[Your Title Here]

by

[Your Name Here]

Department of Electrical and Computer Engineering
Duke University

Date: _____
Approved:

_____
[Your Supervisor Here], Advisor

_____
[Department Committee Member #1]

_____
[Department Committee Member #2]

_____
[External Committee Member]

Dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy in the Department of Electrical and Computer Engineering
in the Graduate School of Duke University
2020

Abstract

[Your Title Here]

by

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Department of Electrical and Computer Engineering
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An abstract of a dissertation submitted in partial fulfillment of the requirements for
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Abstract

Write your abstract here. You should not include references or mathematical notation.

If you want to dedicate your thesis to anyone do so here

Contents

List of Tables

List of Figures

List of Abbreviations and Symbols

Symbols

Put general notes about symbol usage in text here. Notice this text is double-spaced, as required.

$\mathbb{X}$	A blackboard bold X. Neat.
$\mathcal{X}$	A caligraphic X. Neat.
$\mathfrak{X}$	A fraktur X. Neat.
$\mathbf{X}$	A boldface X.
X	A sans-serif X. Bad notation.
X	A roman X.

Abbreviations

Long lines in the `symbollist` environment are single spaced, like in the other front matter tables.

AR	Aqua Regia, also known as hydrocloric acid plus a splash of nitric acid.
SHORT	Notice the change in alignment caused by the label width between this list and the one above. Also notice that this multiline description is properly spaced.
OMFGTXTMSG4ME	Abbreviations/Symbols in the item are limited to about a quarter of the textwidth, so don't pack too much in there. You'll bust the margins and it looks really bad.

Acknowledgements

Thank anyone you like here. It's good practice to thank every granting agency that's given you money since you've been ABD, any other school you visited during your research, and any professional society that's funded your travel.

1

Introduction

Type your introduction here. This is "technically" your first chapter of the dissertation/thesis [1]. This is how to insert IEEE style citation.

2

Duke Dissertation Class Documentation

`dukedissertation.cls` — a document class for dissertations and theses conforming to the 2011 Duke University guidelines. This class is by Michael Gratton and modified by Hugh Crumley. It is based on the 2004 LaTeX2ϵ version of report.cls and code in the older dukethesis.cls dating back to 1987.

The report.cls is Copyright 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 The LaTeX3 Project.

The original dukethesis.cls contained work by Mark Holliday, Charlie Martin, Russ Tuck, Sean O'Connell, Michael Todd, Syam Gadde, and Rajiv Wickremesinghe. Some of this work has been folded into the new document class.

This file may be distributed and/or modified under the conditions of the LaTeX Project Public License, either version 1.3 of this license or (at your option) any later version. The latest version of this license is in `http://www.latex-project.org/lppl.txt` and version 1.3 or later is part of all distributions of LaTeX version 2003/12/01 or later.

This is the June 13,2011 version, 0.5,(updated by Hugh Crumley) by Michael

Gratton. [1]

2.1 Features

This class conforms to the 2011 style guidelines for dissertations, including:

1. Page numbers centered in the footer of each page

2. Margins: 1in top, 1in right, 1.5in left, 1in below footer

3. Title signature page, UMI abstract title signature page, and copyright page automatically generated at `\maketitle`

4. 'Double' spacing throughout body text (really about 10pt extra instead of 12pt extra.)

5. Double spacing between and single spacing within the Table of Contents, List of Tables, List of Figures, Bibliography, and in chapter, section titles, and figure/table captions.

6. Footnotes are numbered consecutively within a chapter and placed at the bottom of the page on which the reference number appears.

7. Page ordering and numbering: roman numeral page numbers appear in the frontmatter (prior to the introduction or Chapter 1). The first numbered page is the Abstract (iv). Arabic numbering from '1' starts in the Introduction or Chapter 1 if there's no Introduction.

8. Optional material supported:

   - Dedication

   - Acknowledgements

---

[1] E-mail: mgratton@math.duke.edu

- Introduction (different from 'Chapter 1: Introduction')

- Appendices

This class also provides some handy features:

1. Use the option 'economy' to get a single-spaced document appropriate for giving to colleagues.

2. Change your copyright from 'All rights reserved' if you're not actually reserving all your rights.

3. New Look: boldface mostly removed in headers for a lighter feel. The word 'Chapter' no longer appears on opener pages, only the number.

