identify what is UNKNOWN
3. Do the KNOWNS tell us anything about the UNKNOWNS? (make a list)
4. COMBINE the KNOWNS with UNKOWNS to see if there is a "new" and important research question that is worth a doctorate

Can think of process as an hour glass



Source: http://trochim.human.cornell.edu/kb/strucres.htm

Example:
Let us suppose that a research problem in a broad general way is as follows:

"Why is productivity in Japan so much higher than in Malaysia"?

- ***too general to be analyzed***:

  What sort of productivity is being referred to? With what industries the same is related? With what period of time the productivity is being talked about?

- ***narrowing down the question:***

  "What factors were responsible for the higher labour productivity of Japan's manufacturing industries during the decade 1971 to 1980 relative to Malaysia's manufacturing industries?"

- ***Further rethinking and rephrasing - operational basis:***

  "To what extent did labour productivity in 1971 to 1980 in Japan exceed that of Malaysia in respect of 15 selected manufacturing industries? What factors were responsible for the productivity differentials between the two countries by industries?"

Research isn't usually done in a vacuum

- Even "ground-breaking" research usually relies on previous work in that field or in a related field
- Good science is usually incremental – there are not many major breakthroughs –especially in a doctorate

Most research builds on what has come before

- **Know your subject!**

  A thorough literature search is essential

  Identify seminal papers & understand their results

- **Pay attention to the details**

  Are there simplifying assumptions that need to be tested?

  Are connections between key results by different researchers being ignored?

What is and what isn't research?

Research Is	Research Is Not
Disciplined	Editorialising
Systematic	Opinionated
Objective	Subjective
Conclusions based upon Evidence	Conclusions based on beliefs or conjecture
Scientific Observation	Dogmatic
Structured	Unstructured
Seeking to disprove the researcher's assumption	Seeking to defend researcher's assumption

Meaningful, productive, and useful research depends on the development of appropriate research questions, the identification of appropriate constructs and the confidence we can have in our findings. Confidence is related to the extent to which we can control or eliminate bias, error and extraneous or interfering variables.

Experts & good researchers know good research when they see it!

Criteria of a "good" research question

Explicit (distinct & testable concepts)

Clear (Meaning obvious and clear relationships between concepts)

Original (Novelty – something new)

Testable (Prove hypotheses)

Has **theoretical significance** or managerial relevance (can be basic or applied research)

A. DEFINING THE RESEARCH PROBLEM

4) Developing research hypotheses

- Should be phrased as a positive, empirical assertion, Such as there is a relationship between X & Y

  "As brand loyalty weakens, market shares will become more volatile"

FUNCTIONS OF A HYPOTHESIS

- Once a problem situation has been located and a problem refined to a researchable form, the researcher's task is to find an answer to the problem.

- If the answer to the question cannot be found from within the body of knowledge already in existence, it is necessary for the researcher to develop a hypothesis.

DEFINITION OF A HYPOTHESIS

- A hypothesis can be defined as the **tentative proposition** suggested as a solution to a problem or an explanation of some observed state of affairs.
- It is a statement of the problem solver's expectations about a **relationship between variables within a problem**.
- A hypothesis can be used to **solve simple or complex problems** and is said to be the most powerful tool that a researcher has at his disposal.
- It gives the research **a direction** that the problem definition fails to give in that it indicates exactly which variables to examine and what relationship to look for.
- A research problem cannot itself be tested-it **must be tested** through the hypothesis that it generates.

A. DEFINING THE RESEARCH PROBLEM

5) Relationship between hypotheses and data analyses technique

- Hypothesis are constructed in everyday life, e.g. when items are lost, when an unusual happening occurs or when something does not act in the normal way.

- In trying to find an answer to a problem situation, people construct hypothesis that direct them to finding the solution to a question.
  Where did I leave the scooter key ?
  What is that rumbling noise ?
  Why didn't the mail arrive ?

- Perhaps you are familiar with questions of this kind and maybe there are many more that you can add to the list that are more pertinent to your situation.

