Open in order to open engineering

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Engineering is a field that touches nearly every aspect of our lives. Almost anything human-made that you come into contact with on a day-to-day basis was worked on by an engineer during at least one phase of its development before coming to fruition. Whether it was in the initial design, the selection of materials, or the manufacturing method, engineering is deeply woven into the fabric of our lives as well as our economic, technological, and social development as a society. Despite the importance of engineering to society, there remains a large portion of our global population that are not able to participate as equal partners in the engineering practice. This includes participating both as consumers and contributors of engineering knowledge.

Accessing engineering knowledge

Despite the recent surge of interest in open access (OA) publishing models, engineering work remains, for the most part, locked away in traditional academic journals (Berg et al., 2016). A recent study found that only ˜17% of published manuscripts in engineering can be accessed by the public for free (Piwowar et al., 2017). This results in a disadvantage for those who have limited ability to purchase access to these resources, which is particularly hard felt in regions of the world where engineering solutions are needed to solve some of our most pressing problems such as access to clean drinking water and reliable electricity.

The need for access to engineering knowledge does not reside solely in the realm of academic publishing. Other areas where inequity in access exists include educational resources and engineering tools such as software and standards. Open educational resources (OERs) is another area that has gained momentum in recently especially as people examine the costs of higher education. The growth of OERs for engineering doesn't seem to have taken off as quickly as in other fields such as computer science or mathematics. Solutions are still needed here for the development of engineering OERs that would provide alternative options for both the engineering student at university and the individual trying to learn on their own.

Production of engineering knowledge

The practice of engineering can include diverse array of work products. The products can include code, multimedia, 3D models, sketches, physical objects, writing, and everything in between. As such, it can be very difficult to find a one-size-fits-all model to prescribe when promoting the addition of open practices to the engineer's workflow. In terms of the tools available to enable an engineer's work, many of the standard tools that an engineering student is trained on and that they will later utilize in the workplace are closed source, proprietary technologies. Common examples include solid modeling software such as Solidworks or PTC Creo and computational tools such as Matlab. Fortunately there is much ongoing work occurring in the development of open source alternatives to these packages such as FreeCAD, BRL-CAD, and GNU Octave. While the maturity of these projects varies and their adoption in the work place is minimal, they show promise for the future availability and usefulness of these tools. The real test is if more widespread adoption can be facilitated such that continued development of these tools could be incentivized.

Engineering standards are another area where access is a major barrier for small scale engineering practice. Engineering standards consist of a set of criteria intended to ensure the proper execution of engineering design as well as adherence to the proper safety specifications. In general standards provide, well... standardization. The trouble with many engineering standards is that they can be expensive to purchase, often in the range of $400-500, for example. This raises the same access issues as with anything else that carries such an expense.

Working toward open solutions for engineering

While I have no expectations of being able to tackle all of the aforementioned, I hope that between myself and the colleagues I work with, we can make a small dent in the practice of open engineering. To that end, I have organized an umbrella initiative called openENGR under which I organize the various projects that we have undertaken to promote the overarching goals of the breadth of engineering work more accessible to others and make the process of practicing openness in engineering easier for engineering researchers and practitioners.

Current projects under this initiative include the Journal of Open Engineering (TJOE), a work in collaboration with PubPub out of the MIT Media Lab, and engrXiv, the engineering archive, an eprint server for engineering built in collaboration with the Center for Open Science on their platform, the Open Science Framework. Future efforts may include OERs for engineering.

References

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