

# Improving reproducibility in building simulation: a pure-Python approach to geometry creation

Steven Firth

Loughborough University

2021-06-23

# My background

- I joined Loughborough University in 2008
- My job title is Reader in Building Performance Modelling
- I teach building simulation, energy data analysis, sustainable building design and renewable energy.
- I was a member of the University's Open Research Working Group in 2019.
- I was awarded the CALIBRE Winter 2019 Award for Open Research
- In 2015 I published the Refit Smart Home dataset on the University's Data Repository (14,307 views, 3,997 downloads)
- I publish papers on FAIR data and open research methods using Python and Jupyter Notebooks
- I maintain the GitHub pages for the Building Energy Research Group

# The problem I am trying to solve

- I would construct a building simulation model of a 4 bed house and to simulate the energy performance of the house using the EnergyPlus software.
- I would like to do this in an open, transparent way so that the whole process is reproducible.

# What is "Reproducible"?

The Alan Turing Institute in its publication 'The Turing Way' defines reproducible research for data science as:

*Work that can be independently recreated from the same data and the same code that the original team used.*

# An Example of Reproducibility

This presentation is reproducible as it is written in code (Latex)

The screenshot displays the TeXstudio interface with a LaTeX file named `presentation.tex` open. The code defines a Beamer presentation with the following content:

```
\documentclass{beamer}

\usetheme{Warsaw}
\definecolor{indigo(web)}{rgb}{0.29, 0.0, 0.51}
\usecolortheme[named=indigo(web)]{structure}

\title{Improving reproducibility in building simulation: a pure-Python approach to geometry creation}
\author{Steven Firth}
\institute{Loughborough University}
\date{2021-06-23}

\begin{document}

\begin{frame}
\maketitle
\end{frame}

\begin{frame}[My background]
\begin{itemize}
\item I joined Loughborough University in 2008
\item My job title is Reader in Building Performance Modelling
\item I teach building simulation, energy data analysis, sustainable building design and renewable energy.
\item I was a member of the University's Open Research Working Group in 2019.
\item I was awarded the CALIBRE Winter 2019 Award for Open Research
\item In 2015 I published the Refit Smart Home dataset on the University's Data Repository (14,307 views, 3,997 downloads)
\item I publish papers on FAIR data and open research methods using Python and Jupyter Notebooks
\item I maintain the GitHub pages for the Building Energy Research Group
\end{itemize}
\end{frame}

\end{document}
```

The rendered slide on the right shows the title, author, date, and a section titled "My background" with a list of bullet points. The slide has a purple header and footer.

Improving reproducibility in building simulation: a pure-Python approach to geometry creation

Steven Firth  
Loughborough University  
2021-06-23

My background

- I joined Loughborough University in 2008
- My job title is Reader in Building Performance Modelling
- I teach building simulation, energy data analysis, sustainable building design and renewable energy.
- I was a member of the University's Open Research Working Group in 2019.
- I was awarded the CALIBRE Winter 2019 Award for Open Research

Pages 1 to 2 of 5 144%

en\_GB, UTF-8, Ready Automatic

# An Example of Open Reproducibility

This presentation is also open as the code is hosted on the BERG Github repository

The screenshot displays the TeXstudio interface with the presentation code on the left and the rendered slide on the right.

**Source Code (presentation.tex):**

```
\documentclass{beamer}

\usetheme{barsan}
\definecolor{indigo(web)}{rgb}{0.29, 0.0, 0.51}
\usecolortheme[named=indigo(web)]{structure}

\title{Improving reproducibility in building simulation}[Improving
reproducibility in building simulation: a pure-Python approach to geometry
creation]
\author{Steven Firth}
\institute{Loughborough University}
\date{2021-06-23}

\begin{document}

\begin{frame}
\maketitle
\end{frame}

\begin{frame}[My background]
\begin{itemize}
\item I joined Loughborough University in 2008
\item My job title is Reader in Building Performance Modelling
\item I teach building simulation, energy data analysis,
sustainable building design and renewable energy.
\item I was a member of the University's Open Research Working
Group in 2019.
\item I was awarded the CALIBRE Winter 2019 Award for Open
Research
\item In 2015 I published the Refit Smart Home dataset on the
University's Data Repository (14,387 views, 3,997 downloads)
\item I publish papers on FAIR data and open research methods
using Python and Jupyter Notebooks
\item I maintain the Github pages for the Building Energy
Research Group
\end{itemize}
\end{frame}
```

**Rendered Slide:**

Improving reproducibility in building simulation: a pure-Python approach to geometry creation

Steven Firth  
Loughborough University  
2021-06-23

My background

- I joined Loughborough University in 2008
- My job title is Reader in Building Performance Modelling
- I teach building simulation, energy data analysis, sustainable building design and renewable energy.
- I was a member of the University's Open Research Working Group in 2019.
- I was awarded the CALIBRE Winter 2019 Award for Open Research