The structural solution for the "Palazzo del Lavoro" of Italia '61 proposed by Mollino, Bordogna, Musmeci
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A competition was organized in Turin in 1959 to construct the "Palazzo del Lavoro" in order to celebrate the first Century of Italian Unity. The building was required for the "Esposizione Internazionale del Lavoro".
Some of the best engineers competed such as Pier Luigi Nervi, Sergio Musmeci, Roccardo Morandi and a group of well-known architects including Carlo Mollino, Gino Levi-Montalcini, Sergio Nicola with Aldo Rizzotti, Roberto Gabetti with Aimaro d'Isola... The engineer Pier Luigi Nervi won the competition.
Three solution were proposed by Mollino, Bordogna, Musmeci. The fusion of architecture and engineering, manifested from these projects, represented a conceptual point of reference and a great stimulous to the study of the thesis.
The first solution was studied for the structural analysis of finite elements and a test of the load-bearing capacity of the section, according to the recent European standards guidelines.
The skeleton is entirely built in reiforced concrete. It consists of large intersecting arches which form a continous frame with the internal gallery. The whole structure measures in plan 170x147 metres.
The repeating patterns of the arches create a dual effect: both structural support and at the same time a great feeling of space.
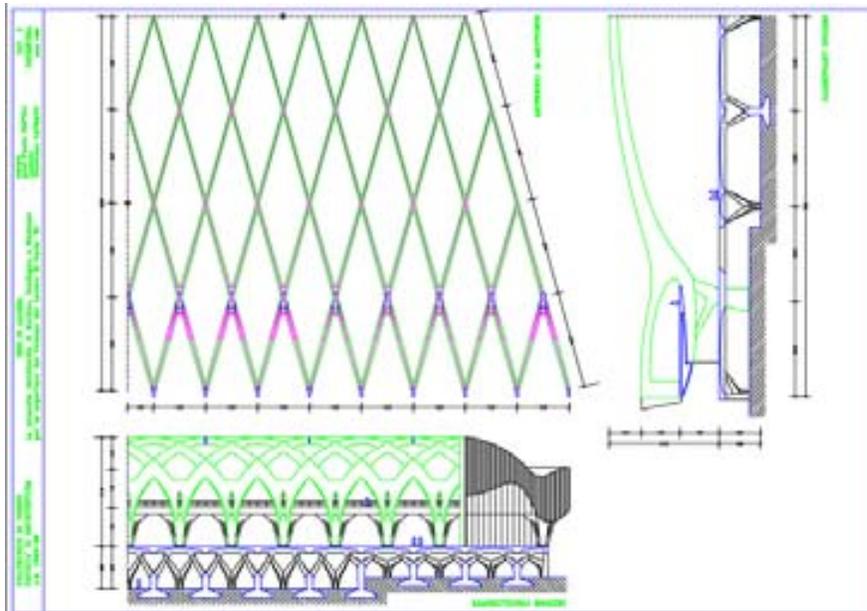
An initial study was completed in the "Archivio C.Mollino" in order to reconstruct the exact geometry of the structure.

The interpretetion of the structural problem was achieved by means of the calculation code Cosmos/M, defining a "finite elements model", a spatial rapresentation of the resistant structure, bonded and solicited by actions, which have the aim of describing the mechanical behaviour.

The shift from the real geometry of the structure to the geometry of the calculating model coincide with a tricky phase: the geometric axis of the structure was divided into finite elements-grid "mesh", the structure looses its real dimensions to assume a "filiform" geometry.

After a first attempt at the modelling done by the "double frame-arch" model, a second phase was carried out which analized just one frame-arch in the space,moulded and bonded in a way to express its structural characteristics which were similar to the first model.

By a comparison between the values of the shifting, the stresses and the constraining reaction, due to the effects of the weight-force of the respective structures, it was possible to the reproduce the "single model" with the "double one": it was noted that their structural behaviour were almost the same.

The "single frame-arch" model was the quickest and most management analysis to undertake, but no less reliable than the other model.