- In order to solve the problem, you attempt to link what is known and what is not known and suggest a possible reason or solution.

- In this way you are hypothesising.

A. DEFINING THE RESEARCH PROBLEM

6) Class exercise

Can you think of a situation arising from your own personal experience that warrants further investigation?

B. CRITICAL REVIEW OF THE LITERATURE (2 hours)

1) Understanding literature search
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8) Referencing
9) Class exercise

B. CRITICAL REVIEW OF THE LITERATURE

1) Understanding literature search

Goals of preliminary research phase

A literature survey – not yet a review

A revised (or refined) research question

A theoretical perspective (a model!)

One or more testable hypotheses (in the model!)

Some sense of the feasibility of the study that is needed to answer the research question (e.g. are data sources available?)

B. CRITICAL REVIEW OF THE LITERATURE

2) Sources of literature search

Different types of information and what they do!

General sources

- Provides an overview of a topic and provides leads to where more information can be found.
- Examples are daily newspapers, news weeklies, popular periodicals and magazines, (e.g. IEEE Spectrum), etc.

Secondary sources

- Provides a level of information “once removed” from the original work.
- Examples are books on specific subjects and reviews of research.
- Primary sources
- The original reports of the original work or experience
- Examples are journals, abstracts, theses, etc.

B. CRITICAL REVIEW OF THE LITERATURE

3) Search techniques

How to carry out effective literature review?

Berlincourt piezometer system (www.piezotest.com), as shown in figure 7. This can be used to calculate another useful parameter, the longitudinal voltage coefficient, g_{33}, which is related to the permittivity of the material ε_{33}^T by

$$g_{33} = \frac{d_{33}}{\varepsilon_{33}^T}. \quad (14)$$

The permittivity of the material is related to the capacitance C_p at constant (or zero) applied stress and the dimensions of the material (thickness, h, and area, A) as shown in equation (15). The capacitance [illegible] usually [illegible] and at low excitation voltage (typically a few millivolts) [19]

$$\varepsilon_{33}^T = \frac{C_p h}{A}. \quad (15)$$

Two samples of PZT with different co-firing profiles were compared. The piezoelectric charge coefficient decayed as continuous varying stress was applied to the materials. This is a common phenomenon for piezoelectric materials and arises because of several factors, including the presence of a defective interface layer, which can give rise to the backswitching of domains [20]. As shown in figure 8, PZT samples co-fired at a peak temperature of 950 °C have a d_{33} value of around 80 pC N^{-1} and samples co-fired at a peak temperature of 850 °C [21] have a lower value of only 50 pC N^{-1} after 8 h of measurement. It should be noted, however, that higher temperature processes tend to produce more cracks in the composite structures, particularly at the connecting area between the cantilever beam and the base. The cracks can prevent the free-standing structure from responding to the mechanical excitation accordingly and also cause electrical shorting between the electrodes.

4.2. Dynamic/resonant measurement

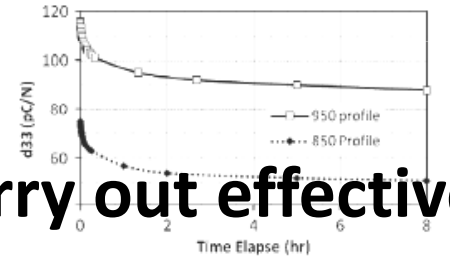

Figure 8. Piezoelectric charge coefficient d_{33} decay over 8 h for samples with a co-fired profile at peak temperatures of 850 °C and 950 °C.

