

Simulating Digital Circuits Using Wang Cubes

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Abstract

This report describes a method by which Wang cubes tiling 3D space can be used to simulate digital circuits, and presents a web-app to run such simulations. It also describes an efficient algorithm used to compute adjacent planes along the z-axis, along with the software architecture and technology used to create the web-app. Common elements of digital circuits (such as clocks, wires, logic gates, *et cetera*), along with the challenges of instantiating them using Wang cubes, are discussed here.

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Let's start with some advice on the subject matter and content of a Bridges paper, since this should be an author's first concern. The Bridges Proceedings are considered a refereed journal, and as such we are trying to maintain quality standards that will make its papers count in academic personnel reviews and promotion cases. Thus, most importantly, every paper should present some novel achievements, experiments, artwork, and/or insights by the authors. General reviews or tutorials, cobbled together from various blogs or Wikipedia pages are not appropriate. Also, keep in mind that the number of pages in the Proceedings as well as your presentation time at the conference are limited; so choose a scope for your presentation that fits into these constraints.

Regular papers should be either 8 or 6 pages, including references. Every paper should nicely fill an even number of pages without a lot of wasted white space, so that we can make optimal use of the Proceedings pages and start every paper on a right-hand page.

Short papers, which have a later submission deadline, should be 4 or 2 pages long, including references. Here it is particularly important to focus on just one or two novel ideas and results. Short papers are not a good medium to give tutorial introductions or cursory reviews over a domain that could be the subject of one or more books. Also, this is not the place to give preliminary ideas on new teaching experiments, or to present intuitive hunches how some classical artwork might be analyzed in a novel way. A Bridges paper should only be submitted after the experiments or novel analysis have been performed and when concrete results are available.

The program committee has found that certain types of papers almost always need to be rejected: papers on numerology or work that extracts numbers or ratios from artwork or architecture. A somewhat "fuzzy" search for the Golden Ratio (or any other ratio) will almost always produce some hits (a simple matter of statistics). However, such coincidences do not tell us anything about the method or intent of the creator of those artifacts, unless there is some other compelling evidence, such as auxiliary lines or notes that explicitly state what the artist or architect was doing.

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Use of this Template

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Figure 1: *An individual figure [?]. Make it large enough so that necessary details can be seen. Fine-tune its size, so that you obtain convenient page breaks.*

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The font is *Times New Roman*. The text of the main body, as well as the figure captions use size 11 pt. Section headings, authors, and affiliations are size 12 pt. Paper title is 16 pt. Abstract is 9 pt. Use this template to see what items are printed in **bold face** or in *italics*. Use italics for emphasis, rather than blood face (which reads like yelling.) Mathematical expressions are typeset in the same font as the body text, as in $\sqrt{b^2 - 4ac}$.

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Figure 2 shows how to format and caption a figure with multiple panels. Here we use the *subcaption* package, which enables the `\subcaption` command. Leave the subfigure captions blank to automatically label the panels (a), (b), etc. We ensure that the full figure does not exceed the width of a full line of text by setting the width of each individual panel to be an appropriate proportion of the `\textwidth`.

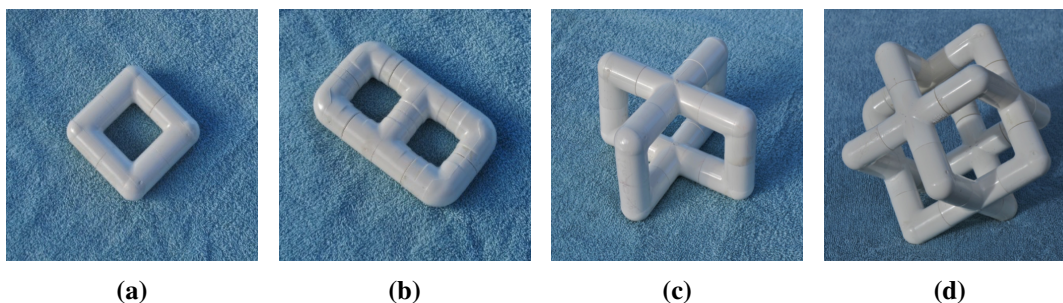


Figure 2: *Orientable handle-bodies made from PVC pipe components: (a) simple torus of genus 1, (b) 2-hole torus of genus 2, (c) handle-body of genus 3, (d) handle-body of genus 7.*

Tables are mostly treated just like figures, except that the caption is placed *above* the table body. This is accomplished by placing the `\caption` before the table data. In this example we reduce the font size in the *tabular* environment so the table fits within the margins. All figures and tables must be referenced and explained in the main text, and they must not bleed into the margins.

Table 1: *Number of Topologically Different Linkings of Two Cube-Frames.*

	2 edge-loops	3 edge-loops	4 edge-loops	5 edge-loops	6 edge-loops	total
2 edge-loops	2sm, 1dm					3
3 edge-loops	0	1sm, 1sp, 2sc, 2dm				6
4 edge-loops	0	2dc	1sm, 10 sc, 2dm, 10dc			25
5 edge-loops	0	0	1dm, 20dc	16sc, 3dm, 1dp, 24dc		65
6 edge-loops	0	0	3dm, 2dc	26dc	14sc	45
					total:	144
	s: swap symmetry		m: mirror symmetry			
	d: different roles for		c: chiral configuration		date: 1/20/2016	
	the two frames		p: pseudo chirality			

Sections and Subsections

Important words should be capitalized in your paper’s title and section headings, while conjunctions (e.g., “and” / “or”) and prepositions (e.g., “of” / “with”) begin with a lower case letter. Avoid most punctuation (one colon or comma is acceptable). Do not end a lone title or section heading with a period. For section headings use `\section*`. Do not use numbered sections unless you refer to a section by number rather than title in the text. If you must have your sections numbered use the `\section` command. For any Bridges paper, it would probably be excessive to use more than two levels of hierarchy in your document. In all papers the **Abstract**, **Acknowledgments**, and **References** headings are unnumbered sections.

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Wrap-up

The paper should end with a brief section that provides some **Summary and Conclusions**. This may be followed by **Acknowledgments** (optional) and **References**. Only list references that you cite in your paper. List all references alphabetically by last name of first author and number them sequentially. When citing references in the text, use `\cite`, as in: “see Coxeter [?]” or just insert “[?]” after the corresponding quote. See the references for correct article [?, ?], book [?], and Bridges Conference Proceedings [?] citations. Since Bridges papers typically have only a few references, we do not require or even recommend that you use `BIBTEX`, but of course you are free to do so. Examples and templates for other types of references can be found in the Guidelines for References section of the Paper Formatting webpage. Don't insert links to references in the body of the paper.

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Summary and Conclusions

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Acknowledgements

Suggestions on how the clarity and usefulness of this guide could be enhanced would be gladly accepted.

References

- [1] Merrel, Paul. “Example-based model synthesis” *Proceedings of the 2007 Symposium on Interactive 3D Graphics and Games*, 2007, pp.105–112 <https://doi.org/10.1145/1230100.1230119>