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DigiTwin

Digital twins for improved dynamic design

Engineering and Physical Sciences Research Council

Digital Twin Operational Platform for Connectivity and Accessibility using Flask Python

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1st International Workshop on Model-Driven Engineering of Digital Twins

ModDiT'21

co-located with MODELS 2021

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Outline

- Motivation
- Framework
- DTOP-Cristallo
  - Three-storey structure
  - Types of Simulations
- Git Repository
- Remarks

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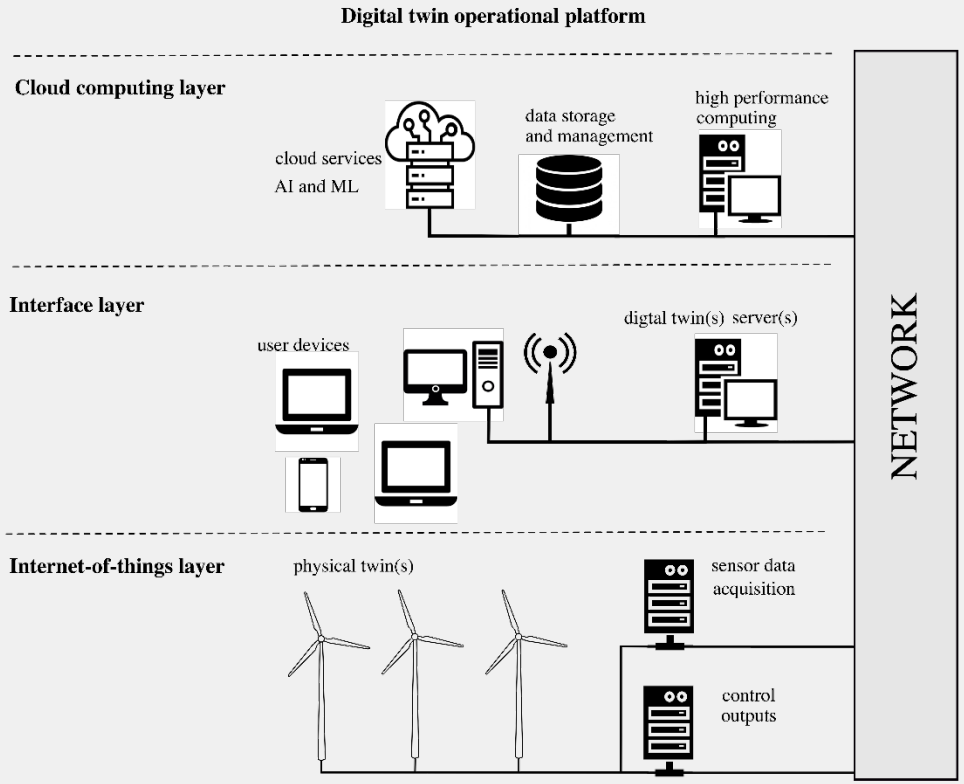
Motivation

- Commercially available digital twins tend to be based on proprietary software
- Creates bespoke and rigid format
- Limiting for collaborative systems and multi-disciplinary design
- Complex and remote systems require added connectivity and accessibility options

