

# ***The Broader Impact of DSP in a Global, Economic and Social Context***

ECE 381: Introduction to Discrete-time Signal Processing

Department of Electrical and Computer Engineering  
Old Dominion University

# *Presentation Outline*

- INTRODUCTION
- IMPACT IN AN ECONOMIC CONTEXT
- IMPACT IN A SOCIO-POLITICAL CONTEXT
- IMPACT IN A GLOBAL CONTEXT
- HISTORY AND UTILIZATION OF DSP
  - Impact of the Digital Revolution in Acoustic Signal Processing
- CONCLUSION
- REFERENCES

# *Introduction*

➤ *“Does improved technology mean progress ? ”<sup>1</sup>*

- Since the early 19<sup>th</sup> century the answer of a majority of Americans to this would be a definite ‘yes’.
- However in the last half century, a growing minority of Americans have adopted a skeptical and negative view of technological innovation as an index of social progress.
- This change was a result of the death and destruction seen during the two barbaric world wars, the Nazi holocaust, the Stalinist terror and the nuclear arms race that involved the destructive use or misuse of modern technologies.
- Improved technology could truly mean social progress only if we define the path of progress and look beyond limited and immediate goals.

## ***Impact in an Economic Context***

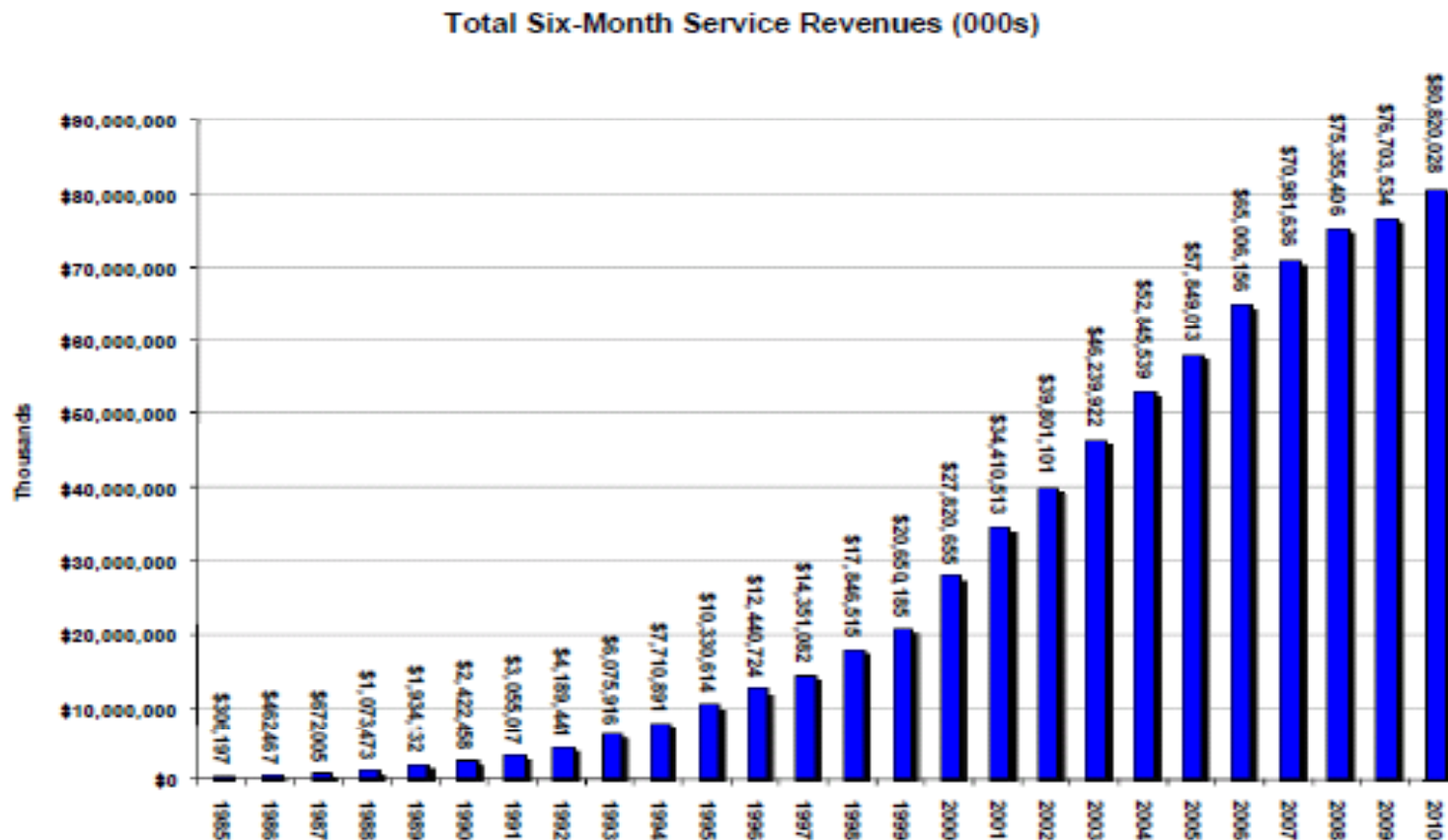
➤ *“History should be our guide. The United States led the world’s economies in the 20th century because we led the world in innovation. Today, the competition is keener; the challenge is tougher; and that is why innovation is more important than ever. It is the key to good, new jobs for the 21st century. That’s how we will ensure a high quality of life for this generation and future generations. With these investments, we’re planting the seeds of progress for our country, and good-paying, private-sector jobs for the American people.”<sup>2</sup>*

