Introduction to 21st-century physics

Luca

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Lecture notes on introductory mechanics and thermodynamics (ING175)

0 Introduction

Until one or more decades ago, the 18th-century physical notions typically taught in introductory Bachelor physics courses was enough to prepare an engineer for future specializations and jobs. Students who wanted to venture into modern theories, such as Relativity, had to learn – and **re-learn** – some of the most important physical notions, which in these theories are quite different from the 18th-century ones. But these modern theories had then still mostly theoretical, not practical importance. So the re-learning efforts of the curious students could maybe be justified.

That situation has changed today. Modern theories are an essential part of many everyday technologies, like nuclear reactors and the Global Positioning System[1], and are require to develop new technological possibilities, from quantum computers[2] to solar sails[3]. An engineering student (including communication and data engineering) may likely end up in a job that requires an understanding of modern physical notions. The diffusion of large language models[4] will moreover require future engineers who actually **understand** those physical notions, not little monkeys that have been trained to manipulate some equations and to throw some technobabble around. Automated large language models are faster, cheaper, and more precise in doing the latter kind of monkey activities. So why should one hire a human to do the same?

It is therefore high time that introductory Bachelor physics courses be based on modern physics notions. Students should not be required to waste

Bibliography

("de X" is listed under D, "van X" under V, and so on, regardless of national conventions.)

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[1] https://www.gps.gov; see Fliegel & DiEsposti 1996; Ashby 2002; Müller et al. 2008. [2] https://www.ibm.com/topics/quantum-computing. [3] see for instance https://www.planetary.org/sci-tech/lightsail, https://www.cubesail.us. [4] https://www.ibm.com/topics/large-language-models.