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The acoustic performance of Regio Theater of Turin

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The purpose of this article is to compare the Lirico's hall acoustics behaviour of Regio Theatre of Turin with the same hall after the acoustics restructuring which took place in 1996. The analysis of two halls involves materials, rooms, and comparison of optimal datums of quality acoustics indexes for opera houses using room acoustics computer model, and also with metrological survey about many similar halls.

1_Introduction

In 1937 the Regio theater of Turin collapsed due to a fire. In February of the same years the office of Public Works of the city announced an architectural competition to rebuild the building. This competition was won by Aldo Morbelli and Robaldo Morozzo della Rocca, which designed a new opera house of 3500 seats. Since the end of the competition this project had had many changes, due to World War II and many and political issues. At the end of the War, the Public Work of Turin could not afford to build this theatre, so a new project of a 1800 seats theater was designed by Carlo Mollino, in the early sixty's.

2_Shape, materials and technology



The photograph showing Carlo Mollino holding an egg representing the main hall painted stands for the low degree of importance that the professor gives to the performing issue of the theatre, in fact as it is well known curved ceiling as a egg shape may produce some focalizations of the sound.

The ceiling of the hall was a sandwich panel with one wooden layer, one sound insulation bitumen layer, and another wooden layer. This solution was used by professor Sacerdote, the acoustics consultant of the project, some years before at Alla Scala Theater of Milan. The bitumen in the sandwich panel was needed to safety reason. This technology was not patented, but it has been done as an useful solution to absorb low sound frequencies.

The ceiling was hanged by wire system, fixed to the concrete canopy above the hall. For each armour it was studying a double bending. The shell shape of ceiling was designed by 36 parabolas.

To follow the foreseen bending, a principal frame of bent elements was necessary, and a second frame essentially with the purpose to stiffen and connect the principal elements, done of many wooden boards, with herringbone trend, and nailed to the extremity. Under these elements the sandwich panel was connected to the ceiling frame.

Inner and outer wooden surfaces was painted, to fill the empty spaces left by the irregularities of the wood. A first coat of repellent paint was given on the inner surface of the ceiling, and after a second coat with the decoration designed by Mimmo Castellano was painted.

In the last phase the companies who worked to make all interior design gave about 2000 lighting glass pipes up to make the ceiling lamp of the hall, well known as the "Regio's cloud" .

3_ The hall of 1973

The Carlo Mollino's hall had been risen many perplexities since the inauguration in 1973.

The main problems expressed by spectators, singers and musician involved the difficulty on the stage, to hear the sound coming from orchestra pit, and a too short reverberation time due to moquette covering the floor, below and into the boxes.

For this reasons The Mollino's hall was not appreciated both musicians and spectators.

The analisys of the hall to seek this issues is made using rooms acoustics computer models.

These models are setted using adsorbing and scattering datas found on historical scientific publication of this project and calculate on the basis of main features of material. The score of the setting is been the reverberation time measured on field in 1973.

Comparing output data with optimal values found on scientific publications of acoustics index the score was not so bad.

Using to study the acoustics behaviour of the hall, we can see as the ceiling could not send sound reflections to the singers on the stage.

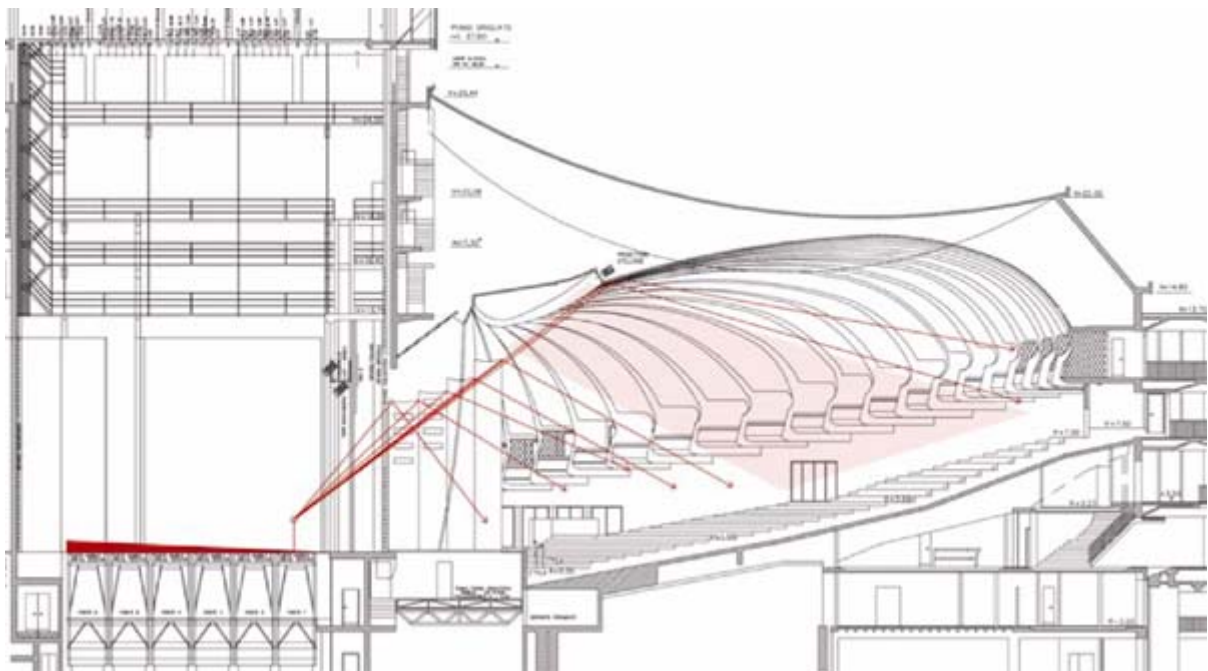
4_ The acoustic restoration of 1996

The subjective judgements induced to take into consideration in the late eighty's to make a renovation of the theatre to improve acoustics behaviour of the Lirico's hall.

The acoustic project, developed by the prof. Muller tried to reduce the sound absorption of the room to increase the RT data (removal of the moquette from floor, walls and boxes, and using armchairs less absorbing) and arrange a structure able to solve the problem of the insufficient perception of the orchestra by the musicians.

Using the same geometrical methods we can see as the project proposed and realized with the four wooden portals built up above the orchestra pit may improve sound reflections to the singers.

The evaluation of performance of the new hall using a room acoustics model show off a reduction of the clarity in the middle of the stalls (hypothesis of a sound source placed in the middle of the stage). Trying to do many numerical simulations we can see the same reduction of clarity which changing position in the stall as the position of source on the stage changes. We cannot find the same fall of clarity, in 1973 Lirico's hall, using room acoustics model of the old project and the same source positions (figure 2).



The room acoustic model has shown as the renovation has improved reverberation time data and the perception by the musicians.

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