UNIVERSITY OF SALENTO

DEPARTMENT OF INNOVATION ENGINEERING

INNOVATIVE NUMERICAL METHODOLOGIES FOR STRUCTURAL OPTIMIZATION OF CIVIL STEEL FRAME

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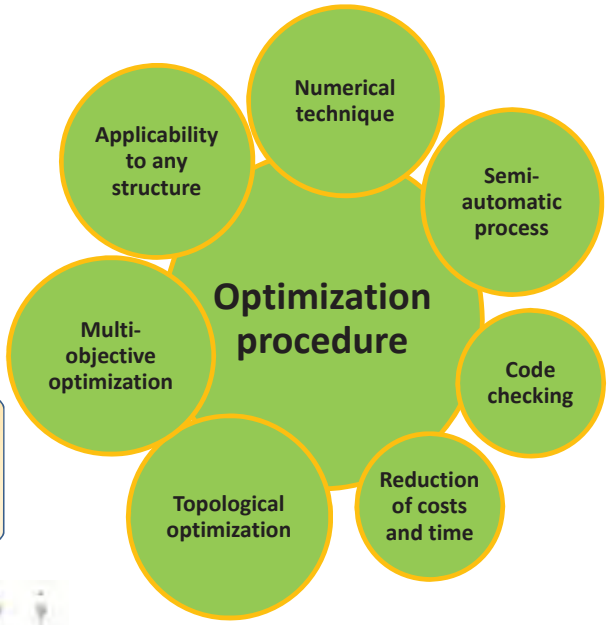
SCOPE OF WORK

This project is aimed at providing two **numerical methods** that define the **optimized configuration** of **civil steel frame structures** through **semi-automatic processes**.

To increase structural performances, satisfy code checking and obtain the reduction of the overall production costs, the **topology optimization** method is exploited to define the **conceptual configuration** of the structures, later parametrically optimized through a **multi-objectives analysis.** Two different **numerical techniques** to optimize civil steel frame design are here presented:

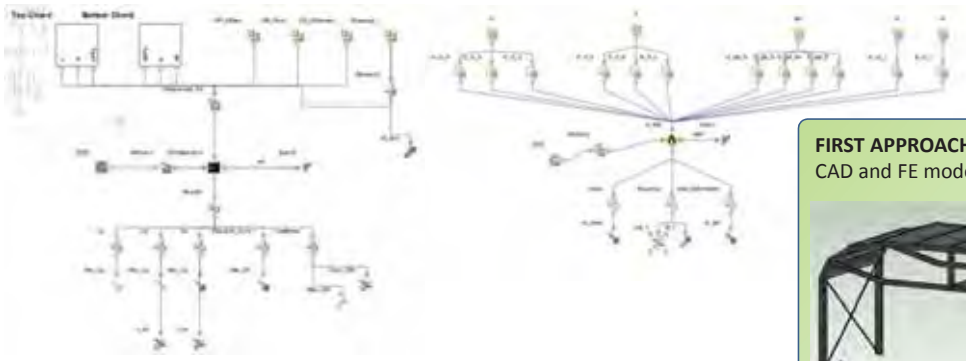


FIRST APPROACH

modeFRONTIER for a topological optimization of the FE parametric model defined in CivilFEM powered by Marc and for a final multi-objective parametric optimization.

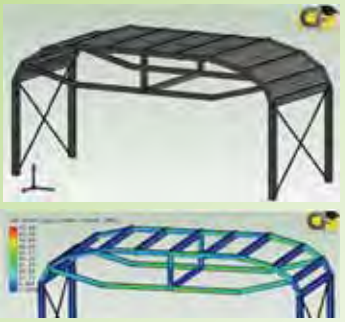
SECOND APPROACH

Combination of **topology optimization method** and **multi-objective parametrical optimization**, that couples "shape optimization" Ansys Workbench tool with modeFRONTIER env

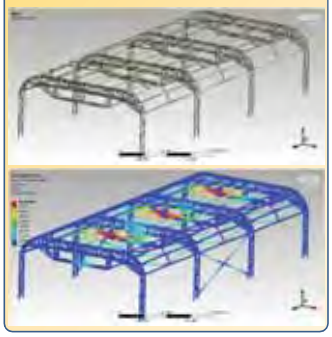


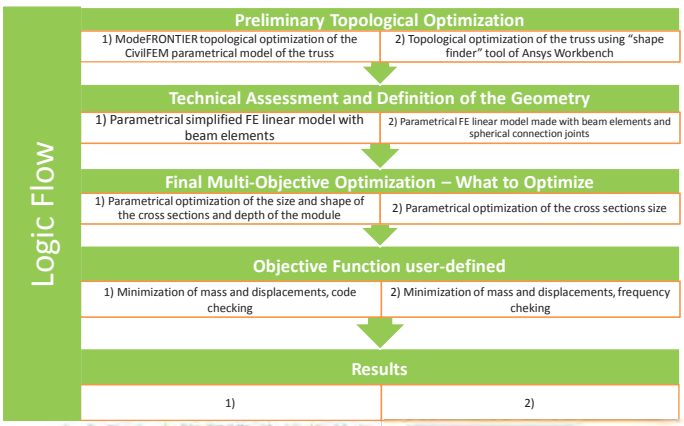
PERCENTAGE SHAPE TARGET INCREASING

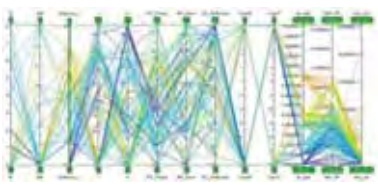
FIRST APPROACH
CAD and FE model results

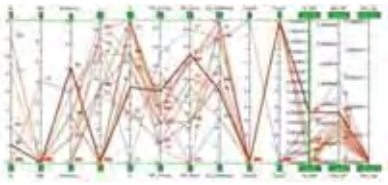


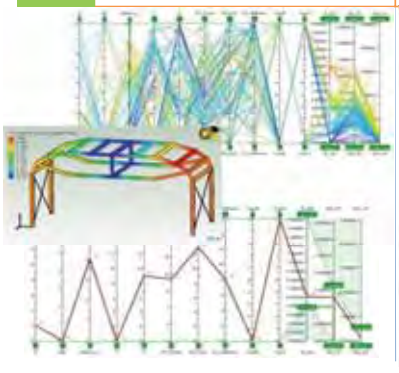
SECOND APPROACH
CAD and FE model results

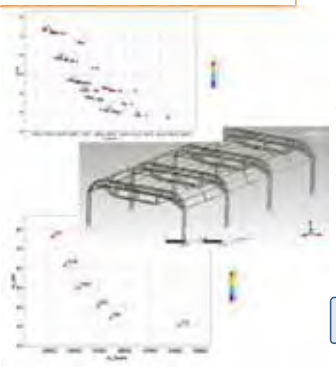












CONCLUSIONS

The civil steel structures obtained are two of the **optimum configurations** chosen among the Pareto solutions. All the **objective functions** are **simultaneously optimized** providing:

-**minimization** of vertical and horizontal **displacements**;
-**reduction** of the value **of the stresses** under the yield strength;
-**minimization** of the total **mass**;
-**optimization** of the **type** and **size** of the beams **cross sections**;
-satisfaction of the **code checking**.

The flexible procedures allows the user to **optimize any kind of parametric structure according to the objective functions**.

They provide two different numerical methods to obtain optimized high performances configurations **reducing the overall design and production costs**.

The work has been developed in collaboration with **EnginSoft** and **Ingeciber**.