As the thickness of the samples was many times smaller than their widths and lengths ($h < w/50$ and $h < l/100$), this method is suitable for measuring the piezoelectric constants related to transverse modes, where the direction of polarization is perpendicular to the direction of the applied stress. The transverse piezoelectric charge coefficient is given as [22]

$$d_{31} = \frac{1}{2\pi f_r}\sqrt{\frac{\varepsilon_{33}^T}{\rho\left[1+\frac{8}{\pi^2}\left(\frac{f_r}{2\Delta f}\right)\right]}}. \quad (16)$$

This is related to the resonant frequency, f_r, the difference between resonant and antiresonant frequencies, Δf, the density, ρ, and the permittivity of the piezoelectric materials. The effectiveness of energy conversion between electrical and mechanical is indicated by the coupling factor, which can be determined using

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A piezoelectric vibration based generator for wireless electronics

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Abstract

[illegible] technologies for wireless sensor networks have gained [illegible] nodes to be self-powered. With this goal in mind, a vibration based piezoelectric generator has been developed as an enabling technology for wireless sensor networks. The focus of this paper is to discuss the modeling, design, and optimization of a piezoelectric generator based on a two-layer bending element. An analytical model of the generator has been developed and validated. In addition to providing intuitive design insight, the model has been used as the basis for design optimization. Designs of 1 cm^3 in size generated using the model have demonstrated a power output of 375 μW from a vibration source of 2.5 m s^{-2} at 120 Hz. Furthermore, a 1 cm^3 generator has been used to power a custom designed 1.9 GHz radio transmitter from the same vibration source.

(Some figures in this article are in colour only in the electronic version)

1. Introduction

The vast reduction in size and power consumption of CMOS circuitry has led to a large research effort based around the vision of ubiquitous networks of wireless sensor and communication nodes [1–3]. The wireless devices are usually designed to run on batteries. However, as the networks increase in number and the devices decrease in size, the replacement of depleted batteries becomes impractical. Therefore, alternative methods for powering wireless sensor nodes are needed. Solar power is one alternative power source that has been used

Table 1. Summary of maximum energy densities of three kinds of transducers.

Type	Energy density (mJ cm^{-3})	Equation	Assumptions
Piezoelectric	35.4	$(1/2)\sigma_y^2 k^2/2c$	PZT 5 H
Electromagnetic	24.8	$(1/2)B^2/\mu_0$	0.25 T
Electrostatic	4	$(1/2)\epsilon_0 E^2$	3×10^7 V m^{-1}

of converter [17]. Such a comparison is given in table 1. From

A Plan for Obtaining Literature

- in a logical order - to provide a systematic means of obtaining relevant literature - once the general area of the research question has been established.

1. KEY WORDS

– compile a list of key word and terms that relate specifically to the research problem.
– ensure that the list is exhaustive by checking terms in a dictionary.
– cross reference terms/descriptors by using another dictionary/encyclopedia (if possible).

2. CONSULTATIONS

– discuss the research problem with specialists and/or colleagues for help in finding sources of literature.

3. PRELIMINARY SOURCES

– using the key words check the preliminary sources for references :

o catalogue

o indexes

o abstracts

o bibliographies

4. SECONDARY SOURCES

– locate textbooks, articles and other secondary sources (also the Internet).

– check secondary sources for relevance and background information.

5. PRIMARY SOURCES

– locate research reports written specifically about the research problem.

– check other primary sources for information on research design and methodology.

6. CONTACTS

– write to organisations and/or institutions that may have an interest in the research problem and be able to supply information or additional contacts.

– from the survey of primary sources, contact any person who may have conducted research in the area, if it is felt that this may be useful.

B. CRITICAL REVIEW OF THE LITERATURE

4) What is a review of the literature?

- It is actually the reading of the works of others before commencing on our own research work.
- Literature review can pave the way for better research.
- It can help in identifying the relevance of the research.

The Purpose of Literature Review

- **LIMIT THE PROBLEM AREA**

- The problem should be small enough and sufficiently specific for adequate treatment and competent analysis.
- Research articles often suggest recommendations for the course that further research should take.

- **DEFINE THE PROBLEM**

- 'Definition' means that the researcher knows exactly what he is looking for, so that data when collected and analysed actually relates back to the problem.

- **AVOID UNNECESSARY REPETITION**

- Do not assume that because most of the existing research adopts one method that it is the only method or the correct method available in the circumstance.

