Sample Latex Showing Various Features for Research Papers

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***Abstract*—Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.**

***Index Terms*—Greek Equations, Matrices, Tables, Figures, Source Code, Theorems**

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This cites Haykin [1].

I. Citations

A. Books

This is a section on citations. The first citation is a series of books, and shows how the edition doesn't matter [2]–[4]. That also used three references [5].

B. Articles

This references a normal journal [6]. Now we want to cite the normal IEEE journals [7], [8]. And finally a conference paper [9].

II. Equations

This demonstrates various equations.
Numbered vs unnumbered equations:

$$\vec{w} = a\vec{x} + \vec{y} \tag{1}$$

$$\begin{aligned} x - y &\approx z \\ x + y &\geq z \\ x + w &\leq z \\ x &\in \mathbb{R}^n \\ y &\to x - z^{\dagger} \end{aligned}$$

Optimization algorithms

$$\begin{aligned} \underset{\boldsymbol{x}}{\text{minimize}} \quad & \boldsymbol{x}^T A \boldsymbol{x} \\ \text{subject to} \quad & \|\boldsymbol{x}\| < 1 \end{aligned} \tag{2}$$

Equations can be referenced (2).

$$\begin{aligned} \tfrac{\mathrm{d}^4 f}{\mathrm{d}x^4} &= \tfrac{\partial^4 f}{\partial x^4} \\ \frac{x-4}{5} &= \tfrac{\partial^5 f}{\partial x^2 \partial y^2} \\ A &= \iiint \mu \vec{J} dV \\ x &= \sum_{i=1}^{N} a_i b_i \end{aligned}$$

$$\langle \Psi | \Psi \rangle = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \tag{3}$$

And here's some polynomial and Differential Geometry

$$\begin{array}{r|l} X-1 & X^2+2X+2 \\ \hline X^3+X^2-1 & \\ -X^3+X^2 & \\ \hline 2X^2 & \\ -2X^2+2X & \\ \hline 2X-1 & \\ -2X+2 & \\ \hline 1 & \end{array} \tag{4}$$

$$2\left(Y-\frac{1}{2}\right)\left(Y+\frac{1}{2}+\frac{\sqrt{13}}{2}\right)\left(Y+\frac{1}{2}-\frac{\sqrt{13}}{2}\right) \tag{5}$$

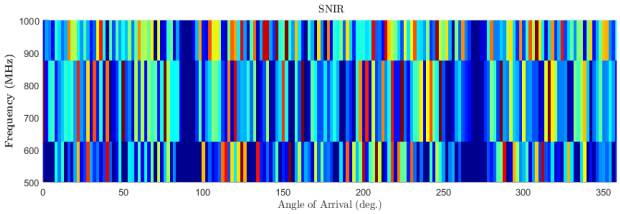

Fig. 1: A sample figure

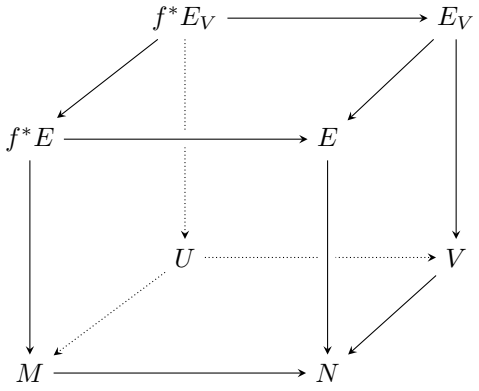

Fig. 2: This is an example of TikZ

TABLE I: Interferers at 60, 200 and 340 deg. with Dipole Array

	Time (s)	Low SINR (dB)	Mid SINR (dB)	High SINR (dB)	BW (deg)
MVDR	–	12.63	14.76	15.57	–
CMA-ES	2380	7.52	3.96	6.66	–
Genetic Algorithm	1900	2.30	1.76	6.22	–
Conjugate Gradient	0.270	0.17	0.71	1.03	–
GSC	0.232	0.06	0.45	1.85	–
DD3	0.295	8.86	2.40	5.90	–

```
library(xtable)

rowNames = c("MVDR","CMA-ES","Genetic Algorithm","Conjugate Gradient","GSC","DD3")
colNames = c("Time (s)","Low SINR (dB)","Mid SINR (dB)","High SINR (dB)","BW (deg)")

table <- matrix(nrow=length(rowNames),ncol=length(colNames))
dimnames(table) = list(rowNames,colNames)
```

Algorithm 1 Conjugate Gradient Method

$\vec{r}_0 \rightarrow \vec{a}(\phi,\theta) - R_{yy}\vec{w}$
$\vec{p}_0 \rightarrow \vec{r}_0$
while $|\vec{r_i}| > tolerance$ **do**
  $a_i \rightarrow \frac{\vec{r}_i^T\vec{r}_i}{\vec{p}_i^T R_{yy}\vec{p}_i}$
  $\vec{w}_{i+1} \rightarrow \vec{w} + a_i\vec{p}_i$
  $\vec{r}_{i+1} \rightarrow \vec{r}_i - a_i R_{yy}\vec{p}_i$
  $b_i \rightarrow \frac{\vec{r}_{i+1}^T\vec{r}_{i+1}}{\vec{r}_i^T\vec{r}_i}$
  $\vec{p}_{i+1} \rightarrow \vec{r}_{i+1} + b_i\vec{p}$
end while

```
table["MVDR","Time (s)"] = "--"
table["CMA-ES","Time (s)"] = "2380"
table["Genetic Algorithm","Time (s)"] = "1900"
table["Conjugate Gradient","Time (s)"] = "0.270"
table["GSC", "Time (s)"] = "0.232"
table["DD3", "Time (s)"] = "0.295"

table["MVDR", "Low SINR (dB)"] = "12.63"
table["CMA-ES","Low SINR (dB)"] = "7.52"
table["Genetic Algorithm","Low SINR (dB)"] = "2.30"
table["Conjugate Gradient","Low SINR (dB)"] = "0.17"
table["GSC", "Low SINR (dB)"] = "0.06"
table["DD3", "Low SINR (dB)"] = "8.86"

table["MVDR", "Mid SINR (dB)"] = "14.76"
table["CMA-ES","Mid SINR (dB)"] = "3.96"
table["Genetic Algorithm","Mid SINR (dB)"] = "1.76"
table["Conjugate Gradient","Mid SINR (dB)"] = "0.71"
table["GSC", "Mid SINR (dB)"] = "0.45"
table["DD3", "Mid SINR (dB)"] = "2.40"

table["MVDR", "High SINR (dB)"] = "15.57"
table["CMA-ES","High SINR (dB)"] = "6.66"
table["Genetic Algorithm","High SINR (dB)"] = "6.22"
table["Conjugate Gradient","High SINR (dB)"] = "1.03"
table["GSC", "High SINR (dB)"] = "1.85"
table["DD3", "High SINR (dB)"] = "5.90"

table["MVDR", "BW (deg)"] = "--"
table["CMA-ES","BW (deg)"] = "--"
table["Genetic Algorithm","BW (deg)"] = "--"
table["Conjugate Gradient","BW (deg)"] = "--"
table["GSC", "BW (deg)"] = "--"
table["DD3", "BW (deg)"] = "--"

table <- xtable(table,
                caption="Interferers at 60, 200 and 340
                label="tab:feko60_200_340")
print.xtable(table,
             type="latex",
             caption.placement = "top",
             file="table.tex")
```

References

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