2.2   Limitations

In it's current form, this class does not support committees larger than six members, or titles longer than four lines. The figure-to-caption space has been abbreviated, as most plotting programs provide ample bottom margins. This default may not be acceptable in all cases.

2.3   Class options

The class supports the following options. Options appear in pairs with the default option in each pair listed first. The exception is the first listed option, which merely activates several other options for convenience.

economy Macro. Enables the options singlespace, nogradschool, and nobind. **Changed in version 0.3**

gradschool Default. Produces signature lines and a UMI abstract title page.

nogragschool Supresses the above.

PhD Default. Format is suitable for a Ph.D dissertation.

MS Modifies the format for Masters Theses. Changes the text on the title page, omits the UMI page, and generates warnings when forbidden document parts are used (i.e., Biography).

openany Default. Allows a chapter to start on any page.

openright Chapters only start on right-hand pages. Only makes sense for twosided documents.

oneside Default. Wide margin (where the binding will be) always occurs on the left edge of a page.

twoside Wide margin occurs on the left of odd pages and the right of even pages. This is for binding duplex printed documents.

final Default. No extra marks, include all pictures.

draft Prints black bars on pages where the contents overflow the margins. Suppresses the inclusion of graphics for speed.

doublespace Default. Double-spaces body text and adds extra space between entries in the Table of Contents, List of Figures, List of Tables, List of Abbreviations, and Bibliography.

singlespace Normal distances between baselines in all cases. Normal spacing in all list-type environments.

newstyle Default. Lighter look for headings.

oldstyle Headings in the classic LaTeXstyle. **New in version 0.3**

bind Default. 1.5in margin for bidning appears on spine-side of a page.

nobind Left and right margins are both 1.25in. **New in version 0.3**

The default options are chosen so that the document will pass the Ph.D format specifications of the graduate school.

Here are some handy examples. Format required by graduate school:

```
\documentclass{dukedissertation}
```

Easy-to-read format for printing, sending to collaborators, etc:

```
\documentclass[economy]{dukedissertation}
```

Suitable for spiral bound copies and the like

```
\documentclass[economy, twoside, bind]{dukedissertation}
```

3

Basic Document Class Features

This chapter is an example of how to format normal material in the dissertation style. Most of this information is standard to LaTeX.

3.1 Intra-chapter divisions: Sections

Section headlines are `\Large` and in the standard font. Compare them to subsections below.

3.1.1 Subsections: Wow! Italics!

Yes, italics. You may now dance. Isn't it funny that upright letters are called "roman" while slanted letters are "italic". That's like Italian, and Romans are Italians too. What gives?

Subsubsections: Smaller and smaller

Subsubsections are allowed, but are not numbered and don't appear in the table of contents. Likewise, you can use the next level of sectioning.

Paragraphs These divisions are unnumbered and do not appear in the Table of Contents.

Subparagraphs This is the finest division possible. It's also unnumbered and omitted from the Table of Contents.

3.2 Let's do some math

Let's look at an equation:

$$\partial f t = f(t) \quad \text{subject to} \quad f(0) = c. \tag{3.1}$$

We've used the `\newcommand` defined in the preamble of `dissertation.tex` to produce the derivative. You can get a second derivative like $\partial^2 f t^2$ by adding some sneaky superscripts. Fancy.

More advanced equation formatting is available in the AMS environments. See the guide amsmath user's guide. Here are some nice examples of cases people usually have trouble with.

An equation that's too long for one line — use `multline`:

$$a + b + c + d + e + f + g + h + i + j + k + l + m + n + o$$
$$= p + q + r + s + t + u + v + w + x + y + z. \tag{3.2}$$

An equation with multiple parts and one number per line — use `align`:

$$a_1 = b_1 + c_1 \tag{3.3}$$
$$a_2 = b_2 + c_2. \tag{3.4}$$

The same equation, set inside the `subequations` environment:

$$a_1 = b_1 + c_1 \tag{3.5a}$$
$$a_2 = b_2 + c_2. \tag{3.5b}$$

Notice that by clever placement of labels, I can reference the pair via (4), the first (3.5a), or the second (3.5b). One number for multiple equations can be accomplished using the `split` environment:

$$
\begin{aligned}
a &= b + c - d \\
&\quad + e - f \\
&= g + h \\
&= i.
\end{aligned}
\tag{3.6}
$$

People often struggle under the complicated and ugly 'eqnarray' environment. Don't do it! The AMS ones are easy. Other stumbling blocks are cases:

$$
a = \begin{cases} b & \text{for } x > 0 \\ c & \text{otherwise,} \end{cases}
\tag{3.7}
$$

matrices:

$$
A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix},
\tag{3.8}
$$

and evaluation bars:

$$
a = \left. \frac{\partial u}{\partial x} \right|_{x=0}.
\tag{3.9}
$$

See the source file for details.