*-President Barack Obama, August 5, 2009*

## *Impact in an Economic Context*

- In the 1980s, the U.S. semiconductor industry lost its market share to Japanese competitors.<sup>2</sup>
- But then it innovated its way back, replacing the old jobs in the dynamic-random-access-memory (DRAM) business with jobs producing microprocessors, digital signal processors, microcontrollers, and automotive semiconductors.
- Companies like Intel, Texas Instruments, and Motorola invested and succeeded, creating better jobs for hundreds of thousands of Americans.
- The wireless revolution provides great promise for America's future economic prosperity.

## *Impact in an Economic Context (cont...)*



**Wireless Service Revenues Reach More Than \$80.8 billion for the Last Six Months of 2010**  
**- Total Twelve-Month Revenues Reach Almost \$160 Billion in 2010**

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# *Impact in a Socio-Political Context*

➤ *“Modern technology has become a total phenomenon for civilization, the defining force of a new social order in which efficiency is no longer an option but a necessity imposed on all human activity.”<sup>3</sup>*

*-Jacques Ellul, August 5, 2009*

➤ *“We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology.”<sup>4</sup>*

*- Carl Sagan, October 1994*

## *Impact in a Socio-Political Context (cont..)*

- Technological and social problems are greatly interdependent. For instance, the prevention of a problem such as water shortages requires either a social change or a technological solution.<sup>5</sup>
  - Social solution: Practices such as water conservation, education, pricing or rationing.
  - Technological solution: Desalination of available abundant water resources.
- Alvin M. Weinberg has argued that the technological fix is quick and reliable while the former is “frustrating, difficult, time-consuming and uncertain in the extreme.” Hence we should to the largest possible extent convert social into technological problems.



## ***Impact in a Socio-Political Context (cont..)***

- Political issues of the last decades like limited economic growth-limited resources debate, global climate change, economic crisis and terrorist threats have proven that there is a dramatic increase in complexity and potential damage of political decisions.<sup>6</sup>
- To anticipate such future opportunities or threats, the European Commission has funded a project to develop an Internet Screening Agent (ISA) that scans the internet for weak signals of emerging social issues that can be solved at an early stage.