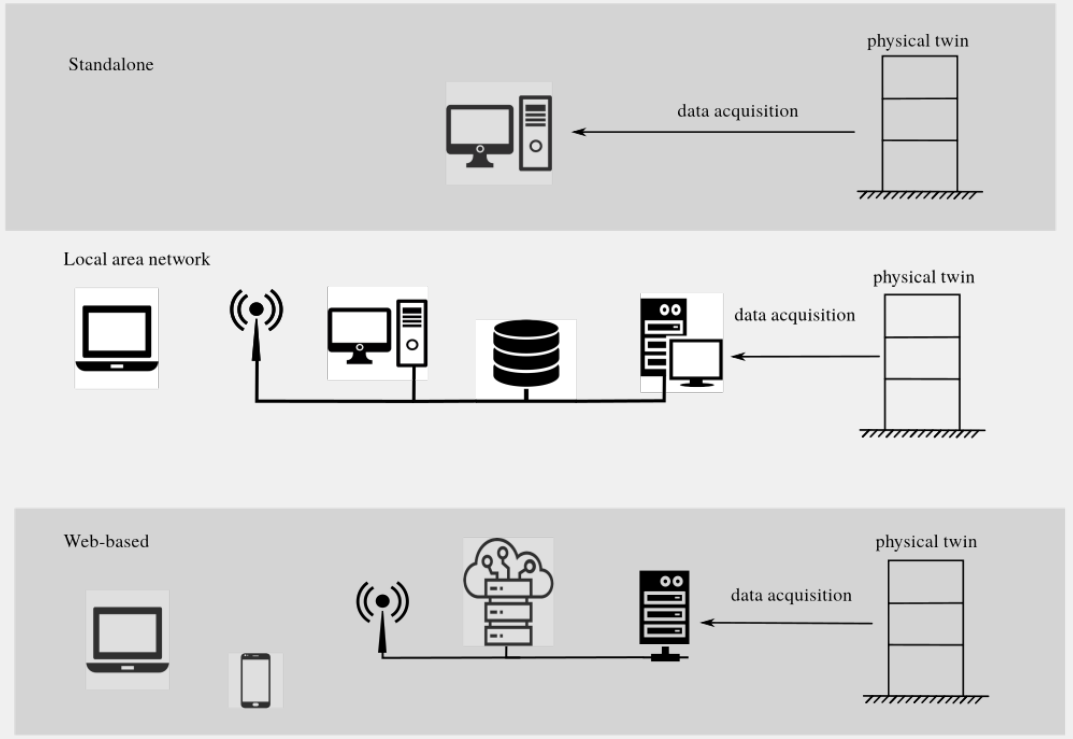
Connectivity Framework

- Digital Twin is much more than a model
- Connections between PT, DT, User, and Resources
- Predominantly 3 layers of operation
- Broad viewpoint for engineering systems



Accessibility Framework

- Commercial DTs are typically standalone – only 1 person can interact with DT at once
- However, complex engineering systems are collaborative, multi-disciplinary projects
- Python Flask allows for deployment to various accessibility options



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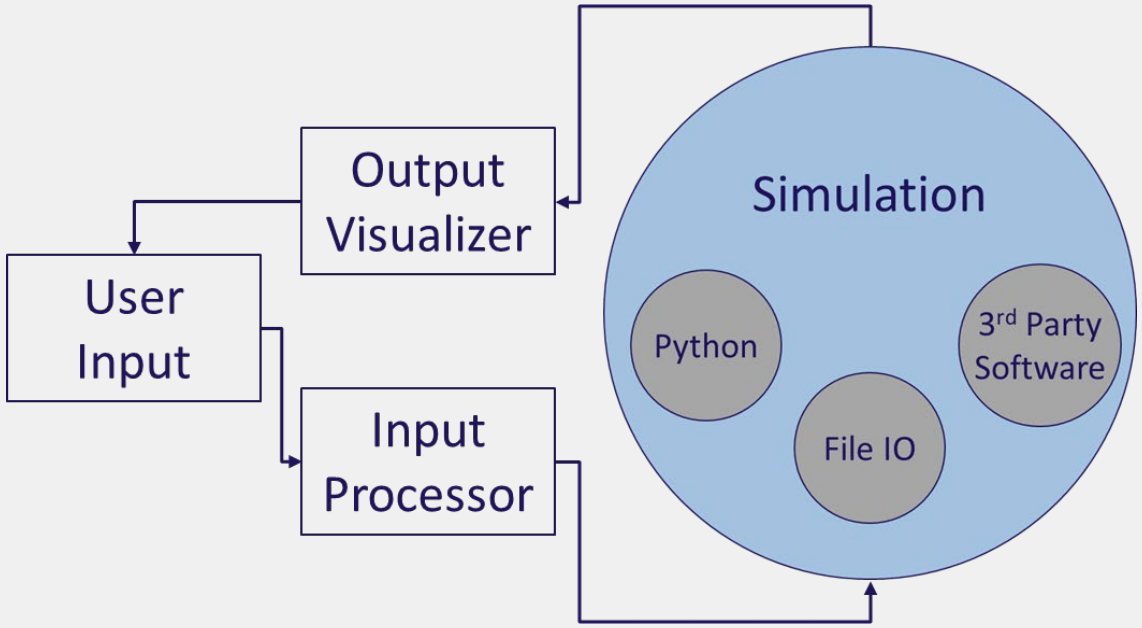
Modular Layout

