

Comparative Analysis of Curricula in Mechatronics, Robotics, or Closely Related Fields at prominent Italian Universities

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Abstract: This scientific article aims to conduct a comprehensive comparative analysis of the curricula offered by various Italian universities in the fields of Mechatronics, Robotics, and closely related disciplines. The study will provide insights into the diversity of educational programs in these fields, identify commonalities, and highlight unique features, thereby aiding prospective students, educators, and policymakers in making informed decisions about program selection and curriculum development.

1. Introduction

In recent years, the fields of mechatronics, robotics, and related disciplines have experienced remarkable growth and transformation, driven by technological advancements and increasing demand for professionals with expertise in these areas [1]. Italy, with its rich industrial tradition and innovative technology sector, has seen a surge in the popularity of educational programs related to mechatronics and robotics [2]. However, there is a significant diversity in the curricula offered by different Italian universities in these fields, reflecting varying approaches to education and training.

The rapid development of mechatronics and robotics technologies, often referred to as Industry 4.0, has led to a growing need for highly skilled professionals who can design, build, and operate advanced robotic systems and intelligent machines [3]. As a result, the curricula of mechatronics, robotics, and closely related programs have become a focal point for educational institutions, industry stakeholders, and policymakers. These programs aim to equip students with the interdisciplinary knowledge and practical skills required to excel in these cutting-edge fields [4].

This study addresses this gap by undertaking a detailed comparative analysis of the curricula in mechatronics, robotics, and closely related fields at various Italian universities. The goal is to provide valuable insights into the strengths, weaknesses, and unique features of these programs, ultimately contributing to the enhancement of mechatronics and robotics education in Italy. This research will not only benefit

students and educators but also inform policymakers and industry leaders in their efforts to shape the future of these dynamic fields in the country.

2. Methods

One of the central aspects of mechatronics education is its multidisciplinary nature, which involves the integration of mechanical engineering, electrical engineering, computer science, and automation. Therefore, we specifically sought universities known for offering interdisciplinary programs that emphasize the fusion of these disciplines. Programs that encourage students to bridge the gap between hardware and software, and foster creativity and innovation, were particularly relevant to our study.

Mechatronics is a multidisciplinary field of science that comprises the knowledge of fundamental sciences (mathematics, physics, chemistry, etc.) mechanics, electronics, computer science and control systems. The idea of this paper is to analyse quantitatively the proportion of different aspects that form mechatronics. The data collection method included a deep analysis of every curriculum that was presented on official web-site catalogues of Italian Universities. According to the analysis performed, among the prominent Italian universities there are only 4 providing a bachelor degree curriculum in mechatronics, robotics or fields have connections to them. The results of the analysis will be presented in the Section Results.

3. Results and Discussions

The first curriculum that was analysed in the scope of this work is the bachelor degree programme “Automation and Control Engineering” at Politecnico di Milano (Fig.1).

Proportions of different aspects forming the curriculum in Automation and Control Engineering at Politecnico di Milano

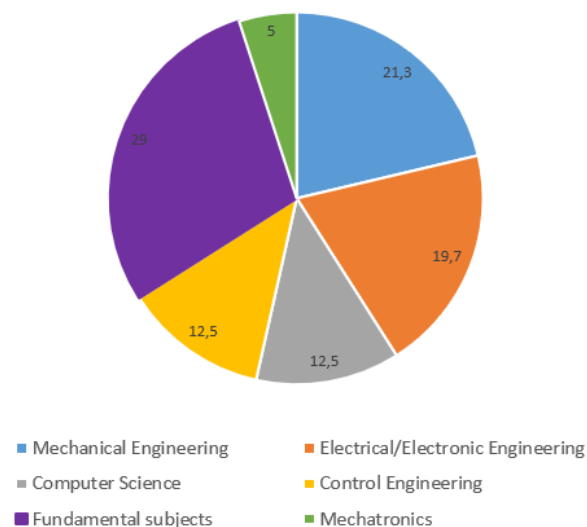


Figure 1 Curriculum in Automation and Control Engineering at Politecnico di Milano [5]

Afterwards, the curriculum in Mechatronic Engineering at Universiteta degli Studi di Padova was analysed. The summary of the discipline distribution is presented in Fig.2. Fig.3 shows the proportion of disciplines forming the bachelor degree curriculum in Automation Engineering at University of Bologna. Fig.3 shows the proportion of disciplines forming the bachelor degree curriculum in Automation Engineering at University of Bologna. Finally, the last bachelor degree programme which participated in the analysis is Mechatronic Engineering at University of Bologna (see Fig.4).