# *Impact in a Global Context*

➤ *“Technology is the knack of so arranging the world that we don't have to experience it.”<sup>7</sup>*

*-Max Frisch, 1957*

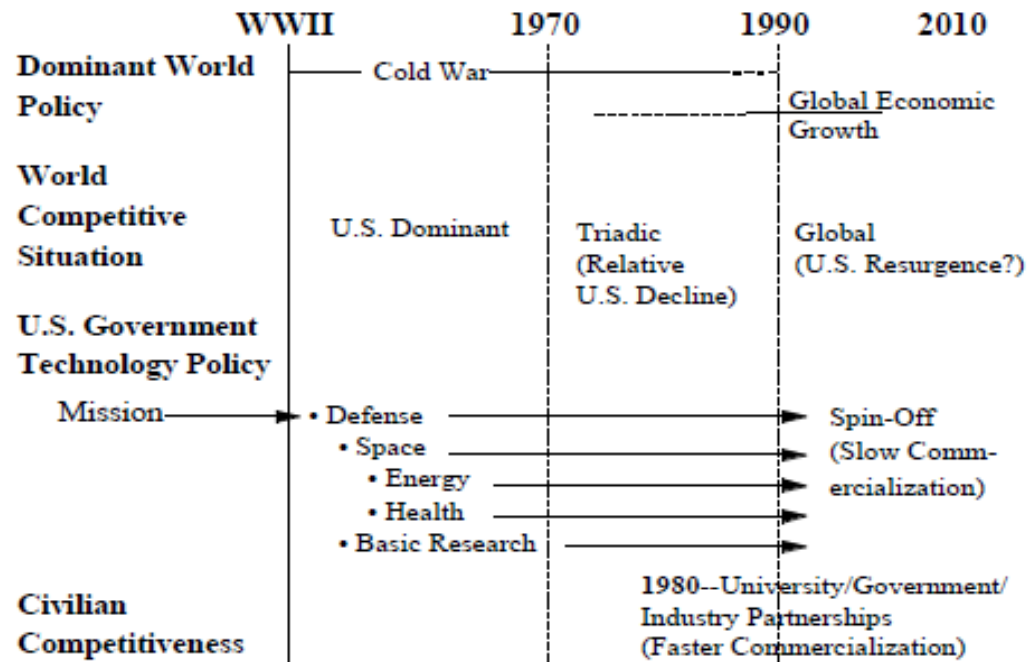
➤ In the 25 years following World War II, the United States enjoyed global competitive and technological dominance.<sup>8</sup>

➤ The competitive challenges of the 1970s and 1980s transformed the global technology landscape.

➤ Sole U.S. dominance gave way to competitive leadership shared by a triad consisting of the United States, Europe, and Japan.

# *Impact in a Global Context (cont..)*

## Evolution of U.S. Technology Policy



## *Impact in a Global Context (cont..)*

- In the modern world, it is nearly impossible to separate many domestic and international problems and managing international challenges will take the effort of all nations.<sup>9</sup>
- This calls for the need to develop an attitude of global citizenship and an important part of genuine world citizenship today is scientific and technological literacy.
- A step towards this has been taken in the Sub Saharan states of Africa where increased attention has been given to the problem of proliferation of information technologies in their national policy.
- The aim of this policy is not just to reduce the rising digital divide from well developed countries to possess equal rights in international relations but also to overcome the problem of digital divide between urban and rural areas.

## *Impact in a Global Context (cont..)*

- For example in Kenya, “Vision 2030” is a policy adopted to develop the information and communication technologies (ICT) sector.<sup>9</sup>
- In order to achieve this goal, three key strategies have been identified
  - Improve universal access to ICT services by developing infrastructure and providing affordable ICT hardware and software.
  - Establish ICT training programs.
  - Enable public service provision through e-government.