The load-bearing capacities of the projects sections were calculated in accordance to the theory about the Ultimate State Limits.
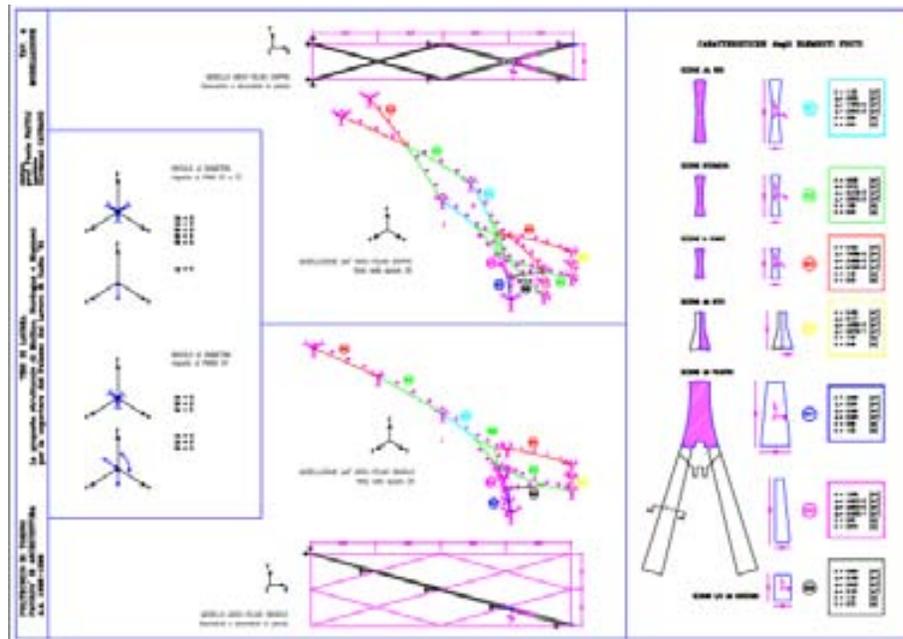
A comparison was then made between the results obtained by the above method and those calculated by Musmeci.

Surprisingly the values are compatible, despite the differents between the method of calculation: Musmeci considered the static scheme of the structure making it simpler for the plane and he adopted the method of ammissible stresses to verify the sections. Our analysis considered the frame-arch in space, which didn't omit the possibility of the six "characteristics of stress" arising, and the following control of the sections was conducted with the theory of U.S.L.
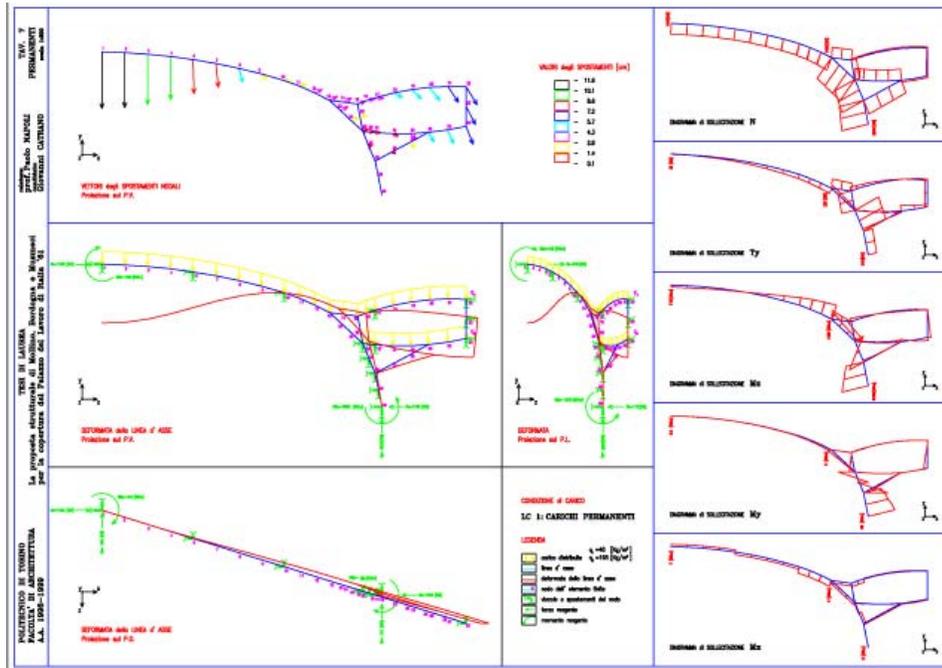
This research was undertaken as a result of the opportunity to take part in the conference "Sergio Musmeci - forma e struttura", holden the 9th of November 1998 in Firenze, at the Accademia delle Arti del Disegno, with the aim of underlinig the special technical role that Musmeci had, with his intuition in structural study together with his sensitivity for shape.

This thesis, verifying the structural proposal in question through current calculation methodology, also gave us the possibility to revisit the integration and osmosis between architecture and engineering.

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