- **SEARCH FOR NEW APPROACHES**

- Be alert to research approaches which may have been overlooked.
- Be prepared to adopt a different viewpoint, particularly in areas where research is sparse.

- **RECOMMEND SUITABLE METHODS**

- Methodology should be appropriate to the research problem.
- Compile a checklist in which you reference ideas on research design, instrumentation, sampling and data collecting and analysis from various studies.

- **SAMPLE CURRENT OPINIONS**

- Newspapers, magazines and non-technical articles may contain unique ideas that have not yet been researched.

B. CRITICAL REVIEW OF THE LITERATURE

5) Critical appraisal

- Perhaps conflicting points of view have been presented and there is a need for more information to be provided to support one or the other.

- Maybe there are deficiencies in the explanations given, or some questions may be raised that need answering.

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COMMENT

Comment on 'Modeling and analysis of a bimorph piezoelectric cantilever beam for voltage generation'

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Abstract
In a recent paper, Ajitsaria *et al* (2007 *Smart Mater. Struct.* 16 447–54) presented a mathematical formulation for the modeling and analysis of a bimorph piezoelectric cantilever beam for voltage generation. Their motivation was the recent increasing trend in using the piezoelectric effect to harvest electrical energy from ambient vibrations. This comment addresses the modeling errors and numerous undefined and missing terms in the mentioned work.

Modeling and analysis of bimorph piezoelectric cantilever beam for voltage generation

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Abstract

Piezoelectric materials (PZT) have shown the ability to convert mechanical forces into an electric field in response to the application of mechanical stresses or vice versus. This property of the materials has found extensive applications in a vast array of areas including sensors and actuators. The study presented in this paper targets the modeling of PZT bender for voltage and power generation by transforming ambient vibrations into electrical energy. This device can potentially replace the battery that supplies the power in a micro watt range necessary for operating sensors and data transmission. One of advantages is the maintenance free over a long time span.

Feasibility of this application has been repeatedly demonstrated in several literatures, but a real demonstration of a working device is partially successful because of the various design parameters necessary for a construction of the PZT bender. According to literature survey, the device can be modeled using various approaches. This paper focuses on the analytical approach based on Euler-Bernoulli beam theory and Timoshenko beam

B. CRITICAL REVIEW OF THE LITERATURE

6) Quote, paraphrasing , summarizing and synthesising

Quotations

- must be identical to the original, using a narrow segment of the source.
- they must match the source document word for word and must be attributed to the original author.
- generally used less frequently in the engineering/sciences than in the humanities because the ideas expressed are normally more important than the words used to express them. You must have a good reason to use a quote.
- Being unable to write a better sentence than the original is *not a good reason.*

Paraphrasing

- involves putting a passage from source material into your own words.
- a paraphrase must also be attributed to the original source.
- paraphrased material is usually shorter than the original passage, taking a somewhat broader segment of the source and condensing it slightly.

Summarizing

- involves putting the main idea(s) into your own words, including only the main point(s).
- once again, it is necessary to attribute summarized ideas to the original source.
- summaries are significantly shorter than the original and take a broad overview of the source material.

Synthesizing

- allows you to combine information and ideas from multiple sources to develop and strengthen your argument(s).
- demonstrate that you have read widely on the topic use and cite multiple sources.

Example:

The original passage:

Students frequently overuse direct quotation in taking notes, and as a result they overuse quotations in the final [research] paper. Probably only about 10% of your final manuscript should appear as directly quoted matter. Therefore, you should strive to limit the amount of exact transcribing of source materials while taking notes. Lester, James D. Writing Research Papers. 2nd ed. (1976): 46-47.

A legitimate paraphrase:

In research papers students often quote excessively, failing to keep quoted material down to a desirable level. Since the problem usually originates during note taking, it is essential to minimize the material recorded verbatim (Lester 46-47).