# *History and Utilization of DSP*

- Digital Signal Processing as a discipline dates back to the 1950s but its roots go much further back.
- The spark that generated interest in this field was the realization that digital computer technology was on the verge of great leaps forward in both speed and miniaturization.
- Traditional analog processing devices such as filters and spectrum analyzers turned digital and resulted in major improvements for many applications.
- Acoustic signals such as speech, seismic, and sonar signals were prime candidates for digital processing because of their relatively low bandwidths.

# ***Impact of the Digital Revolution in Acoustic Signal Processing***

➤ *Acoustic Surveillance*: Detecting the source of acoustic energy, for example monitoring airport noise and detecting sound from submarines in the oceans.<sup>10</sup>

- In a busy ocean, locating sound generated by a potential submerged target among all the noise coming from surface ships and fishing vessels is a challenging task.
- Underwater microphones (hydrophones) are placed around the ocean to pick up signals from submarines. They are placed in a geometric configuration called hydrophone array.
- Hydrophones produce continuous analog signals that can be sampled to produce a single time-series for each hydrophone.

# ***Impact of the Digital Revolution in Acoustic Signal Processing (cont..)***

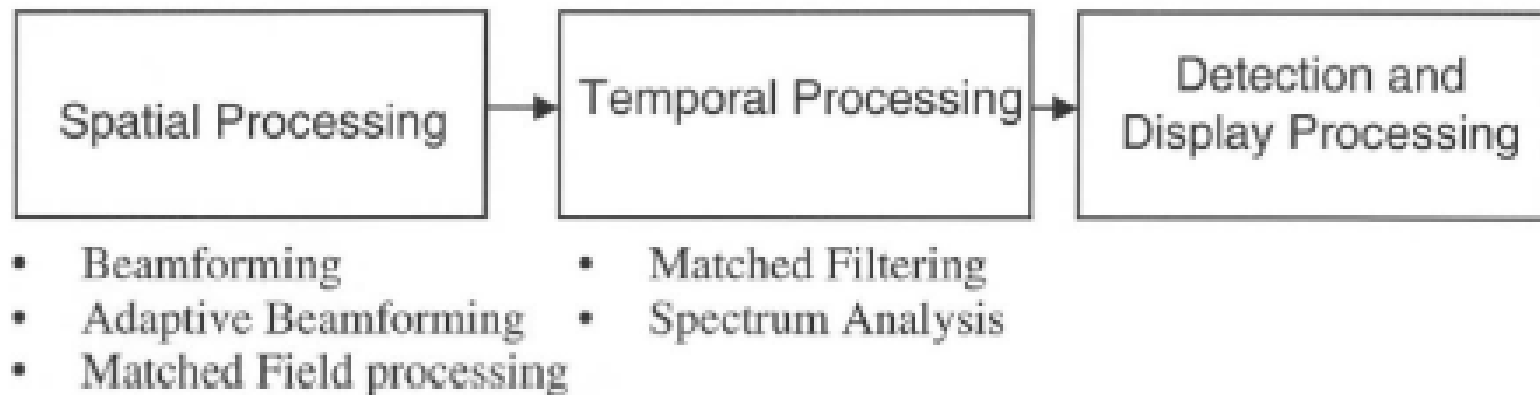


Figure. Typical stages of acoustic processing (Source Ref.10)



# ***Impact of the Digital Revolution in Acoustic Signal Processing (cont...)***

## ***Evolution of Acoustic Signal Processing<sup>10</sup>:***

- 1950s to early 1960s : Analog instruments like sound level meters, octave band analyzers, accelerometers etc.
  - Battery operated, about the size of a breadbox or two and heavy.
  - Data was read from meters and manually written down.
  - Large multi-channel analog magnetic tape recorders were used to record data.
  - Hydrophones sent signals via underwater cable to shore processing stations.

# ***Impact of the Digital Revolution in Acoustic Signal Processing (cont...)***

## ***Evolution of Acoustic Signal Processing:***

- 1960s to early 1970s : Use of the first digital computer an LGP-30.
  - Analog front-ends were used to analyze and integrate the analog data.
  - Analog-to-digital converters fed this data to computers that could format, sort, print and display the data.
  - Spectrum analysis became practical in software with the invention of Fast Fourier Transform(FFT).
  - New acoustic processing algorithms were developed.

