

# ENGINEERING YOUR CAREER: IS AN ADVANCED DEGREE RIGHT FOR YOU?

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## INTRODUCTION

How do you decide whether and when to attend graduate school? Pursuing a graduate degree in engineering can significantly shape the trajectory of your professional career. Your decision process should weigh various factors that span from professional to personal. An undergraduate research experience can help inform this decision based on first-hand experience working in a lab and interacting with graduate students. However, many students make this decision based on their sole impression of what a PhD in engineering does – most often the professor standing in front of the classroom. If you don't see yourself as a professor, you might think that graduate school is not for you. You might also have incomplete information about what graduate school involves or believe that you can't afford it. In this article, we seek to clarify the potential purposes of pursuing an advanced degree, outline the long-term career opportunities that an advanced degree provides, and describe what a graduate school path might look like.

Many students have a genuine passion for discovering and developing new knowledge. Pursuing a graduate degree for such a student provides a deep dive into a subject of interest (~2 years for a Master's degree and ~5 years for a Doctoral degree – PhD). This is often done collaboratively in state-of-the-art research laboratories. A great deal of personal fulfillment can be achieved from the pursuit of a graduate degree. The weighting of all such personal factors cannot be addressed in this publication, and as such the authors focus primarily on professional considerations while noting that the personal criteria (e.g., partners, preferences on geographic location, department size, distance from family, etc.) cannot be discounted.

A practical approach to thinking about graduate study is to first construct your career path trajectory. Some career paths require an advanced degree; some require specialized knowledge outside of a student's discipline obtained through a Master's degree, job experience, or some other certification; and others do not. With this career path in hand, talk to

advisors or faculty, alumni in the field, and other trusted mentors. You may find you do not need an advanced degree to achieve your goals, or you may find that you need an MD/PhD plus residency to follow your dream job! Some companies and hiring managers have a great deal of confidence in the letters after your name – MBA, MS, PhD, PE (Professional Engineer),<sup>[1]</sup> or something else. Your career path will help you investigate potential employers to determine how important extra letters are and if the university's "pedigree" is important in your desired industry.



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One potential pathway after your Bachelor's degree is either a Master's of Science or Master's of Engineering degree. The availability of these degrees varies by institution, as do the requirements. Some Master's programs will require a thesis project, similar to a PhD but often of smaller scope and duration, while some will be coursework only. Master's of Engineering programs are often more applied in their coursework as opposed to Master's of Science programs, which may have a deeper focus on fundamentals. One especially important consideration is that PhD programs in engineering are typically funded by research grants or fellowships, meaning that you receive a stipend or financial support as you complete your degree. On the other hand, Master's degrees are largely *not* funded, meaning you often pay out-of-pocket. This can be a significant cost -- the average Master's degree ends up costing ~\$60K, though this can vary considerably with factors such as being in-state versus out-of-state or programs being in-person versus hybrid or online. Master's degrees in engineering can be useful if you are pivoting from one engineering discipline to another that is closely related, or if your employer has a tuition reimbursement program and it is required for your career progression. Outside these scenarios, the additional salary increment for a Master's degree relative to a Bachelor's degree may not justify the opportunity cost in time and forgone salary to obtain it. Some students choose to pursue a Master's as part of a PhD program as an intermediate degree, but this is rarely required and often a matter of personal choice and interest.

Beyond the Master's level, a PhD degree is very often required to obtain an academic position at a university (or a community college), and many students pursue graduate studies with the thought of potentially becoming a professor. However, academia is not the only path or even the most common career opportunity for new PhD graduates. One study suggests that only around 12% of PhD engineering graduates end up in an academic position.<sup>[2, 3]</sup> Many more PhD graduates enter industry, consulting, government, or national labs immediately after graduation. A PhD tells employers that you are smart, self-directed, and highly motivated – all qualities that lend themselves to *many* potential positions within an organization. While a PhD's first position after graduate school might be closely related to their research, they may branch out depending on their personal career goals and interests as well as opportunities available within the company.

Some students may fear getting pigeonholed with a PhD degree. While the PhD degree will necessarily close some early career paths, specifically entry-level Bachelor's positions, it can increase the diversity of potential positions, especially for those that seek candidates with a multidisciplinary skill set. For example, a chemical engineering PhD might also be well equipped for a data science position

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because of the additional skills acquired during the engineering graduate degree, or someone with a B.S. chemical engineering degree might earn an electrical engineering MS and be poised to become an expert in controls engineering. In addition, positions at national labs almost exclusively recruit PhD graduates.

You may also find a PhD useful if you have entrepreneurial interests. As a technical subject matter expert, PhDs in an industry can be well positioned to take the lead on projects that translate cutting-edge research from the laboratory to the market. Often senior management – especially in research and development organizations – and industry executives have advanced degrees (perhaps in addition to an MBA). As this is a common career path, there are industrial leadership development programs that specifically recruit PhD graduates.

If you've decided to explore the PhD a bit more, what can you expect from the experience? When considering PhD programs, several models exist, often depending on the size of the program and resources available. Large, well-established programs with a variety of faculty may operate on a **cohort model**. In the cohort model, the program admits an entire class of students at once and typically goes through a matching process with advisors during the first year of the program. Students may informally interview with different advisors and make a ranked selection based on their interests. This can be an advantage if you are more open about your interests and what you want to work on, but it can be a disadvantage if you are intent on working with a particular advisor who has limited space, and you end up getting matched with a different faculty member.

The other main model for PhD programs is the **direct admit** model. Smaller programs or ones without extensive resources may prefer this model, as it can allow a better balance of incoming students to funded research positions. In the direct admit model, students and faculty will connect prior to the application process and discuss projects that are available or of interest. If the student and faculty agree that the project is a good fit for the student, the student will apply to the program, and, if admitted, will begin work with the faculty member immediately, versus going through a matching process. These preliminary connections can occur at conferences, through information sessions hosted by

the faculty member or program, or by students reaching out directly to faculty with whom they have an interest in working<sup>[4]</sup> – perhaps by looking at the *Chemical Engineering Education* Graduate Guide!

It is important that you carefully consider all your options after completing a BS degree in chemical engineering. Knowing yourself, what motivates you, what work environment you thrive in, and your long-term goals can help inform that decision and help you choose the right school for you.<sup>[5]</sup> While graduates who choose to stop with the BS degree can have a long and fulfilling career, having a better idea of career opportunities available to candidates with an advanced degree and understanding the time and financial commitment required are essential in making an informed decision about graduate school.

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