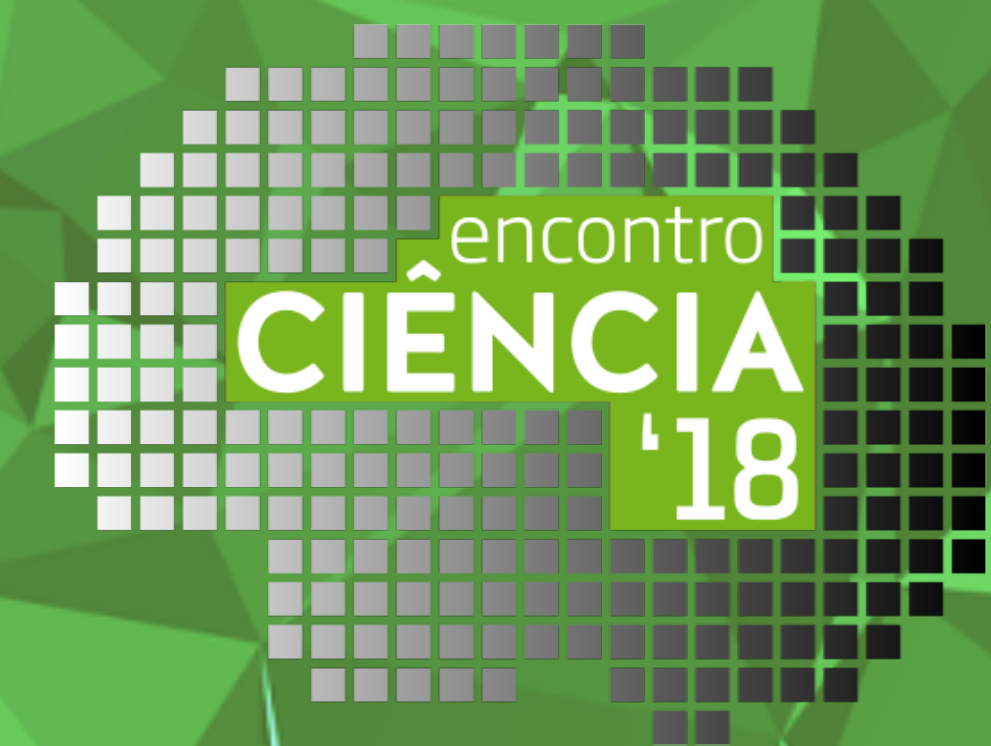# Context-Oriented Algorithmic Design

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The Problem

Algorithmic Design (AD) is an approach for architecture that allows architects to take advantage of algorithms to produce complex forms for their projects, to simplify the exploration of variations, or to mechanize tasks, including those related to analysis and optimization of designs. However, it suffers from two major problems:

- Different types of models are required, but a single algorithm is not able of producing all of them without major changes.

- To visualize these models during development, architects rely on Computer-Aided Design (CAD) and Building Information Modelling (BIM) tools, which suffer from performance issues and do not offer traceability features.