When we reference an equation with something like `\eqref` (3.1). If you click on the above references in the PDF, your viewer should scroll up to the above equation. It's handy. Labels and references may be attached to all sorts of objects. There is a `\label` attached to this chapter (it appears at the top of this file), and we may reference it by (`Chapter~\ref{chap:example}`), producing "Chapter 3". By default these ref's are hyperlinked as well. Later, we'll see labeled and referenced figures and tables. Particular pages may be labeled with standard `\label` commands in the text and referenced via `\pageref`.

You might also like the links from `\cite` commands to the corresponding bibliographic entry. Go look at this imaginary book by Stephen Colbert [**?**]. If you're not a bibtex expert, look in `mybib.bib` at the `@ARTICLE` that generated this entry. It shows an example of accents on author names and how to preserve upper-case for letters in the title. Other entries show the use of the `and` keyword between author names. You may order a particular author's name as either "first last" or as "last, first". The actual format of the bibliography is controlled by the `\bibliographystyle{}` command in `dissertation.tex`.

3.3   Table of Contents Behavior

Now is a good time to look back at the Table of Contents. Notice that you may click on entries here to warp to the corresponding document location. In Adobe Acrobat and many other viewers, you can open a 'bookmarks' pane. This should be populated with named and numbered sections and subsections identical to the Table of Contents.

3.4   Figures and footnotes

Figures are set with very little space between the caption and the bottom of the included graphic. This is because most graphics programs pad the edges of images. If you find the spacing unsatisfactory, you may always add a bit manually. The text of the caption is single-spaced, and the word 'Figure' is set in small caps. See Fig. 3.1. Notice the use of the nonbreakable space "~" between the "Fig." and the reference. Figures (and tables) are examples of 'floats — objects that LATEXdecides where to place for you. You may give LATEXsome hints. Change the `\begin{figure}[tbp]` to a `\begin{figure}[b!]` to restrict the placement. Inside the [ ], you can put the following

FIGURE 3.1: Longer caption for actual body of dissertation. Figure captions should be BELOW the figure.

t Allow placement at the top of the page

b Allow placement at the bottom of the page

h Allow placement 'here', in the middle of the page close to the text that the figure environment appears next to.

p Allow placement on a seperate 'floats page' that has no body text.

! Tighten the screws on the placement algorithm. This doesn't force things to happen as you say, but it makes it much more likely. Be careful: the bang option can cause figures to appear above the chapter title and in other bad locations.

Notice that each entry just changes what is *allowed*, but no preference among the

entries can be registered. The default is [tbp], which is a very good default for a document like this, since floats in the middle of a page trap too much whitespace for double-spaced text. There is also a prohibition against having a page with more than 75% float. Instead, long floats will get kicked over onto float pages. Float pages are often a bad idea, as the creation of one will often cause a domino effect, with all subsequent figures appearing on float pages themselves, and all these float pages appearing together at the end of the chapter. (This is more like sinking than floating.) Avoid this by physically moving where the figure environment appears in your source file to an earlier location. Don't be afraid to put the environment before the first spot you reference it! Many float problems can be solved by a combination of relocating the figure environment and a little fiddling with the [ ] options.

Also notice the order of the graphic, caption, and label. If you deviate from this, strange things can happen. The caption of this figure shows the use of short captions (inside []). These caption appear in the List of Tables, while the   captions appear in the body. If you omit the [ ] short caption, the long caption will be used in its place.

Another technical note: since this style sheet is designed for processing by pdflatex, `\includegraphics` looks for PDFs, PNGs, and JPGs instead of the usual PS, EPS, and TIFF formats. You can convert existing graphics with a vareity of tools. PDF graphics are preferred, as they scale nicely. The open-source software Inkscape runs on Mac OSX, Windows, Linux, and some UNIX variants. Versions 0.46 and beyond have great support for creating and editing PDFs. It can even be used to convert other docs.

