

**FACOLTA' DI ARCHITETTURA
"VALLE GIULIA"**



THESIS OF DOTTORATO DI RICERCA

**The role played by Mechanical science in the
Architects and Engineers design in the Renaissance**

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INTRODUCTION TO THE THESIS AND POSITION OF THE PROBLEM

Brief introduction of the thesis project

The following chart, synthetically, expresses the *Introduction* of my thesis. In the first column, round brackets, I wrote the name of the paragraph (*Introduction*) to which the reader can make reference.

<i>Scheme</i>	<i>Presentation of the thesis project</i>
<i>Ph.D student</i>	▪ Raffaele PISANO
<i>Main advisor</i>	▪ Prof. Danilo CAPECCHI
<i>Title of the thesis</i>	The role played by Mechanical science in the Architects and Engineers design in the Renaissance
<i>Key words</i>	▪ <i>Classical mechanics</i>: an historical-critical study of physical theory from Middle Ages to Renaissance. ▪ <i>Renaissance</i>: to study scientific works of Renaissance translated into Latin or into <i>volgare</i> language. ▪ <i>Military engineering</i>: a scientific study concerning applications of mechanical science to arms and machines ▪ <i>Leonardo da Vinci</i>: contribute of his mechanics to the origin of modern Science and the art of design. ▪ <i>Architecture of the Fortificazioni</i>: an historical-fundaments study regarding statics Science ▪ <i>Primary sources</i>: original and remarkable scientific manuscripts during the Renaissance. ▪ <i>Epistemology</i>: our epistemological analysis on the conception of Science between XV and XVII cent..
<i>Hypothesis of study and general objectives</i>	Was it a commision between Science and technology/design during Renaissance? Scientific historiography concerning the problem list in the architecture and in the engineering of XVI and XVII century is limited and, mainly, focused on Galileo Galilei's (1564-1642) manuscripts. In Italy, during the centuries XV and XVI cleverly worked a considerable number of engineers and architects. Their role seems is enough studied to be able to think that their writings could also offer a remote contribution to the origin of modern Science. However, a recent work regarding manuscripts published in that period, among which those of Mariano Iacopo called Taccola (1382-1458?), Leon Battista Alberti (1404-1472), Francesco di Girogio Martini (1439-1502) et al. has shown, , that Italian engineers had not deeply developed effective criterions of mathematical dimensional. It seems to make exception Leonardo da Vinci (1452-1519) that studied resistance of (wood) solid. [...] In this thesis I intend to develop an exhaustive historical analysis to show the influence of the Renaissance science in the theory of the design. In order, I will try a revision of the actual historical reconstruction founding it also on epistemological reflections. I will study, through an investigation historical-critic and on fundaments, to a certain extent, Galilei's mechanics is fed on ideas of other researchers to him contemporary (or just previous): i. g, Galilei's theory
(The mechanics of engineers and mechanics of philosophers)	

	concerning resistance of solids was based on two geometrical fundamental assumptions already known in the late Middle Age, (although scientifically still embryonic): 1. Geometrical one that study the mechanism of breaking-points. 2. Mechanical one that study breaking points of materials involving also physical nature of the matter. [...]
<i>Objective specific</i> (Objective of the thesis)	After historiographical contributions on History of Science and Technology by Edward Grant, Clagett Marshall (1916 -), Charles Singer (1876-1960), Alexandre Koyré (1892-1864), Bertrand Gille (1920 - 1980) and on the origin of modern Science by Richard Westfall (1924-1996), I will study the role played by mechanical Science in the History of Science during the Renaissance and on its role in the design for public works. In <i>primis</i>, I will investigate on mechanical Science (statics) in Italy in the first years of XVI cent., according to two very different approaches among them. The first one, usually classified as Aristotelian in which the equilibrium of the bodies was set as a dynamic problem referable to the principle of virtual works. The second approach, classified as Archimedean and identified statics theory with the <i>centrobarica</i> (physical-mathematics theory of equilibrium). In this period the protagonists of development of mechanical theory in Italy according to the Aristotelian approach were Niccolò Fontana called Tartaglia (1500?-1577) and Girolamo Cardano (1501-1576); while, students that theorized according to Archimedean approach were Federico Commandino (1509-1575) and Francesco Maurolico (1494-1575). The two approaches cohabited with alternate developments. But in the second period of XVI cent., the approach of the <i>centrobarica</i> took the windward one thanks to the inheritance left from Tartaglia and Cardano to Renaissance mechanical students as Giovanni B. Benedetti (1530-1590), Guidobaldo dal Monte (1545-1606) and Galileo Galilei. I will also study an historical <i>excursus</i> regarding primary role of Aristotle's mechanical philosophy. In order, I also will study Renaissance encyclopaedists limiting to consider Italian authors during scientific Renaissance. The research will continue by means of historical study on fortifications design during late Middle Ages as technical application of the mechanical Science. In the third chapter I will use the logic and the mathematics as historical investigation categories to discover the inductive or deductive character of pre-Galilean (scientific) theories. In this way, I will try to individualize, eventually, a theoretical model to make Science during the Renaissance. Beyond, an application of the historical categories of A. Koyré to the mechanical Science of the architects and the engineers should allow me to individualize, to a certain extent, theoretical choices used by the Renaissance scientists. Considered that the contribution of Galilei and the large historiography on its writings are already abundantly known, I will focus on elements less investigated of its literature and of its scientific method. In the fourth chapter I will dedicate to study the role played by Leonardo da Vinci's design and <i>Le Meccaniche</i> (1581) by Guidobaldo dal Monte (1545-1606) in the development of Renaissance mechanical Science. Another objective is to build a new interpretation of the historical development of structural mechanics based on the crucial role played by Renaissance engineers and architects.
<i>Methodology and program of the activities</i> <i>Waited for results</i>	▪ Research and study based on primary sources. ▪ Scanning of activity and cognitive objectives every four months. ▪ Recognition of the role played by mechanical Science in the architectural design during Renaissance. ▪ A theoretical and precise model to make Science in the Renaissance. ▪ A new historical interpretation of origin of structural mechanics and history of technology based on scientific crucial contribution assumed by engineers and Italian architects during the Renaissance ▪ The individualization of a historical model based on logical and mathematics choices that would enrich the actual organization of fundamentals of physics among XVII and XX cent.
<i>Critical points</i> (Objective of the thesis)	▪ In order to understand better the role played by translations of the primary sources among XIV-XVI sec., I will also study the Renaissance encyclopaedists limiting to consider Italian authors of Renaissance. ▪ I will use the logic (classical and non-classical) and the mathematics as historical investigation categories to discover the inductive or deductive character and the organization of the scientific theories pre-Galilean. ▪ The application of the historical categories of A. Koyré to mechanical Science of the

architects and the engineers, should allow me to individualize, to a certain extent, the theoretical choices used by the Renaissance scientists.

- I will study the role played by Leonardo da Vinci's design and *Le Meccaniche* (1581) by Guidobaldo dal Monte (1545-1606) in the development of the Renaissance mechanical Science.



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