# ***Impact of the Digital Revolution in Acoustic Signal Processing (cont...)***

## ***Evolution of Acoustic Signal Processing:***

- 1975 to 1985 : The Acoustic Research Center(ARC) was established in California
  - Emphasis on real-time signal, information processing and displaying the results.
- 1977 to 1979 : The Acoustic Underwater Sound Experiment (AUSEX) project
  - To test the hypothesis that a submerged submarine with the right apparatus should be able to detect an antisubmarine warfare aircraft overhead at significant ranges.

# ***Impact of the Digital Revolution in Acoustic Signal Processing (cont...)***

## ***Evolution of Acoustic Signal Processing:***

- Mid and late 1980s: Shipboard signal and information processing experiments.
  - Large, fast memory for buffering interim signal processing results and fast transfers to processors.
  - Application programs were now written in C, a big advance over the earlier Fortran.
- 1986 to 1988: ARIADNE project.
  - Modern Soviet submarines generated much less noise and had to be detected using more hydrophones which resulted in increased processing load.
  - Vector array processing hardware, node cluster processor and data-flow architecture

# *Conclusion*

- Modern technology has brought forth the most complex and the most imposing creations in human history.
- The right use of technology has seen societies reach a peak of success and prosperity while misuse of the same technology has witnessed their great fall.
- Digital Signal Processing can be considered a road to most future inventions and advances.
- DSP has seen application in various fields like speech and image processing, medical imaging, seismic forecasting, wireless communication and many more

# *References*

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copy	More table copy <sup>a</sup>		

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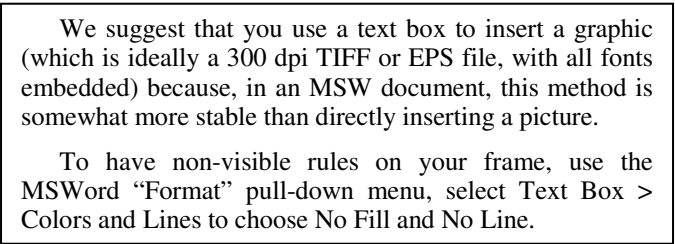


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[1] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955. (references)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

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### **Table of Contents**

**In-Text Citation**

**Print Documents**

**Electronic Documents**

**Footnotes**

**Figures & Tables**

- **Figures**
- **Tables**

**Abbreviations & Acronyms**

**Equations**

**Bibliography**

**Other Recommendations**

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**Single author**

W.-K. Chen, *Linear Networks and Systems*. Belmont, CA: Wadsworth, 1993, pp. 123-135.

**Edited work**

D. Sarunyagate, Ed., *Lasers*. New York: McGraw-Hill, 1996.

**More than one author**

T. Jordan and P. A. Taylor, *Hactivism and Cyberwars: Rebels with a cause?* London: Routledge, 2004.

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R. Hayes, G. Pisano, D. Upton, and S. Wheelwright, *Operations, Strategy, and Technology: Pursuing the competitive edge*. Hoboken, NJ : Wiley, 2005.

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**Series**

M. Bell, et al., *Universities Online: A survey of online education and services in Australia*, Occasional Paper Series 02-A. Canberra: Department of Education, Science and Training, 2002.

**Corporate author**

World Bank, *Information and Communication Technologies: A World Bank group strategy*. Washington, DC : World Bank, 2002.

**Conference (complete conference proceedings)**

K.-L. Wu, C.C. Aggarwal, and P.S. Yu, "Personalization with dynamic profiler," in *Proceedings third international workshop on advanced issues of e-commerce and web-based information systems*, 2001, pp. 12-20.

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Australia. Attorney-Generals Department. *Digital Agenda Review*, 4 Vols. Canberra: Attorney- General's Department, 2003.