- Python Flask
- Separate user input and calculations for easier implementation
- Each aspect can be written by separate experts
- New simulations need
  1. Functionalized calculation
  2. Modified HTML/CSS/JS for inputs/outputs

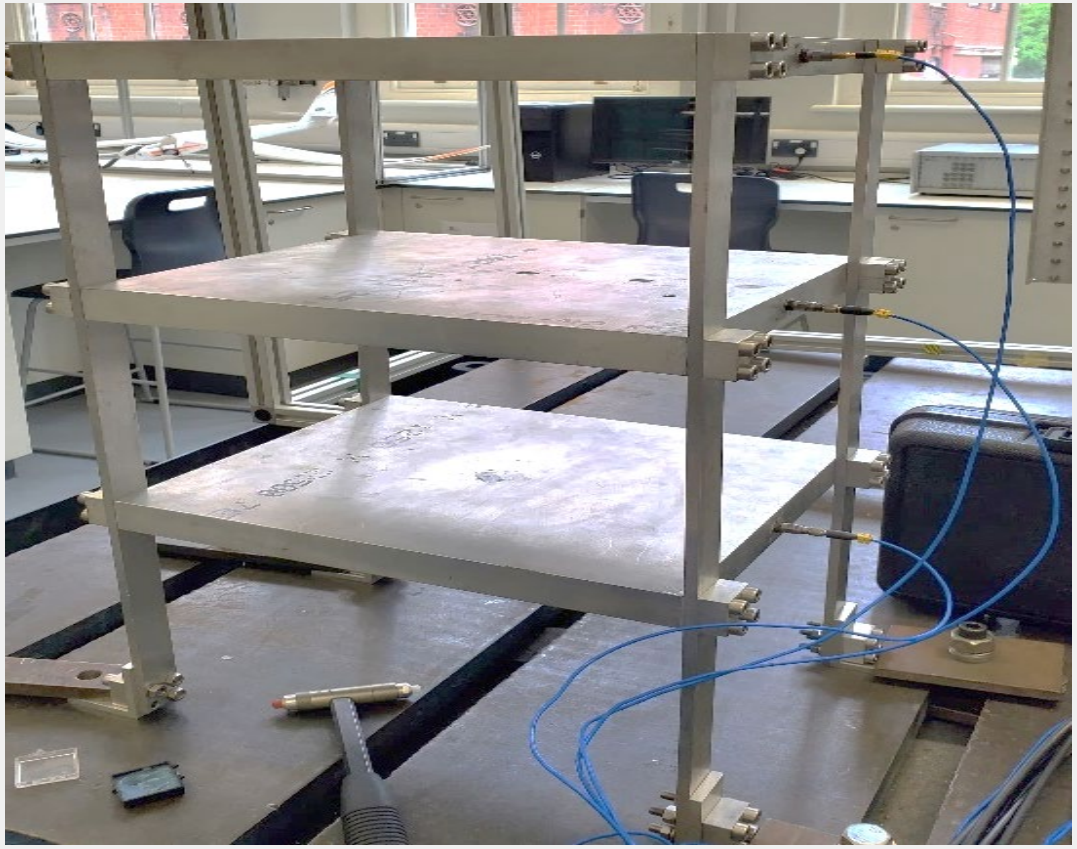


DTOP-Cristallo

- The demonstration operational platform : DTOP-Cristallo
- System specific
- Browser-based user interface
- Python-based calculations
- 6 total tools
  - 3 general categories