Objectives

The objectives are the development of a data model that supports the different modelling contexts used by architects, and the creation of a programming environment that supports the algorithmic approach and offers a way to visualize the results with real-time feedback and traceability during development.
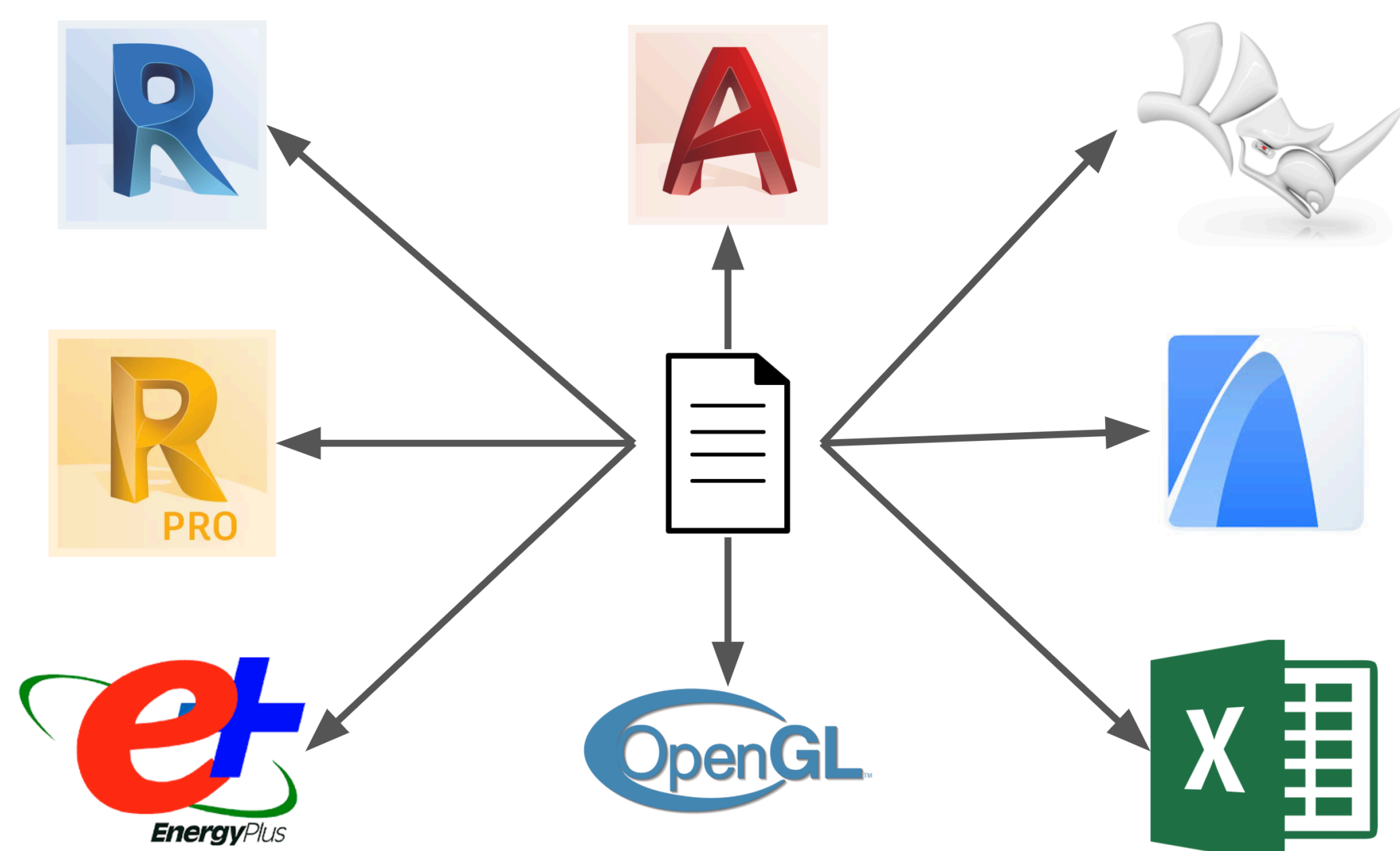