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**International Standard**

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### **Technical report**

K. E. Elliott and C.M. Greene, "A local adaptive protocol," Argonne National Laboratory, Argonne, France, Tech. Rep. 916-1010-BB, 1997.

### **Patent / Standard**

K. Kimura and A. Lipeles, "Fuzzy controller component, " U. S. Patent 14,860,040, December 14, 1996.

### **Papers presented at conferences (unpublished)**

H. A. Nimr, "Defuzzification of the outputs of fuzzy controllers," presented at 5th International Conference on Fuzzy Systems, Cairo, Egypt, 1996.

### **Thesis or dissertation**

H. Zhang, "Delay-insensitive networks," M.S. thesis, University of Waterloo, Waterloo, ON, Canada, 1997.

### ***Parts of a book***

- These examples are for chapters or parts of edited works in which the chapters or parts have individual title and author/s, but are included in collections or textbooks edited by others.
- If the editors of a work are also the authors of all of the included chapters then it should be cited as a whole book using the examples given above in Books.
- Capitalize only the first word of a paper or book chapter.

### **Standard format**

[#] A. A. Author of Part, "Title of chapter or part," in *Title: Subtitle of book*, Edition, Vol., A. Editor Ed. Place of publication: Publisher, Year, pp. inclusive page numbers.

### **Single chapter from an edited work**

A. Rezi and M. Allam, "Techniques in array processing by means of transformations, " in *Control and Dynamic Systems*, Vol. 69, Multidemsional Systems, C. T. Leondes, Ed. San Diego: Academic Press, 1995, pp. 133-180.

### **Conference or seminar paper (one paper from a published conference proceedings)**

S. Al Kuran, "The prospects for GaAs MESFET technology in dc-ac voltage conversion," in *Proceedings of the Fourth Annual Portable Design Conference*, 1997, pp. 137-142.

### ***Journal articles***

- Capitalize only the first word of an article title, except for proper nouns or acronyms.
- Every (important) word in the title of a journal must be capitalized.
- Do not capitalize the "v" in volume for a journal article.
- Either spell out the entire name of each journal that you reference or use accepted abbreviations. Consistently do one or the other.

- You may spell out words such as volume or December, but you must either spell out all such occurrences or abbreviate all.
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- If you refer to only one page, use only p. 111.

### **Standard format**

**[#] A. A. Author of article. "Title of article," *Title of Journal*, vol. #, no. #, pp. page number/s, Month year.**

### **Journal article**

R.R. Yager, "Multiple objective decision-making using fuzzy sets," *International Journal of Man-Machine Studies*, vol. 9, no. 4, pp.375-382, Jul. 1977.

### **Electronic Documents**

- When you cite an electronic source try to describe it in the same way you would describe a similar printed publication.
- If possible, give sufficient information for your readers to retrieve the source themselves.
- If only the first page number is given, a plus sign indicates following pages, eg. 26+.
- If page numbers are not given, use paragraph or other section numbers if you need to be specific.
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- The access information will usually be just the URL of the source.
- As well as a publication/revision date (if there is one), the date of access is included since an electronic source may change between the time you cite it and the time it is accessed by a reader.

### **Webpage**

J. Nielsen, "Ten Usability Heuristics," 1994,  
[http://www.useit.com/papers/heuristic/heuristic\\_list.html](http://www.useit.com/papers/heuristic/heuristic_list.html).

### **Documents within a website**

Microsoft Corporation, "Site management cycle," 2003,  
[http://msdn.microsoft.com/library/en-us/comsrv2k/htm/cs\\_gs\\_concepts\\_ntqq.asp](http://msdn.microsoft.com/library/en-us/comsrv2k/htm/cs_gs_concepts_ntqq.asp).

### **Article in electronic newsletter or magazine**

C. Sherman, "Teoma vs. Google, round two," April 2, 2002,  
<http://searchenginewatch.com/searchday/02/sd0402-teoma.html>.