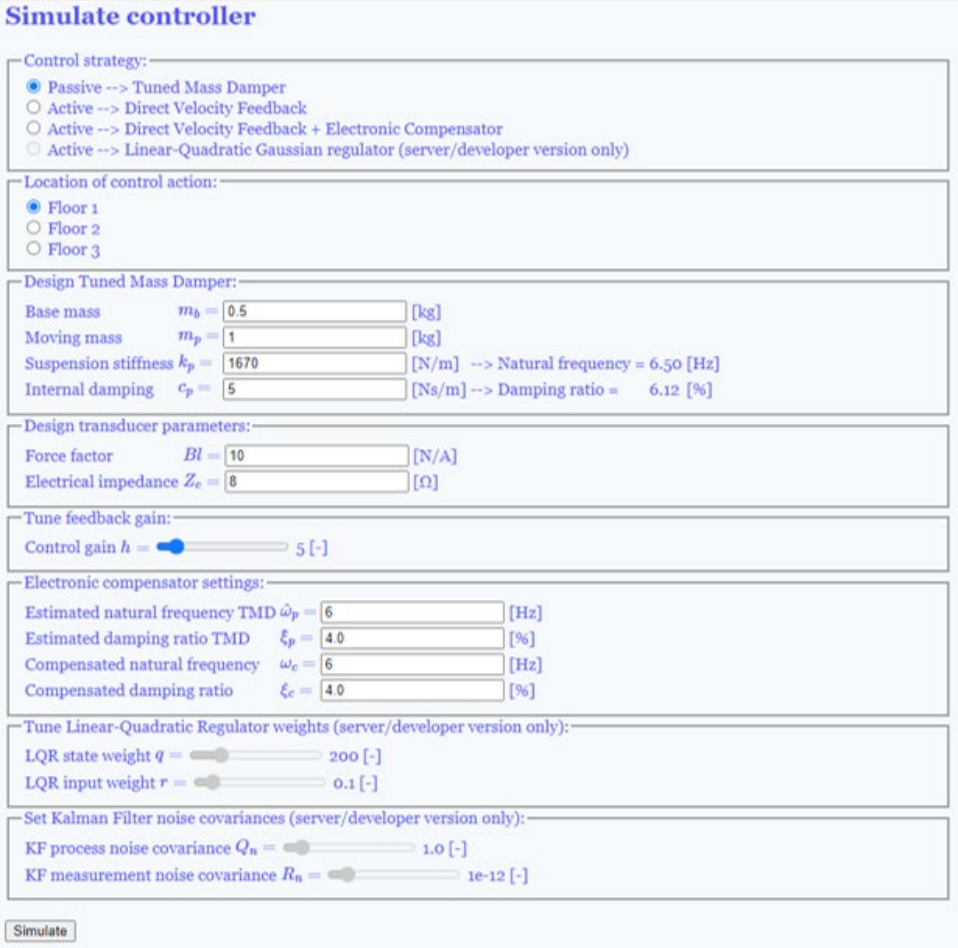
Three-Storey Structure

- Benchtop scaled 3-storey building
- Aluminium construction with reinforced joints
- Simple prototype for demonstration purposes



Self-Contained Tools

- Simulations programmed purely in python
- Fundamentally separated into frontend/backend operations
- User input simulation parameters (variety of object types)
- Output displays results via browser



