School of Engineering, Faculty of Applied Science

Creating an Open Textbook for Engineering Thermodynamics

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Objectives

The soaring cost of textbooks has a negative impact on students' accessibility to learning materials and academic performance.[1,2] Open education resources (OER) offer the benefits of reduced cost, improved accessibility, and better retention rate.[3]

Thermodynamics is a fundamental subject in many programs, such as engineering, physics and chemistry. This project aims to

- create an open textbook for introductory engineering thermodynamics, containing the most fundamental topics of classical thermodynamics suitable for an entry-level undergraduate engineering course;
- provide students with concise, freely-accessible alternatives to commercial textbooks, helping to reduce their financial stress;
- create shared knowledge and develop adaptive, flexible teaching and learning material for instructors and the broader learning community.

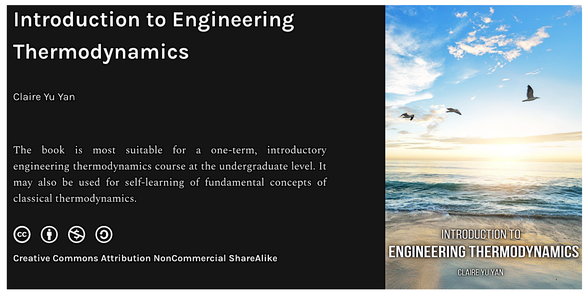

Figure 1: "Introduction to Engineering Thermodynamics" published on on Pressbooks with Creative Commons License.

https://pressbooks.bccampus.ca/thermo1/

Publishing Platform and Open Repositories

This open textbook is published on Pressbooks, a B.C./Yukon open authoring platform hosted by Bccampus, with Creative Commons License. It can be accessed via open repositories, such as UBC cIRcle, OER Commons, Open Textbook Library, LibreTexts, and MERLOT, expanding its accessibility and fostering inclusivity in education on a global scale. It can also be downloaded in different format, e.g., PDF, EPUB, HTMLBook etc.

Table 1: Usage Statistics as of May 20, 2024

Open repository	Downloads	Views	Countries
UBC Library Open Collections	195	202	10
OER Commons	11	365	n/a

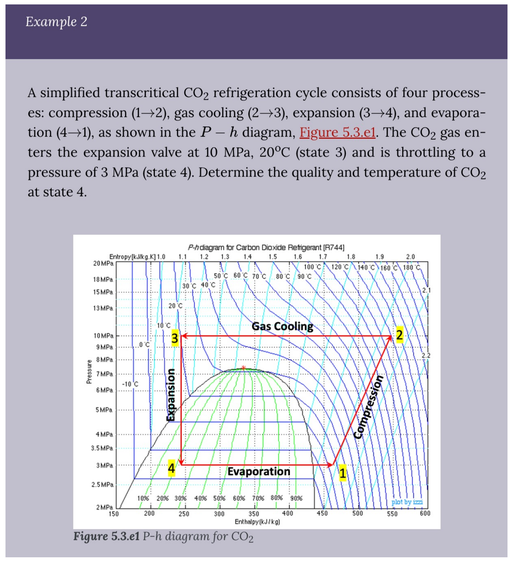

Figure 2: Solved examples

Book Features

The book consists of six concise chapters tailer-made for the 1st undergraduate thermodynamics course. It features

- step-by-step solved examples to help students understand key concepts (Figure 2)
- thermodynamic tables for five common fluids
- user-friendly, pop-out equations and glossary, and alt-text for accessibility (Figure 3)
- interactive H5P practice problems for students to perform self-assessment (Figure 4)

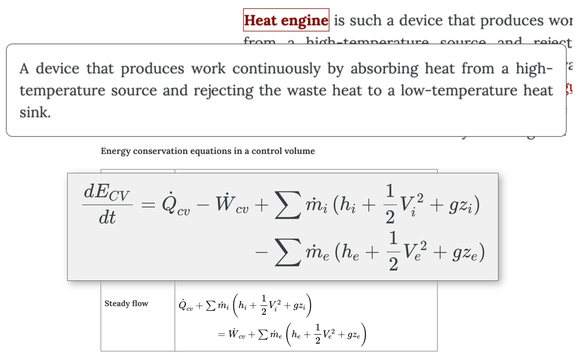

Figure 3: Pop-out windows for accessibility

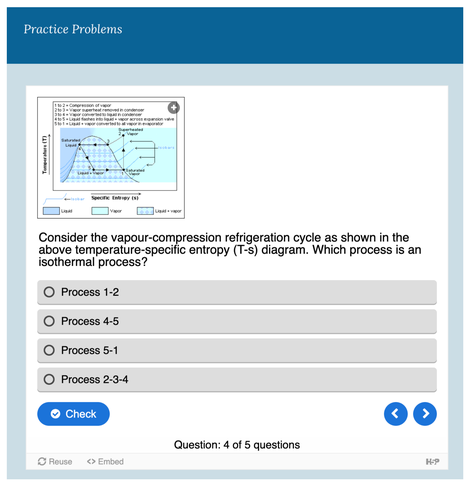

Figure 4: Interactive H5P practice problems

Ongoing project

Building on this open textbook, a second project conducted by Drs. Yan, Keulen, and Dehkhoda and two graduate students, focuses on creating a problem bank using Jupyter Notebook. This project, funded by UBC's OER Accessibility Grant, aims to deepen students' understanding of thermodynamics through interactive problem-solving. The problem bank is hosted on a GitHub website and features over 50 programmable problems and interactive thermodynamics diagrams, allowing students to experiment with equations and input parameters and "visualize" the corresponding outputs and comprehend the underlying principles.

https://thermo-oer-ubc.github.io/Thermo-OER/intro.html

References

1. College Board, *Trends in College Pricing 2019*. https://research.collegeboard.org/media/pdf/trends-college-pricing-2019-full-report.pdf
2. Imed Bouchrika, *Average College Textbook Cost: How To Cut It Down Without Compromising Studies*. https://research.com/education/average-college-textbook-cost
3. Zhao, Y., Satyanarayana, A., Cooney, C. (2020, November), *Impact of Open Education Resources (OER) on Student Academic Performance and Retention Rates in Undergraduate Engineering Departments,* 2020 Fall ASEE Mid-Atlantic Section Meeting, https://peer.asee.org/36048

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