3.4.1   List of Figures

If you've put even one measly figure in your document, grad school rules say you need a List of Figures. It's automatically generated for you if you do a `\listoffigures`

Table 3.1: Long table caption appears on in the body text. See the short caption in the List of Tables. Table captions need to be ABOVE the table.

Numbers	Letters	Symbols
1	a	†
2	b	⌣̈
3	c	×
4	d	♯

in the master file (heck, it's there right now). Go look at the list of figures now. You should be able to click on the figure number to warp to the figure. You'll also see the result of the 'short caption' used above.

3.5   Table example

Just to make sure tables are formatted correctly, here's an example of a table float, see Table 3.1. You should note that [b] formatting (`\begin{table}[b]`) can cause floats to appear under the footnotes. Try changing it here and see the ugliness. Tables are identical to figures, except that the word 'Table' appears in the caption and its entry is in the List of Tables instead of the List of Figures.

3.5.1   Footnotes

Footnotes are allowed.[1] They are numbered with arabic numerals inside each chapter and appear at the bottom of the page.[2] The little footnote numbers are also hyperlinks. Try clicking them. You should place the footnote command immediately following the period of the sentence it is attached to. Any spaces or newlines will result in strange spacing between the number and the sentence.

---

[1] But, you should probably just work them into the text since it's annoying to jump around when reading.

[2] …rather than the end of the chapter or the thesis. Those would properly be endnotes, I guess.

3.6 Corner cases in formatting, such as very very very long section titles. Man, this goes on forever.

Common corner-cases involve very long titles (like above). In these cases, the long titles are set single-spaced both here and in the Table of Contents.

3.6.1 Figure and Table caption cases are neat, and this is an absurdly long subsection heading

Consider the shield logo again with an absurd caption, as in Fig. 3.2. Also examine the new table, Table 3.2. Both of these have been forced onto a floats page so you can see what that looks like.

FIGURE 3.2: The Duke logo again, but now with a really long rambling caption. This caption should be set single-spaced in the LoF and in the body text. What do you think about having graphics in the main directory of a project? I'd prefer them in a folder, then put 'foldername/picturename' as the argument to includegraphics.

Table 3.2: The same silly table again, but with a really long caption.

Numbers	Letters	Symbols
1	a	†
2	b	⌣̈
3	c	×
4	d	♯

4

Nonsense text for layout proofing

Enjoy some Lorem Ipsum text! This should create about two full pages of text so you can verify the margins are correct (especially if you're doing two-sided).

4.1 Lorem Ipsum

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neque ac dolor.

4.2   More nonsense

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5

Lorem ipsum prompta platonem intellegat ut est Tamquam epicurei ne duo Et quidam iuvaret eum

Ea dico populo saperet nam, atqui mundi viris et vim. Te choro aperiri vim.

Duo ignota nonummy ei. Ex augue latine luptatum eum. Omnesque scaevola vis ne, erat perpetua convenire ius in. Duo cu movet sonet corrumpit. Ex eos reque prodesset.4

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suavitate nec, cu sed erat veniam postea. In tale facilisi posidonium per, pri suscipit deterruisset an.

5.2   Ipsum

Lorem ipsum vis at liber dicit diceret. Id fierent omittam est, vis natum electram eu, prompta sensibus at vix. Ut mea modus novum reprimique, vel euismod referrentur an. Ne legimus placerat abhorreant nec, no deleniti interesset vis. Vel adhuc graeci cu, ea est graecis fabellas.

Vel ex facer suscipiantur definitiones, mea vituperatoribus sale porro no, ut aliquip disputando sit. Ad graece albucius oporteat nec, vim voluptatum interesset in. Autem mundi eos ei, omnesque voluptaria et pri, falli quaerendum quo cu. Dicit equidem ceteros ne duo, ad oratio nostrud fierent usu, ei aliquyam periculis intellegam vim. Audiam principes sententiae sed et, ex his dicant facilis. Posse primis melius an per, quod assueverit duo id, cu usu animal propriae.

An natum nemore est, et eum quidam semper voluptua, meliore euripidis ei sea. Mei mutat invidunt ex. Vix choro delicata te. Causae mediocrem an his, choro vidisse id est. Mundi dolor id mei, an duo tation omittam.