Approach

By exploring approaches such as Context-Oriented Programming, we can develop algorithms that can be interpreted differently with regards to the context being used. With these contexts, we can produce a three-dimensional model for visualization and an analytical model, e.g., made only with surfaces for radiation analysis, without changing the algorithm. We call this approach Context-Oriented Algorithmic Design (COAD).
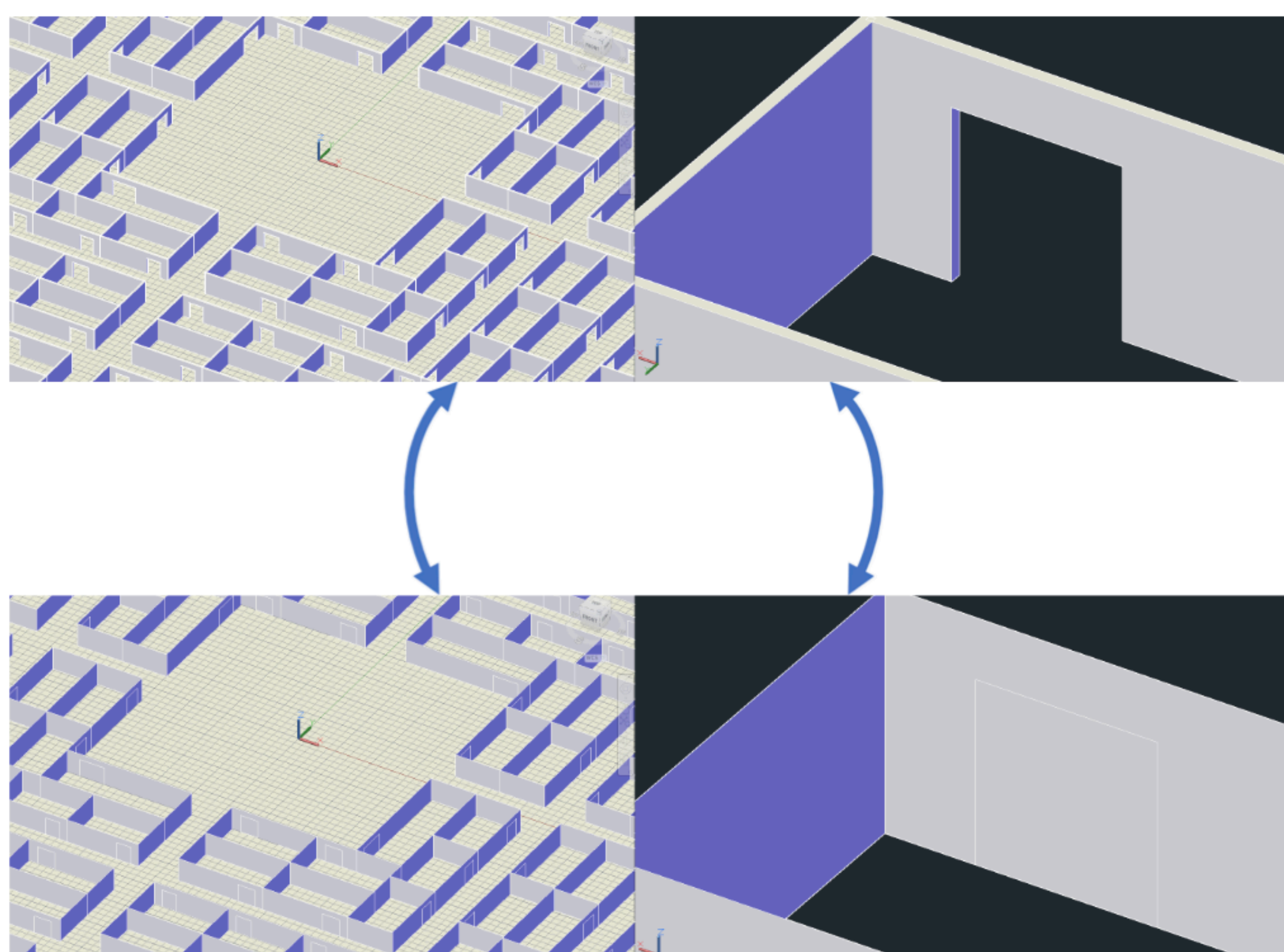
To clearly see the relationship between the developed code and the model, we propose a visualizer that explores technologies, such as OpenGL. The visualizer allows real-time feedback by updating the model as the code is changed, as well as traceability that relates each generated element to the fragment of code that produced it.
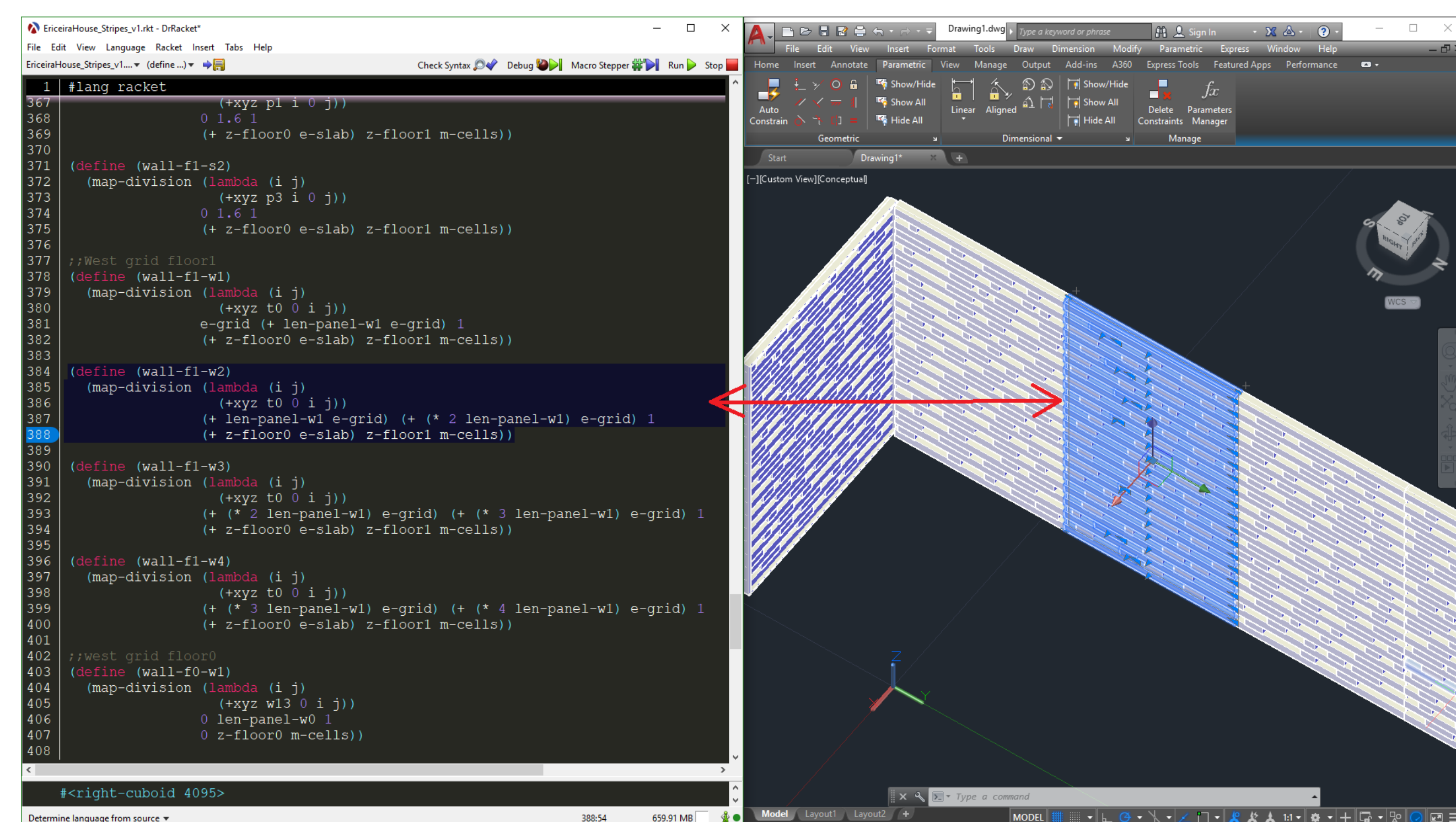