The original passage:

Students frequently overuse direct quotation in taking notes, and as a result they overuse quotations in the final [research] paper. Probably only about 10% of your final manuscript should appear as directly quoted matter. Therefore, you should strive to limit the amount of exact transcribing of source materials while taking notes. Lester, James D. Writing Research Papers. 2nd ed. (1976): 46-47.

An acceptable summary:

Students should take just a few notes in direct quotation from sources to help minimize the amount of quoted material in a research paper (Lester 46-47).

The original passage:

Students frequently overuse direct quotation in taking notes, and as a result they overuse quotations in the final [research] paper. Probably only about 10% of your final manuscript should appear as directly quoted matter. Therefore, you should strive to limit the amount of exact transcribing of source materials while taking notes. Lester, James D. Writing Research Papers. 2nd ed. (1976): 46-47.

A plagiarized version:

Students often use too many direct quotations when they take notes, resulting in too many of them in the final research paper. In fact, probably only about 10% of the final copy should consist of directly quoted material. So it is important to limit the amount of source material copied while taking notes.

B. CRITICAL REVIEW OF THE LITERATURE

7) Referencing and citing references

- There are two places where references need to be included in a piece of writing:

(1) In-text references (citations) - in the text of your writing

(2) Reference list - at the end of your writing (before the appendix)

- Every source (e.g. text book, journal, electronic source) that you cite in your report (in-text references) must be included in the reference list and every reference included in your reference list must be cited in your report.

(1) In-text references (citations)

- It is VERY IMPORTANT to use the correct format for in-text references and reference lists.
- The required format depends on the discipline in which you are writing.
- There are hundreds of different referencing styles.
- You should always check which style is expected.
- One of the common used format in Engineering is Harvard system of referencing.

General Rule

In-text references in Harvard format give the author's surname(s) and the year of publication. Note that the full stop for the end of the sentence comes after the citation. For example:

> The common earthworm (Lumbricus terrestris) is a terrestrial annelid of the class Oligochaeta (Baker & Garland 1982).

Using et al.

- If a book has **four or more authors, you can use the Latin abbreviation, et al.** (short for et alia, meaning 'and others').
- Note that there is a full stop after 'al.' and that it is not necessary to use italics for 'et al.' in the Harvard referencing system.

Example:

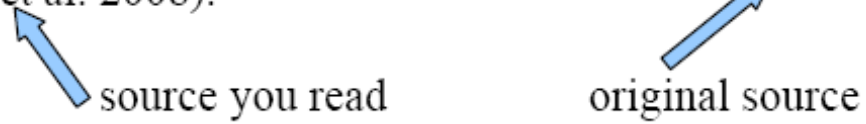
> Most fungi consist of tubular filaments called hyphae, and a mass of these in one organism is known as a mycelium (Purves et al. 2004).

Secondary citations

- Sometimes, you may want to use a piece of information that another author has cited from a different source.
- If the source you are reading contains citations from another source, the ideal thing to do is to find that original source, read it, paraphrase the relevant information and cite the source.
- Sometimes, it is not possible to find the original source and you may have to secondary cite the source.
- A secondary citation contains the original author and the year plus the secondary author (where you read the information) plus the year.

Example:

Between the years 1954 and 1994, the population of sooty terns on Ascension Island fell from 500 000 to 200 000 (Ratcliffe et al. 1999, cited in Reynolds et al. 2008).



(2) Reference Lists

- As well as using in-text citations, you must also include a reference list at the end of your piece of work.
- A reference list is different from a bibliography, which lists all works read, whether or not they are cited in your work.
- A reference list contains only those works that you have cited in your writing.
- In the Harvard referencing style, references are listed in alphabetical order of authors' surnames (**A – Z) at the end of your piece of writing.**

- **In a scientific** report, the reference list is usually between the acknowledgements and the appendix.
- Reference lists should be single spaced with a single line space between each reference.
- The format of the reference list depends on the type of source you are citing.
- It is important to carefully note all details in reference citations such as the **order of details, when to use italics, where to put full stops** and **commas, capitalisation of words, and when to use parentheses.**