Ex magna facer torquatos vel. Te pro sumo legere consequat, duo ea luptatum phaedrum. Nec in laboramus interesset cotidieque, deleniti vivendum ex eam, at senserit hendrerit vel. Est rebum falli ad, cu latine viderer efficiendi nec. Vidisse delectus te mei. Eu sanctus patrioque philosophia usu.

At veniam malorum iuvaret his, eos soluta ullamcorper ut. Zzril integre sit ut, sed regione percipitur contentiones et, mea no aliquyam efficiendi. Vix et neglegentur definitiones, ne graeco dictas omittam est. Id mel eros soluta corrumpit, oportere torquatos vim an.

An est eligendi efficiendi intellegam, illud putent labitur eu duo. Id fabellas salutatus argumentum has. Qui malorum prompta ex, eu sea nostrud admodum

sensibus. Ex tamquam complectitur has, diceret volumus eam cu. Eam nusquam deleniti ponderum cu. No eam tale moderatius.

Est saepe dicam abhorreant ut, omnes soleat quo no. Duo ceteros pericula interesset ut. Nec eu iudico option, persius euismod no eum. Per ea luptatum oporteat qualisque.

Dico veri nec ei, est ne audiam graecis corrumpit. Dico possit an pri, illum feugiat cum ne, ne duo lorem corpora platonem. Cum no aeque feugait, in vis odio nihil. Iusto sadipscing scriptorem ne est. Ius ad salutandi intellegebat.

Nonummy mentitum his an, viris maiorum assentior pri cu, duo errem partiendo quaerendum ad. Cum aperiam sententiae ex. Dolor salutandi pro in, nec ei utinam causae, praesent concludaturque quo te. Id fuisset consequat eum, vide eirmod qui et. Cu tollit ubique concludaturque has, his id sale consectetuer, eu mel discere scripserit. Mei diceret efficiantur eu, no sea doctus meliore reformidans.

Nihil accommodare sit ea, nec et mutat dolorum. Ut conceptam persequeris vis, ea luptatum consetetur nam. Vix ea deleniti evertitur. Has enim consequat id, falli clita duo an.

Appendix A

Populo Ornatus

Ut quando convenire scripserit mei, ut accusam noluisse eam. At scripta democritum quo, reque everti an qui, posidonium efficiendi ut mel. Pro an reque habemus, augue nemore conceptam in vim. Eu cibo ancillae takimata usu.

No vis albucius rationibus, eum doming ceteros constituto id. Ad suas zzril laudem cum. Natum mollis singulis vel te, ea elit imperdiet duo, odio inermis et eos. Nam ad vocibus tractatos, sit no vidisse diceret omnesque, mollis omnesque ea mea.

Ut est ridens principes scribentur, menandri interesset adversarium ius ut. Ut duo elit dissentias, at sea eleifend scripserit, eam nibh rebum definitiones an. Cum te quaeque epicuri mentitum, his elitr essent et, in sea habeo aliquid convenire. Quo euismod sadipscing definitionem an, ut duo iusto aliquando, graece appetere ne nec.

Consul imperdiet dignissim vis et, mei liber vidisse principes et, eu nam docendi voluptua democritum. Qui no dicat tamquam sanctus, saepe tincidunt no mel. Pro ignota albucius consetetur in, sint qualisque assueverit eam ut, vis graeco denique signiferumque ne. Sale appellantur contentiones eu his, pro magna ornatus ut, ad vidit omnesque euripidis pri. Sea congue moderatius in, his dicit suscipit no, mei

ei incorrupte assueverit. Nusquam nominavi et quo, idque delenit vim an, posse quaeque an mea.

Suas elitr lucilius sit an, aeterno persius vel eu. Mel at essent aperiam repudiare. Tale consul eum ne, eam no meis delenit iudicabit, an sint mutat pri. Nec no clita propriae pericula, duo explicari gubergren ei. Ne sit autem nominavi, te falli deserunt per. Quo tractatos suscipiantur ex, electram dignissim usu no, cu congue iriure vivendo vim.

At vero graeci fuisset his, quo similique persequeris ad. Ex est graece mandamus, antiopam voluptatum his ea. Assum appellantur mel an, ei mea veri commune efficiendi. Pri blandit urbanitas no. Nam ex enim reque, ut nec iusto regione ullamcorper, facer harum pertinacia mei ei. Erant veniam imperdiet an eam, veniam mucius equidem ius eu, at scripta labitur est.