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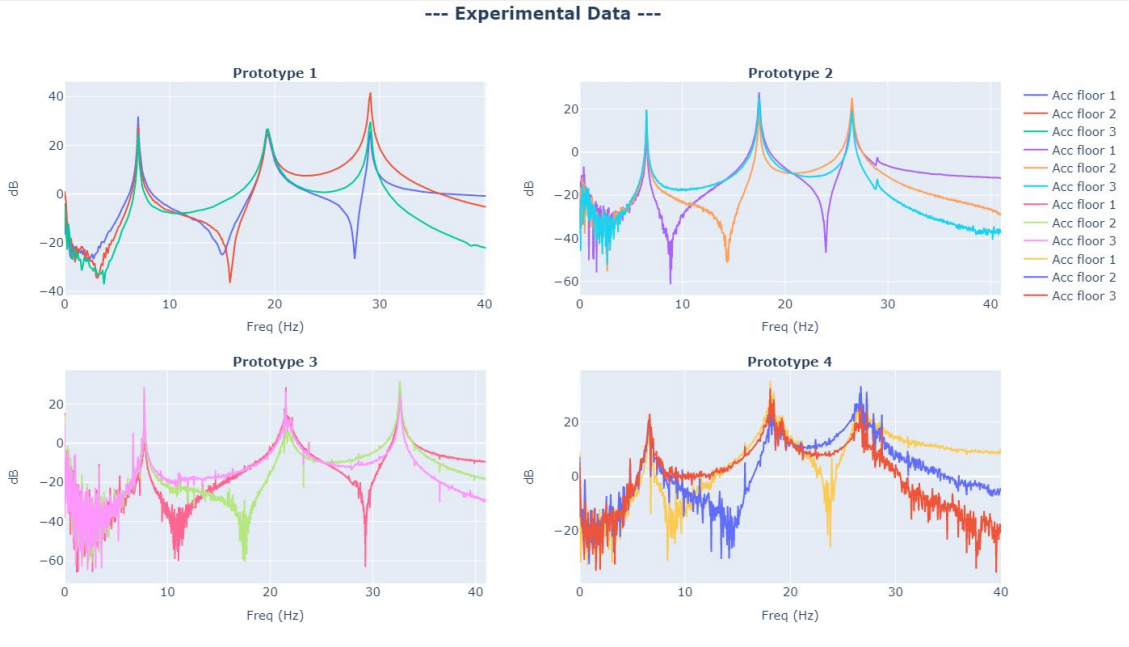
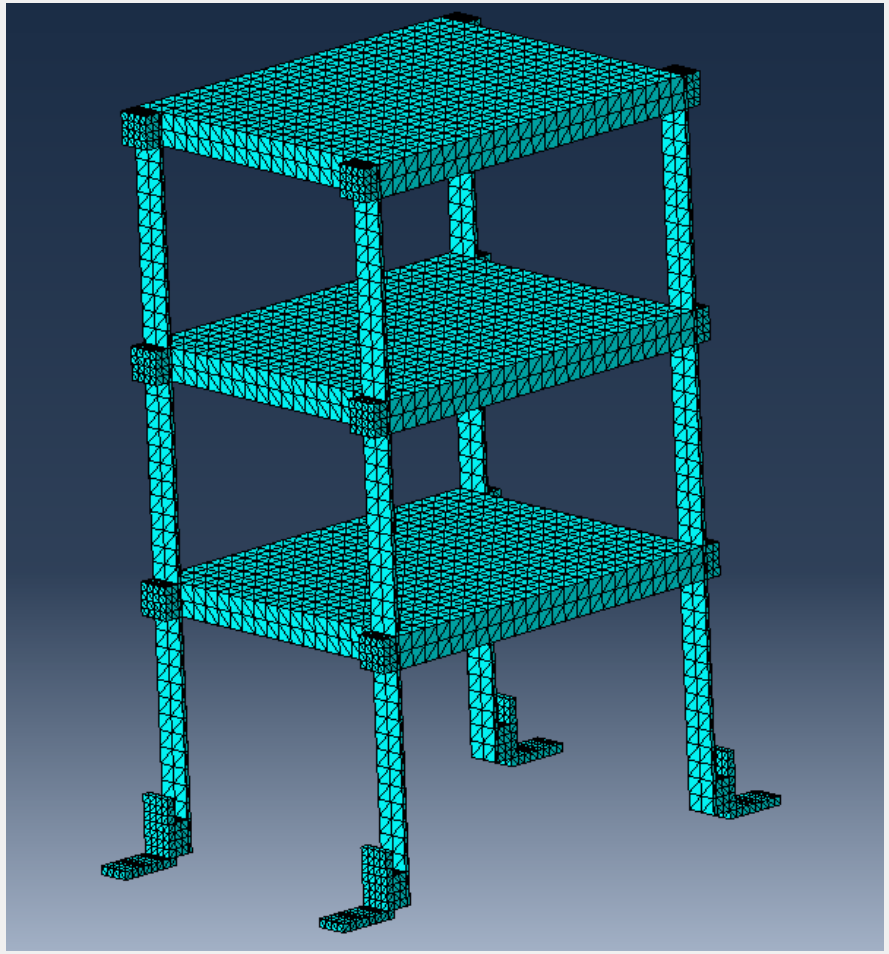
File IO

- Python interacts with local files
- Location can be hard-coded or user supplied
- Pre-recorded data
- Low RAM simulation utilization



3rd Party Simulation Tools

- Most engineering designs use multiple licensed software
- High degree of trust in those software
- Easier to sell if using trusted software
- ABAQUS shown as example
  - Python script generated from user input
  - ABAQUS called via command prompt



GIT Repository

- Publicly available GIT repository
- All 6 simulations available with open-source code
- Instructions to deploy in Standalone, with easy modification to deploy in LAN
- Spread possibilities for collaborations with engineering and computer science communities

- https://github.com/Digital-Twin-Operational-Platform/Cristallo

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Remarks

- Our framework puts forth an open-source and easy to implement Digital Twin Operational Platform
- Our DTOP connects the user with the DT, PT, and computational resources
- Our DTOP gives accessibility options for both local and global deployment
- DTOP-Cristallo gives a demonstration of the interface layer and is freely available for download/use via GIT
- The whole purpose is for collaborations, so let me know your thoughts

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Thanks for your Attention

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