Automation in the Design of Mezzanine Floor Racking Systems

*Artificial Intelligence* (AI) can be defined as a developed technology which has come to supplant cyclic tasks in different work environments. It allows the optimization of operational costs and productivity. Thanks to it, there have been published several studies in different areas: as an evaluation procedure to define the probability of guilty in legal processes; in clinical studies to develop and simulate new drug composition, and to predict electrocardiogram behavior of heart problem patients; in the automotive industry, in the automation of production systems and tasks, due to the product variants and complexity, leading to simplify manufacturing processes; and in the design of photo-voltaic systems in modeling, sizing, control and diagnosis stage.

One of the most affected, and challenging, industries around the world is the civil industry, principally at the design stage. The structural design process of beams and columns, nowadays, are simply developed at its majority by spreadsheets; leaving seismic deformation and strain evaluations of connections to commercial software diagnosis, which use the Finite Element Method – FEM, like SAP 2000, Ansys or Abaqus. The structural design work can be reduced to *evaluate* structural members behavior, at different load and area conditions; develop an *economic* and *engineering* reports, which shows the cost of the structure, due to materials, equipment and handwork, and the complete structural design procedure. Finally, the *CAD drawings* of the structure (normally, 2D drawings) can be developed in AutoCAD.

A software, made in *Python - Jupyter*, has been developed to automate this work environment in the design of mezzanine floor racking systems. Its design procedure follows AISI S-100-16 and ANSI MH16.1 north American standards to guarantee an adequate structural behavior and NSR-10 Colombian standard for the evaluation of seismic behavior in structures installed in Colombia. Once it selects the beams, columns and joists of the structure, from a database, it allows the user to ask for an economic and an engineering reports made in LaTeX - PDF. Finally, the user can ask for an automatic CAD drawing of the structure, both 2D and 3D drawings, in dxf format. All this work has been made completely with *open source* tools and it does not require AutoCAD, Excel nor Word to work. Basically, the work of three weeks made by a mechanical and, or, a civil engineer, an industrial engineer and a CAD drafter in just five minutes.

Keywords: AI, structural design, Mezzanine, Python, Jupyter.