Digital Twin Operational Platform for Connectivity and Accessibility using Flask Python

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Outline

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• DTOP-Cristallo
  • Three-storey structure
  • Types of Simulations
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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
• 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
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
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
• 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
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
Thanks for your Attention