BOOK

In-text citation	Reference List
One author …(Fletcher 1992). Fletcher (1992) suggests that…	author's surname; author's initials; year of publication; title of book (in *italics*); publisher Fletcher, NH 1992, *Acoustic systems in biology*, Oxford University Press, New York. Place published
Two authors …(Grant & Grant 2008). Grant and Grant (2008) argue that…	Grant, PR & Grant, BR 2008, *How and why species multiply: the radiation of Darwin's finches*, Princeton University Press, Princeton.
Three authors …(Swanson, Kim & Gluckman 2007). Swanson, Kim & Gluckman (2007) define a …	Swanson TA, Kim SI, & Gluckman 2007, *Biochemistry and molecular biology*, 4th edn, Lippincott, Williams & Wilkins, Philadelphia PA. Note: if a book has more than one edition, you need to state the edition.
Four or more authors …(Purves et al.	Purves, WK, Sadava, D, Orians, GH & Heller, HC 2004, *Life; The science of biology*, Sinauer Associates,

JOURNAL ARTICLE

In-text citation	Reference List
One author …(Plummer 2002). Plummer (2002) quite clearly argues that…	Author's surname; author's initials; year of publication; title of journal article Plummer, KM 2002, 'Proteomics and genomics tools for the war on apple scab', *NZ Bio Science,* vol. 11, no.4, pp. 38-41. volume; issue; Page no.'s; title of journal (in *italics*)
Two authors …(Gendall & Forster 2007). Gendall and Forster (2007) found that…	Gendall, AR & Forster, JW 2007, 'Genetics of reproductive development in forage legumes', *International Journal of Plant Developmental Biology,* vol. 1, pp. 245-252.
Three authors …(Tonkin, Humphries & Pridmore 2006). In another major study, Tonkin, Humphries and Pridmore (2006) found that…	Tonkin, ZD, Humphries, P & Pridmore, PA 2006, 'Ontogeny of feeding in two native and one alien fish species from the Murray-Darling Basin, Australia', *Environmental Biology of Fishes,* vol.76, pp. 303-315.
Four or more authors …(Yucel et al. 2009).	Yucel, R, Bird, FL, Blanksby, TM, Valenta, K, Gendall, AR, Plummer, KM, Malone, BS & Harvey, AS 2009. 'A broad based, grass-roots community of practice achieving curriculum reform in first year

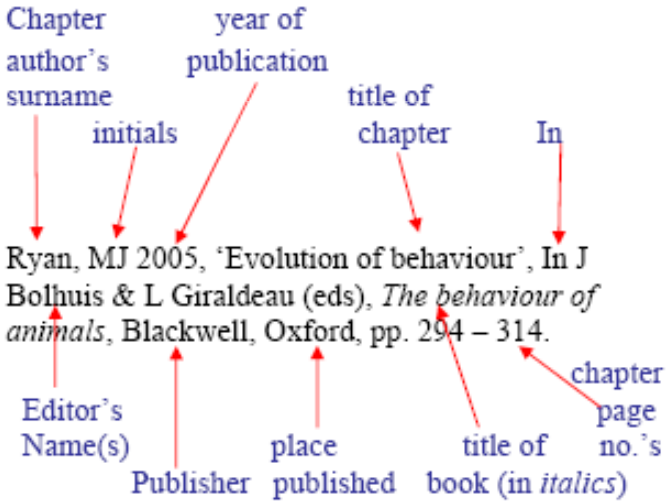
CONFERENCE / SEMINAR / SYMPOSIUM PAPER

In-text citation	Reference List
…(Rosse 2007). Rosse (2007) analysed…	Rosse, M 2007, 'Facing the difficult questions in Question Time', *Proceedings of the 2007 Australasian Association for Engineering Education Conference* 9-13 December 2007, Melbourne.

