School of Mathematics
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Yr Ysgol Fathemateg
Haf 2017

Language Tools for Mathematics

Celfi Iaith ar gyfer Mathemateg

Motivation

Writing mathematics requires specific fonts and layouts.

LaTeX is the standard typesetting system for mathematics.

structure	`\title, \chapter, \section, ...`
symbols	`\alpha, \pi, \sum, \int, ...`
styles	`\bold, \italic, ...`
mathematics	`\equation, \theorem, ...`
references	`\label, \ref, \cite, ...`

There is no built-in support for **bilingual documents**.

In this project we have developed a LaTeX package which defines commands for marking text from different languages, so that different language versions of the same document can be typeset. The package can be used by including the following line in the document preamble.

```
\usepackage{culang}
```

Cymhelliant

Mae angen ffontiau a dyluniadau penodol i ysgrifennu mathemateg.

LaTeX yw'r system safonol ar gyfer teiposod mathemateg.

strwythyr	`\title, \chapter, \section, ...`
symbolau	`\alpha, \pi, \sum, \int, ...`
arddulliau	`\bold, \italic, ...`
mathemateg	`\equation, \theorem, ...`
cyfeiriadau	`\label, \ref, \cite, ...`

Does dim cefnogaeth gynhenid ar gyfer **dogfennau ddwyieithog**.

Rydym wedi datblygu pecyn LaTeX sydd yn diffinio gorchmynion ar gyfer clustnodi testun mewn ieithoedd gwahanol, fel gellir teiposod fersiynnau o'r ddogfen mewn gwahanol ieithoedd. Gellir defnyddio'r pecyn drwy gynnwys y linell ganlynol yn rhaglith y ddogfen.

```
\usepackage{culang}
```

The Mandelbrot Set

Consider the following iterated system,

$$z_{n+1} = z_n^2 + c \quad \text{with} \quad z_0 = 0.$$

The Mandelbrot set is the set of complex numbers c for which z_n does not diverge to infinity as $n \to \infty$.

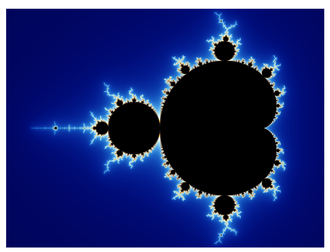


Figure 1: The Mandelbrot set

The elaborate boundary of the set is infinitely complex and exhibits self-similarity, and is therefore a fractal object.

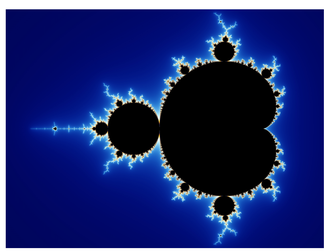
```
\documentclass{article}
\usepackage{culang}

\begin{document}
\title{\en The Mandelbrot Set \cy Set Mandelbrot}
\maketitle

\en Consider the following iterated system,
\cy Ystyriwch y system ailadroddol ganlynol,

\begin{equation}
z_{n+1} = z_n^2 + c \text{\en with\cy gyda} z_0 = 0.
\end{equation}

\eng{The Mandelbrot set is the set of complex numbers
$c$ for which $z_n$ does not diverge to infinity
as $n\to\infty$.}

\cym{Set Mandelbrot yw'r set o rifau cymhlyg $c$ sydd
fel nad ydyw $z_n$ yn dargyfeirio at anfeidredd
pan mae $n\to\infty$.}

\begin{figure}
\centering
\includegraphics[scale=0.2]{mandelbrot}
\caption{\en The Mandelbrot set\cy Set Mandelbrot}
\end{figure}

\en The elaborate boundary of the set is infinitely
complex and exhibits self-similarity, and is
therefore a fractal object.

\cy Mae ffin goeth y set yn anfeidrol gymhleth ac yn
dangos hunan-gueflunedd, ac mae felly yn
wrthrych ffractal.

\end{document}
```

Set Mandelbrot

Ystyriwch y system ailadroddol ganlynol,

$$z_{n+1} = z_n^2 + c \quad \text{gyda} \quad z_0 = 0.$$

Set Mandelbrot yw'r set o rifau cymhlyg c sydd fel nad ydyw z_n yn dargyfeirio at anfeidredd pan mae $n \to \infty$.



Darlun 1: Set Mandelbrot

Mae ffin goeth y set yn anfeidrol gymhleth ac yn dangos hunan-gueflunedd, ac mae felly yn wrthrych ffractal.

Acknowledgement I would like to thank my supervisors Dr D Evans and Dr D McConnell and also the Cardiff University Centre for Education Innovation for their support in carrying out this project.
Cydnabyddiaeth Hoffwn ddiolch i fy ngoruwchwylwyr Dr D Evans a Dr D McConnell ac hefyd i Ganolfan Arloesedd Dysgu Prifysgol Caerdydd am eu cefnogaeth i gyflawni'r project yma.

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