### **ACM Digital Library**

J. Raskin, "Looking for a humane interface: Will computers ever become easy to use?" *Communications of the ACM*, vol. 40, no. 2, pp. 98-101, Feb. 1997.

### **IEEE Electronic Library**

M. Phillips, "Reducing the cost of Bluetooth systems," *Electronics & Communication Engineering Journal*, vol. 13, no. 5, pp. 204-208, Oct. 2001.

### ***E-Books***

#### **Standard format**

**[#] A. Author. Title of E-book. Place: Publisher, Date of original publication. [Format] Available: Source.**

T. Eckes, *The Developmental Social Psychology of Gender*. Mahwah NJ: Lawrence Erlbaum, 2000. [E-book] Available: netLibrary e-book.

### ***E-Journals***

#### **Standard format**

**[#] A. Author, "Title of Article," Title of Journal, vol., no., p. page numbers, month year. [Format]. Available: Database Name (if appropriate), article number (if given), internet address. [Accessed date of access].**

#### **Journal article from online full-text database**

A. Holub, "Is software engineering an oxymoron?" *Software Development Times*, p. 28+, March 2005. [Online]. Available: ProQuest, <http://il.proquest.com>. [Accessed May 23, 2005].

#### **Journal article in a scholarly journal**

A. Altun, "Understanding hypertext in the context of reading on the web: Language learners' experience," *Current Issues in Education*, vol. 6, no. 12, July 2003. [Online]. Available: <http://cie.ed.asu.edu/volume6/number12/>. [Accessed Dec. 2, 2004].

#### **Newspaper article from online database**

J. Riley, "Call for new look at skilled migrants," *The Australian*, p. 35, May 31, 2005. Available: Factiva, <http://global.factiva.com>. [Accessed May 31, 2005].

#### **Newspaper article from the Internet**

C. Wilson-Clark, "Computers ranked as key literacy," *The West Australian*, para. 3, March 29, 2004. [Online]. Available: <http://www.thewest.com.au>. [Accessed Sept. 18, 2004].

### ***Non-book formats***

#### **Standard format**

**[#] A. A. Person, Responsibility (if appropriate), Title: Subtitle. [Format]. Special credits (if appropriate). Place of publication: Publisher, Year.**

#### **Microform**

W. D. Scott & Co, *Information Technology in Australia: Capacities and opportunities: A report to the Department of Science and Technology*. [Microform]. W. D. Scott &

Company Pty. Ltd. in association with Arthur D. Little Inc. Canberra: Department of Science and Technology, 1984.

### **Software**

Thomson ISI, *EndNote 7*. [CD-ROM]. Berkeley, Ca.: ISI ResearchSoft, 2003.

### **Video recording**

C. Rogers, Writer and Director, *Grrls in IT*. [Videorecording]. Bendigo, Vic. : VideoEducation Australasia, 1999.

### **Footnotes**

- Number footnotes separately in superscripts (Insert | Footnote).
- Place the actual footnote at the bottom of the page in which it is cited; do not put footnotes in the reference list (endnotes).
- Use letters for table footnotes.

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- [It is recommended that footnotes be avoided. Instead, try to integrate the footnote into the text.]

### **Figures & Tables**

- All figures, figure captions, and tables can be at the end of the paper.
- Large figures and tables may span a whole 8.5 inches wide page. Place figure captions below the figures; place table titles above the tables.
- If your figure has two parts, include the labels “(a)” and “(b)” as part of the artwork.
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### **Figures**

- Please do not include captions as part of the figures.
- Do not put captions in “text boxes” linked to the figures.
- Do not put borders around the outside of your figures.
- Figure axis labels are often a source of confusion.
  - Use words rather than symbols.
    - As an example, write the quantity “Magnetization,” or “Magnetization  $M$ ,” not just “ $M$ .”
  - Put units in parentheses.
  - Do not label axes only with units.
    - For example, write “Magnetization (A/m)” or “Magnetization ( $A \cdot m^{-1}$ ),” not just “A/m.”
  - Do not label axes with a ratio of quantities and units.
    - For example, write “Temperature (K),” not “Temperature/K.”
- Multipliers can be especially confusing.
  - Write “Magnetization (kA/m)” or “Magnetization ( $10^3$  A/m).”