THESIS

In-text citation	Reference List
…(Venn 2007). Venn (2007) studied…	Venn SE 2007, 'Plant recruitment across alpine summits in south-eastern Australia', PhD thesis, La Trobe University.

CHAPTER IN AN EDITED BOOK

In-text citation	Reference List
One author The author of the chapter is cited …(Ryan 2005). Ryan (2005) contends that… **Multiple authors** The same rules as for books (shown above) apply when there are multiple authors for chapters.	

ELECTRONIC JOURNAL ARTICLE (AVAILABLE ON INTERNET ONLY)

In-text citation	Reference List
…(Battestin & Macedo 2007). Battestin and Macedo (2007) showed…	Battestin, V & Macedo, GA 2007, 'Effects of temperature, pH and additives on the activity of tannase produced by *Paecilomyces variotii'*, *Electronic Journal of Biotechnology*, viewed 26 June, 2007 http://www.ejbiotechnology.info/content/vol10/issue2/index.html#research

LABORATORY MANUAL

In-text citation	Reference List
…(Department of Zoology, La Trobe University 2009)	Department of Zoology, La Trobe University 2010, *BIO1AD Unit guide and laboratory manual,* p.108.

WEBSITE

- Electronic sources, particularly websites, should be used cautiously.
- Not all information found on the Internet is reliable.
- Websites with URLs that end in *.com are commercial sites and may not be reliable (they may contain bias or* inaccurate information).
- If you are unable to identify the *author (person or* organisation) or the *date of an Internet source, it is less likely to be reliable, and* probably should not be used as a source in your writing.
- ***Wikipedia*** *can be a useful source of background information in the initial stages* of researching a topic. However, because the authors of the information are not identified, it is advised **NOT** to cite *Wikipedia in lab reports, assignments,* essays etc.

If possible, a reference to an Internet source should include:

- The author of the document (this is often an organisation rather than an individual)
- The year of publication or most recent update
- The title, or a description of the document
- The date the document was viewed
- The URL (i.e. http//www….)

WEBSITE

In-text citation	Reference List
Person as author …(O'Neil 2009) O'Neil (2009) describes…	**Person as author** O'Neil, D 2009, *Mendel's genetics*, viewed 12 January, 2009, http://anthro.palomar.edu/mendel/mendel_1.htm
Organisation as author …(Center for Insect Science Education Outreach, The University of Arizona 1997). The Center for Insect Science Education Outreach, The University of Arizona (2007) states that…	**Organisation as author** Center for Insect Science Education Outreach, The University of Arizona 1997, *Arthropod information*, viewed 27 January 2009, http://insected.arizona.edu/arthroinfo.htm
Author but no date …(Viridans Biological Databases n.d.) Viridans Biological Databases (n.d.) describe...	**Author but no date** Viridans Biological Databases (n.d.) Wild plants and animals of Victoria, viewed 27 January 2009, http://www.viridans.com/WTV/WTV1.htm

B. CRITICAL REVIEW OF THE LITERATURE

8) Class exercise

1 Introduction

As MEMS and Smart Material technologies mature, embedded and remote systems are becoming more attractive. In applications such as medical implants and structural monitoring the need to supply power can be a significant engineering problem. Traditionally, remote devices have used batteries to supply their energy. Batteries offer only a limited life span to a system, and the recent, rapid advances in integrated circuit technology of the type described by Moore's law have not been matched by similar advances in battery technology. Thus, power requirements place important limits on the capability of remote microsystems. An alternative to batteries is to make use of ambient energy that is available in the environment surrounding a system. Possible sources of ambient energy include vibration, solar energy, and temperature difference. This paper describes the development of a prototype self-powered generator that utilises vibrations to produce power.

Assignment 1: 10% (individual homework)

Search for a journal article from e.g. IEEE website and:

1) Identify the problem statement
2) Identify the hypotheses
3) Relate the hypotheses with the data analyses
4) Refer to one of the cited references
5) Compare one of the quoted/paraphrases sentence with the original sentence(s) in the cited reference.