Cellular Algorithms
a next-generation Software
for MCAE

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Cellular Algorithms Software

ABSTRACT *

CASoft is an **MCAE** (Mechanical Computer Aided Engineering) Software that builds, solves, and renders graphically large scale computational models for :

3D Solids, Shells and Framed Structures

CASoft is funded upon a **new engine** that outruns FEM (Finite Element) computational engines by three orders of magnitude; both for computational speed and for model size. CASoft's is driven by a **new GUI** (Graphic User Interface) that includes in the same framework of Windows : the Fractal model generator, the run of the model, and the online graphic streaming of the results. The entire analysis job runs in real time.
Such computational efficiency, shifts the clock of the user from hours into seconds, and paves the way to move from a single analysis of the model, into **parametric design**.

The development of the new engine, though, was aimed at expanding the frontier of computation toward new applications, insofar 'impossible' for FEM engines.

One application is **Virtual Welding**, i.e. the calculation of the thermo-mechanical cycle of the welding process. This development was backed by Project **WAM** (**W**elding **A**nsaldo Nucleare **M**arina Militare) that provided the experimental validation of the computational models across a sample of welding processes. WAM has produced also Protocols for Quality Welding, that ensure distortion-free joints. Most important, WAM has shown the formation of **plastic hinges** in the Quality Welded joints. That finding reverts the state-of-the-art assumption that the welded joints will fail before the material. That assumption leads to the application of conservative Safety Factors for structural design.

Another application is **Design-by-Analysis :** a proviso offered by the normative codes to bypass the conservative values of the Safety Factors. In the WAM project the plastic hinge evidenced in the experiment was reproduced with a CASoft model, leading to a reduction of the Safety Factor from the nominal value of 1.3 to the limit value of 1.01.

Another application is the least weight **Optimal Design,** Its application is both for the reduction of the mass, and, complementarily, for the elongation of the free spans.
The three Apps said above have been combined together to produce the optimal design of a lightweight long-span **Cellular Flat Slab** (CFS). The high performance of CFS opens the way to new applications in many different areas of steel carpentry.

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