

# Older Engineering Books are Open Educational Resources

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**Abstract**—*This paper explores the availability of older, public domain books that could help fill the current need for open engineering texts. Public domain availability for engineering books plus physics, chemistry and mathematics books were explored. Results indicate that over 50% of works published prior to 1964 are now in the public domain and can be used freely.*

**Index Terms**—*copyright, open educational resources, public domain, engineering, textbooks*

## INTRODUCTION

Identification or development of appropriate and affordable course materials is an essential part of the process of developing a successful course. This activity is even more important in the online environment where students can be located in any time zone or geographic region, where access to a library, reliable mail delivery or high-speed internet may be problematic. The COVID-19 pandemic forced many traditional classes online and highlighted these challenges to the broader educational community. The pandemic also exacerbated challenges of affordability and access for students. Many students borrow textbooks from libraries to avoid the cost of purchasing them, yet many libraries closed during the pandemic or reduced hours and access to collections.

Multiple studies have demonstrated that rising textbook costs negatively affect student retention and success [1, 2, 3]. Data indicate that textbook prices increased by 88% percent between 2006 and 2016 [4] so the problem is real and significant. In 2018, the U.S. Congress authorized the Open Textbooks Pilot Program to encourage and support higher educational institutions in developing free resources in the form of open textbooks. Renewed in 2019 and extended in 2020, the program has provided over \$10 million dollars in funding for new materials with a projected savings to students of \$30 million dollars over the next five years [5]. In addition to federal assistance, many universities and colleges have funded open educational resource (OER) grants to assist in the development of new textbooks and encourage the transition from commercial to open education tools. The list of participating institutions is long and include many engineering-focused programs such as: University of California, Virginia Tech University, Penn

State University, Massachusetts Institute of Technology, University of Minnesota, Arizona State University, University of Kansas, and many others.

These initiatives, along with OER found in collections like the Open Textbook Network and MERLOT, are noteworthy and helpful but progress is slow. It takes time to write a textbook and the existing offerings of OER by subject vary greatly in number. For some topics, there are many open textbooks to choose from but that is not yet the case for engineering. Surveys of engineering faculty reveal awareness of the issue of textbook affordability and cite the lack of quantity and quality of engineering OER as reasons for lack of adoption, though the potential value of OER as supplementary material, to provide alternate explanations and examples, was mentioned. [6, 7]. This project explored the potential quantities of older engineering texts, no longer in copyright, that could be considered when seeking appropriate OER for engineering courses.

## METHODOLOGY

The underlying hypothesis of this study is that older books represent a significant untapped source of OER in the engineering curricula. Current U.S. copyright law protects works for 95 years thus works published prior to 1925 are automatically in the public domain. For works published prior to 1964, specific rules were in place such that if a copyright was not renewed within the requisite time period, then the work moved into the public domain. This study examined the copyright status of English language books published prior to 1964.

There are two commonly used sources of information on the copyright status of U.S. published works – the U.S. Copyright Office and the HathiTrust. The HathiTrust Digital Library contains over 17 million volumes digitized from academic and special library collections and features a search interface that allows users to limit results by copyright status, i.e., to public domain resources. In addition, the copyright status of large numbers of materials in the HathiTrust Digital Library are undergoing examination via the Copyright Review Program [8] with current results indicating that over 50% of works published between 1924 and 1963, inclusive, are in the public domain due to lack of copyright renewal [9]. Thus the HathiTrust

Digital Library comprises a ready-made source of information on older (and more-recently published) public domain works. Subject searches on engineering topics were performed within the HathiTrust Digital Library to determine if the percentages of public domain works were similar to those for the overall HathiTrust Digital Collection.

A secondary search was performed using the Library of Congress classification codes for engineering. There are no subject headings that identify textbooks or core works, however, so the searches were perforce quite general. The HathiTrust Digital Library collection includes many esoteric works as well as duplicate records for identical titles, therefore an additional investigation of the copyright status of engineering books was performed using a core list of books identified as being useful for college libraries. The 1967 edition of *Books for College Libraries* was used to generate the list of titles. The 1967 edition was selected since it was closest in publication date to 1963, the year that copyright law governing renewals changed. The *Stanford Copyright Renewal Database*, populated with data from the U.S. Copyright Office, was used to check the copyright renewal status of each work listed in engineering sections of *Books for College Libraries*, following the process used by the Copyright Review Program [10].