Data Model

In order to have a correct representation for all contexts, it is also important to have a data model that supports all the necessary information. This model includes, not only the geometrical information for the visualization of the elements, but also additional information that is required for analysis processes and the production of documentation, among other uses. The data model uses the Industry Foundation Classes (IFC) as basis, which has been used to represent building and construction data for several years.

Integration

Although CAD and BIM applications suffer from performance issues that make them less appropriate for algorithmic approaches, they are still the standard tools used in the work process of architects, engineers, and designers. We will integrate the programming environment with these tools to allow users to explore algorithmic approaches and still produce the results in the necessary tools.
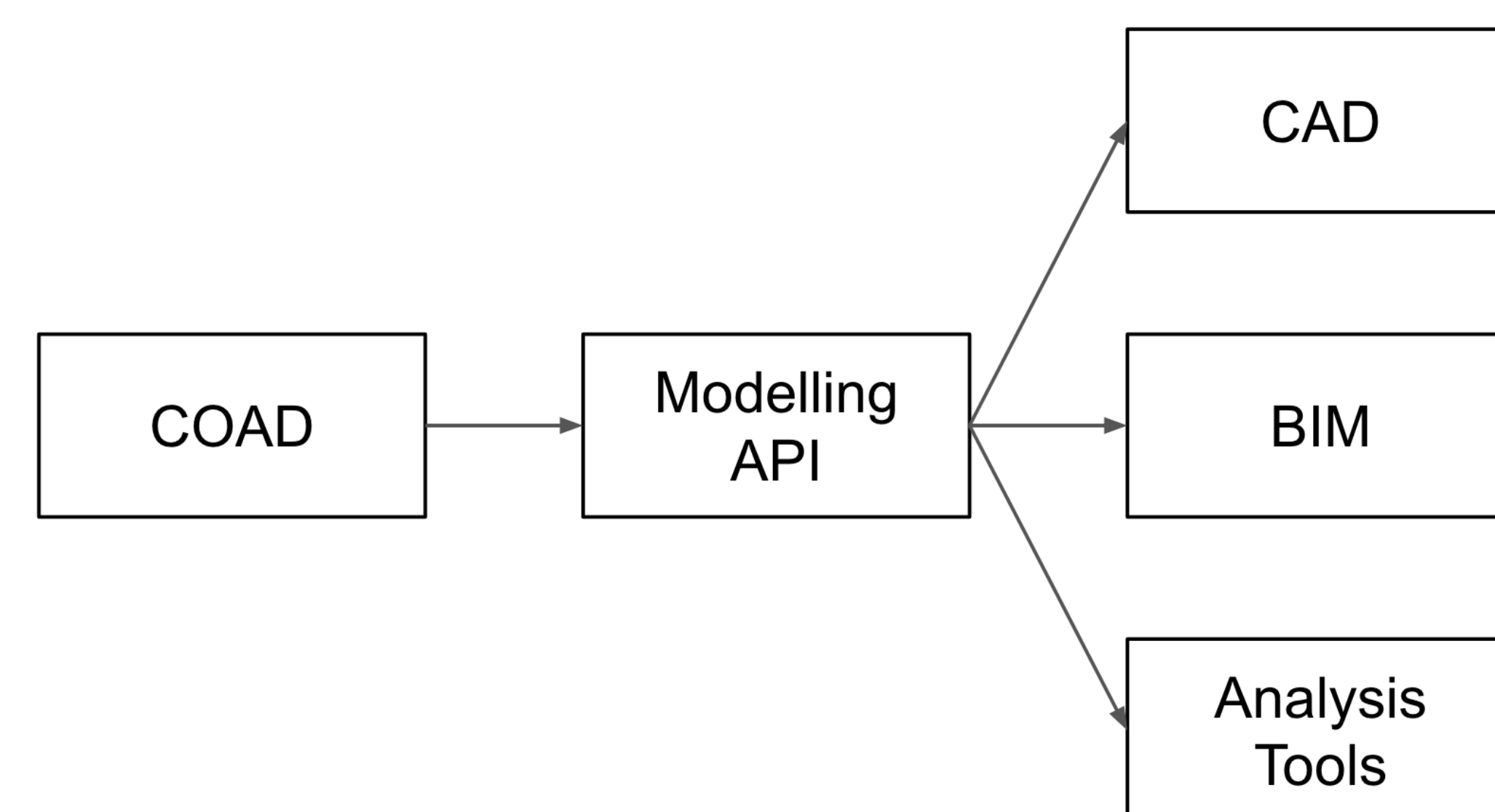
Acknowledgements

References

- Ferreira, B. and Leitão, A.M., 2018, April. Context-Oriented Algorithmic Design. In *11th European Lisp Symposium* (p. 84).