Et quo soluta graecis accommodare. Tamquam mentitum menandri vim ut. Ut nec melius senserit, ut mei sale aeque. Prompta delectus mea te, fierent adipisci ad per, mei odio pertinax senserit et. Per ut persius singulis. Id qui malorum iracundia, semper conceptam cu sed.

Vis nominavi urbanitas intellegat an, ut numquam deseruisse sea. Et quo dico aeque adipiscing, ius ea commodo epicurei, eum cu nulla imperdiet efficiantur. Ea cum simul scripserit. Ius reque decore voluptaria ei, nec sensibus mediocrem eu, sit iriure vivendo ad. At munere maiestatis mel, ex persius honestatis nec. Nihil omnes definiebas duo cu, dicat ancillae no vix. No est prompta apeirian, mel ad quaestio theophrastus mediocritatem.

Persequeris intellegebat disputationi et nec, nam ne alia solum reque, ad pri clita appellantur reprehendunt. Clita iracundia ex cum, placerat invidunt dissentias ius id. Possit dictas recteque sed ne. At eam singulis recusabo intellegat, ius in probo clita posidonium, id atqui paulo rationibus pro. Ut elit mucius qui. Mel ea ubique nostrud takimata. Cu eos vituperatoribus temporibus feugait.

Per putent nusquam oportere cu, nullam discere te sea, an vix quot mutat. Cibo reque nostrum nec eu, justo mucius aeterno vis id. Facer tempor cu vix, ex saepe similique maiestatis qui, ne pro eripuit offendit. Id mel cetero efficiantur. Cum homero aeterno euismod an, vulputate definitiones ne quo.

Sed exerci incorrupte et, usu mundi molestiae reformidans in, at probo vocibus quo. Ex vel aliquip maluisset. Qui enim error an, molestie incorrupte an ius. Id maiestatis temporibus mei, tantas oporteat ocurreret id pri. Ei nam velit doming utroque.

Suas vituperata mel eu, ex veri omnes duo, an modo molestie ius. At vis moderatius dissentias scripserit, nullam aliquam usu no. Cibo diceret sed an. Sea cu ridens convenire.

Pro prima blandit no. His ut dicit iriure oblique, eos meis urbanitas abhorreant te. Usu cu perpetua principes. Mutat utinam insolens id cum. Quo tale iudicabit conclusionemque ex. Eos id harum accommodare.

Vel legere liberavisse ut, et aeque timeam usu. Vis eu dico sanctus appetere, id vix graecis repudiare, ad persecuti mnesarchum mei. No atqui nemore deseruisse eum. Meliore accumsan accommodare in qui, an tation rationibus has, ea nulla aliquip euismod his.

Utinam ridens cum eu. Duo aliquam omnesque cu, sea elitr appetere ea. Mea no quas discere apeirian, munere hendrerit conceptam duo an, nec ad habeo tritani. Vis exerci volumus no. Omittantur reprehendunt no has. Malis accusata necessitatibus no nam.

No solet assentior ius, an ferri dissentiet pro, vix ad tantas offendit. Pro tollit consequat gloriatur ne, eu vix amet posidonium. Errem utamur veritus vix ea. Sed laboramus omittantur id, ut sonet voluptatum has, cu doctus iriure menandri eos.

Regione iudicabit ei per. Cum ea aliquip voluptatibus. Sit in partem explicari. Ne probo labores placerat mei. Ullum pertinax ea his, per cu persius impedit adipisci.

Fabulas ancillae dignissim ei his, ius no nulla melius suscipiantur, ne vel laudem eripuit gubergren.

Ei qui equidem adolescens. Has ad accusata urbanitas voluptatum, no pri ferri dicit. Ne qui veritus omittam neglegentur, usu et lorem audiam mediocrem. Vim falli dictas labitur cu, dolores laboramus constituto id has, sit ea sint summo utroque.

Mei graecis definiebas eu, ad his brute omittam elaboraret. Ridens laoreet eos ne, diam mnesarchum ne sea. Idque everti ea pro, eruditi probatus patrioque eu has. Cum omnes gubergren ex, cum te noster offendit indoctum. Putant dissentiunt duo ex, dicat etiam cu quo. Duo esse probatus complectitur ex, vitae eripuit nostrum no sed, cum odio veri reformidans ex.