Proportions of different aspects forming the curriculum in Mechatronic Engineering at Universita degli Studi di Padova

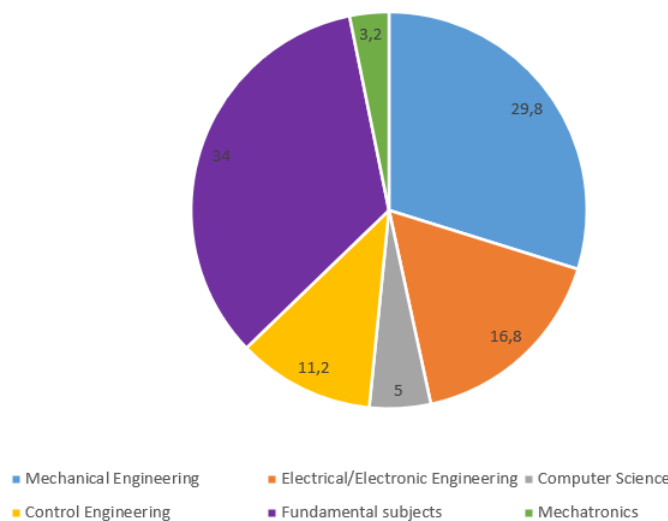


Figure 2 Curriculum in Mechatronic Engineering at Universiteta degli Studi di Padova [7]

Automation Engineering curriculum at University of Bologna

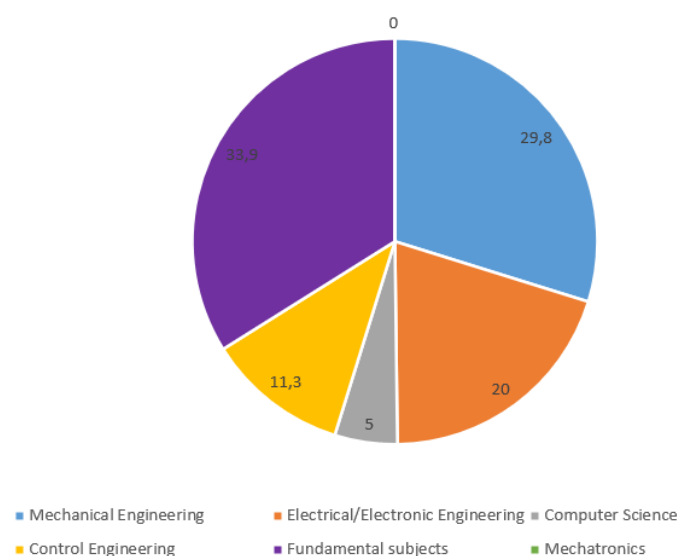


Figure 3 Automation Engineering curriculum at University of Bologna [6]

Table 1 summarizes the results of the analysis including the duration of study, number of ECTS credits, presence/absence of bachelor thesis project and QS ranking of the university by subject (Engineering and Technology).

The analysis shows that in all the programmes included one of the most predominant disciplines is Fundamental subjects which means that Italian universities pay vital attention to teaching fundamental sciences before teaching specialty courses. At the same time, a large proportion of subjects related to Mechanical Engineering is included in every curriculum. All programmes have a duration of 3 years, with a required minimum of 180 ECTS credits. What is very noteworthy is the absence of Bachelor thesis project as a part of the curriculum.

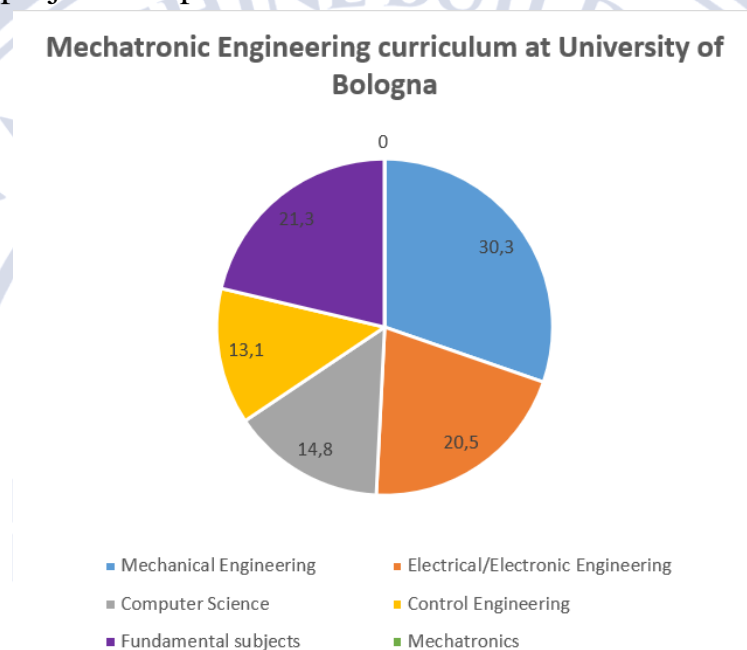


Figure 4 Mechatronic Engineering curriculum at university of Bologna [6]

Table 1

Aspect of study	Automation and Control Engineering (Politecnico di Milano)	Mechatronic Engineering (University of Padova)	Automation Engineering (University of Bologna)	Mechatronic Engineering (University of Bologna)
Duration of study (years)	3	3	3	3
ECTS credits	186	183	180	180
Bachelor thesis project	No	No	No	No
QS Ranking by subject (2020)	18	180	108	108

4. Acknowledgements

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