- Do not write “Magnetization (A/m) ( 1000” because the reader would not know whether the top axis label in Fig. 1 meant 16000 A/m or 0.016 A/m.
- Figure labels should be legible, approximately 8 to 12 point type.

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- Define abbreviations and acronyms the first time they are used in the text, even after they have already been defined in the abstract.
- Abbreviations such as RIT, SI, ac, and dc do not have to be defined.
- Abbreviations that incorporate periods should not have spaces: write “C.N.R.S.,” not “C. N. R. S.”
- Do not use abbreviations in the title unless they are unavoidable

### **Equations**

- Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1).
- First use the equation editor to create the equation.
- Then select the “Equation” markup style.
- Press the tab key and write the equation number in parentheses.
- To make your equations more compact, you may use the solidus ( / ), the exp function, or appropriate exponents.
- Use parentheses to avoid ambiguities in denominators.
- Punctuate equations when they are part of a sentence, as in

$$L \frac{di_L}{dt} = V_{CC} - v_c - (R + R_L)i_L$$

$$C_e \frac{dv_e}{dt} = i_L - \frac{v_e - V_{EE}}{R_e}$$

$$C \frac{dv_c}{dt} = C \frac{dv_e}{dt} + i_L - i_c$$

- Be sure that the symbols in your equation have been defined before the equation appears or immediately following.

- Italicize symbols (*T* might refer to temperature, but *T* is the unit tesla).
- Refer to “(1)” not “Eq. (1)” or “equation (1)” except at the beginning of a sentence: “Equation (1) is ... .”

## **Bibliography**

- The reference list should appear at the end of your paper.
- Begin the list on a new page.
- The title *References* should be either left justified or centered on the page.
- The entries should appear as one numerical sequence in the order that the material is cited in the text of your assignment.
- Number citations consecutively in square brackets [1].
- The sentence punctuation follows the brackets [2].
- Give all authors' names; do not use “*et al.*” unless there are six authors or more.
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- Papers that have not been published should be cited as “unpublished”.
- Papers that have been submitted for publication should be cited as “submitted for publication”.
- Papers that have been accepted for publication, but not yet specified for an issue should be cited as “to be published”.
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- For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation

## **Other Recommendations**

- Use one space after periods and colons.
- Hyphenate complex modifiers: “zero-field-cooled magnetization.”
- Avoid dangling participles, such as, “Using (1), the potential was calculated.” [It is not clear who or what used (1).]
  - Write instead, “The potential was calculated by using (1),” or “Using (1), we calculated the potential.”
- Use a zero before decimal points: “0.25,” not “.25.”
- Use “cm<sup>3</sup>” not “cc
- The abbreviation for “seconds” is “s” not “sec.”
- Do not mix complete spellings and abbreviations of units: use “Wb/m<sup>2</sup>” or “webers per square meter,” not “webers/m<sup>2</sup>.”
- When expressing a range of values, write “7 to 9” or “7-9,” not “7~9.”
- A parenthetical statement at the end of a sentence is punctuated outside of the closing parenthesis (like this).
- (A parenthetical sentence is punctuated within the parentheses.)
- In American English, periods and commas are within quotation marks, like “this period.”
- Other punctuation (!,?) is “outside”!
- Avoid contractions; for example, write “do not” instead of “don't.”
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- If you wish, you may write in the first person singular or plural and use the active voice (“I observed that ...” or “We observed that ...” instead of “It was observed that ...”).
- Remember to check spelling.

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- [If your native language is not English, please get a native English-speaking colleague to proofread your paper.]

Revised by Gina Bush 8/12/08