Vide ipsum ei vel, at diam nominavi his. Etiam assueverit nam eu, ut habeo nusquam eleifend mei. Pro eirmod perpetua id, minim urbanitas usu no. Vim elitr nominati definitionem ex. Ex tollit quaerendum has, nonumy inciderint eos ne. Vis posse munere honestatis ut.

Eu ornatus meliore usu, enim aeque possim eu cum. Pri ad everti fabellas, at pro omnium convenire repudiare, ut mel hinc minimum. Eam et puto reque mollis. Sed ad ponderum lobortis, cu pro viris vitae. Est et iriure inimicus, eos eu laoreet feugait voluptatum, agam aliquando voluptatibus pro eu.

Ex tale eirmod nec. Illud conclusionemque ad his. Sit augue error in, eu mea labitur voluptua, labores ullamcorper vis te. No usu enim aperiri facilisi. Ad vis brute soluta fastidii, meis mundi iuvaret his ea. Has eu cibo rebum. Mundi numquam repudiare ei cum, pri dicam tritani recusabo ea, pri id appareat qualisque.

Eu facete perfecto nec, te vel tale choro petentium. Mel in essent quodsi, ocurreret corrumpit in pri. Est in fabulas similique elaboraret, in viderer delenit vim. Eu vel paulo graeco viderer. Et ius elit debet latine, ad vel ferri voluptaria appellantur.

Vis ad docendi albucius, ne nam sale prima comprehensam. Adhuc inani accusam ex vis. Utamur labitur adipisci nec ei. No persius conceptam adversarium pro, ei

dicunt officiis lucilius usu. Te pri petentium vituperata, vis at solum dicit quaeque, minimum delectus singulis ei vim. His te nibh patrioque dignissim, qui ne euismod argumentum. Quo lucilius sensibus cu.

Est ea nihil debitis deseruisse, mea ne malis nostrum. Vel cu doctus euismod disputationi. Eos ut harum habemus, minim verear maiestatis mei ut. Te nam mundi deseruisse sententiae, pri an nibh eros velit. Ne omnium torquatos ius. Sit id congue quaeque intellegebat, homero volutpat dissentiunt ne usu, ei elit vituperata reformidans eum.

Ut sed corpora accumsan, his cu vero iriure probatus. Ubique latine ea per, usu no erant facilisis. Augue diceret eruditi ea vel, in diam maiorum ullamcorper eum. Vel no iriure latine suscipiantur, cu nec omittam liberavisse disputationi.

Congue repudiandae delicatissimi ut duo, fastidii iudicabit ut sea, eum integre sadipscing an. Cu vel alii liber, ceteros nostrum expetendis per eu, ne congue gloriatur vulputate cum. Eius fierent pericula has cu. Ea has atqui perfecto. Pericula torquatos ius ei, convenire theophrastus id sea, in dicit facilis facilisis mel. Nam modo diam ocurreret an.

Ferri sensibus eloquentiam quo et, mel an nullam vituperata, mollis dignissim sententiae sit ne. An pro perpetua democritum, te eam feugiat delicata deterruisset. Per minim choro ad, prodesset voluptatum ea usu, ea tempor putent quo. Mazim facete scribentur ea sea. Ea pri doctus feugait, ius eu vituperatoribus menandri, dico munere ubique ne his.

Mel no assum nusquam intellegebat, ius platonem consulatu an. Populo ornatus in sea. Sea soleat salutatus ne. Quo error saepe adolescens at, id cum duis voluptatum. Per maiorum mentitum te. Quem iudicabit percipitur per ea. Qui aliquid eruditi ad, ne vix veritus scripserit.

An duo postea aliquip. Nusquam luptatum id vis. Vim no magna inani. Eos et agam aliquid ancillae, verear ponderum no qui.

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Biography

Bonan Yan is a PhD candidate at the Department of Electrical and Computer Engineering, Duke University. He received B.S. degree in Electronics and Information Engineering from Beihang University, China in 2014 and M.S. degree in Electrical and Computer Engineering from University of Pittsburgh, USA in 2017. His research interests are application-specific computing schemes with emerging nonvolatile memories. His expertise is on the VLSI design of controllers and interface circuits for resistive memory devices, e.g. MRAM and RRAM. He has developed a series of monolithically integrated RRAM-CMOS mixed-signal in-memory computing engines for machine learning hardware acceleration since 2015.

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