## RESULTS

A search of the HathiTrust Digital Library using the subject “engineering” and limited to English-language books, returns approximately 53,000 works, many of which are dissertations and theses. Of these, approximately 11,000 titles (22%) are in the public domain, with about half that number (11%) published after 1924. By comparison, a search of the HathiTrust’s visualization of works by call number, Library of Congress classification T – Technology, retrieves over 191,000 English-language books with 65,000 (34%) in the public domain [11]. These latter figures are probably better approximations of the numbers of engineering works in the Hathi corpus given that many works related to engineering do not have the term “engineering” in the subject heading. Since many of the subjects in the engineering curricula relate to mathematics, chemistry and physics those subjects were also examined using the visualization of works by call number tool. The percentages found for public domain English-language books in those fields were 15% (mathematics), 24% (chemistry), and 32% (physics). None of these percentages come close to the over 50% figure cited by Wilkin and the Copyright Review Program [8, 9]. This may be

attributable in part to the significant number of dissertations and theses in the HathiTrust Digital Library on engineering topics.

Given that it is difficult to identify textbooks using subject headings or by the broad Library of Congress classifications used in the visualization tool, the engineering section of *Books for College Libraries* was used to identify works in engineering that were recommended for use in a higher educational setting. Titles are arranged by Library of Congress classification so all works in the classification T (technology) and U-V (military science) were searched, with the exception of works in TR (photography) and TX (home economics). The *Stanford Copyright Renewal Database* was used to search for copyright renewals. Of the 497 titles in T (Technology), 281 had not been renewed (57%). The U-V section (military science) had 309 titles with 172 not renewed (56%). Lists of titles in the foundational fields of mathematics, chemistry and physics were also searched, yielding non-renewal rates of 48%, 50%, and 46%, respectively.

## DISCUSSION

The HathiTrust Digital Library is a useful resource for identifying works in the public domain. As the Copyright Review Program continues to review the copyright status of pre-1964 and other works, the number of items identified as being in the public domain will continue to grow. Based on the Library of Congress classification of works in the HathiTrust, engineering works in the public domain appears to be lower than average, but when textbook-like resources are examined separately, the percentage of engineering titles in the public domain (57%) appears similar to the overall average for the HathiTrust Digital Library (53%). Some examples of public domain texts include:

- Bellman, Richard. *Introduction to matrix analysis*. NY: McGraw-Hill, 1960.
- Gibson, Robert and Claude E. Wilson. *Master! problem solving in chemistry*. NY: Monarch Press, 1963.
- Hicks, Tyler G. *Writing for engineering and science*. NY: McGraw-Hill, 1961.
- Kenyon, Richard A. *Principles of fluid mechanics*. NY: Ronald, 1960.
- Levinson, Irving. *Mechanics of materials*. Englewood Cliffs, NJ: Prentice-Hall, 1963.
- McCormac, Jack C. *Structural Analysis*. Scranton, PA: International Textbook Co., 1960.

- McCullogh, James D. and Hosmer W. Stone. *Experimental general chemistry, with problems*. NY: McGraw-Hill, 1963.
- Oliver, John W. *History of American technology*. NY: Ronald, 1956.
- Rusk, Rogers D. *Introduction to college physics*. NY: Appleton-Century-Crofts, 1954.
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While it is heartening to know that over 50% of pre-1964 works are in the public domain, the question of how useful these works might be as OER remains to be answered. Future studies might examine the utility of these older texts to provide supplemental OER in specific subject areas. It is possible that older works in fundamental fields such as mathematics, chemistry and physics may provide richer options for OER than engineering texts, given the rapid pace of technological change. Works with a historical bent are likely to still be relevant but other titles may be useful as well, if only as sources of sample problems, worked examples and alternate explanations of concepts. It will require the expertise of engineering faculty to make the determination of value but first they must become aware of the availability of these public domain works.

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