



SALARY & CAREER REPORT 2022

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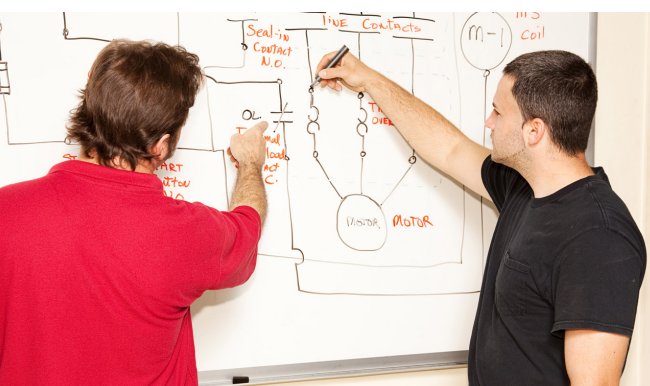
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SALARY & CAREER REPORT 2022

AT THE INTERSECTION OF ADVANCED MANUFACTURING, supply chain challenges, post-pandemic growth and continuing talent shortages, the design engineer continues to find plenty of enthusiasm for the work and optimism about the industry's future. The annual Salary & Career Survey e-book reviews the views of engineers around the world and finds that despite the conflicting forces buffeting the industry from the outside, the engineer's focus remains on integrating technology to improve operational performance.



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CHAPTER 1:

Collaboration Broadens in the Electronic Design Community

ALEX PAULTRE, Editor-at-Large, *Electronic Design*

The continued rise of Community as a Business Model also is impacting design engineering, creating both challenges and opportunities.

Collaboration of design and development efforts in the creation of products, services, and solutions isn't a new idea, but recent developments in both the tools available and the reasons to use them have permanently changed the design landscape. The ability for a team to work together remotely using telepresence tools and software has proven to be a game-changer in all aspects of the electronic products manufacturing industry.

According to MarketsandMarkets.com, the global enterprise collaboration market should grow from \$47.2 billion in 2021 to \$85.6 billion by 2026 (**Fig. 1**). This is being driven by the increased demand for real-time remote collaboration tools, cloud-based collaboration and design services, and project- and task-management solutions. Although these trends have been in existence for some time, the perfect storm of COVID-19 lockdowns forced a significant acceleration in application growth and market penetration.

This market report covers many development areas, but the electronic design aspect of the industry now touches anything that takes power to operate. In our latest Salary Survey, we had over 500 professionals working in the electronic design and development industry answer several questions about their jobs and the application spaces they serve. Of our survey group, over half were involved in Design & Development Engineering, with the second biggest block being made up of various levels of executive and operating engineering management.

This article will cover one of the many interesting aspects of the industry that was highlighted in the survey—in this case, remote design and development collaboration. Using collaborative software tools for design and development engineering isn't a brand-new idea, it was trying to break out into the design mainstream for the last decade in one



Global Enterprise Collaboration Market Trends

1. The global enterprise collaboration market is expected to grow to \$85.6 billion by 2026.



form or another. However, the telepresence “perfect storm” of COVID-19 forced the industry to adopt these next-generation team-based solutions, if only to enable their company to function in a quarantine environment.

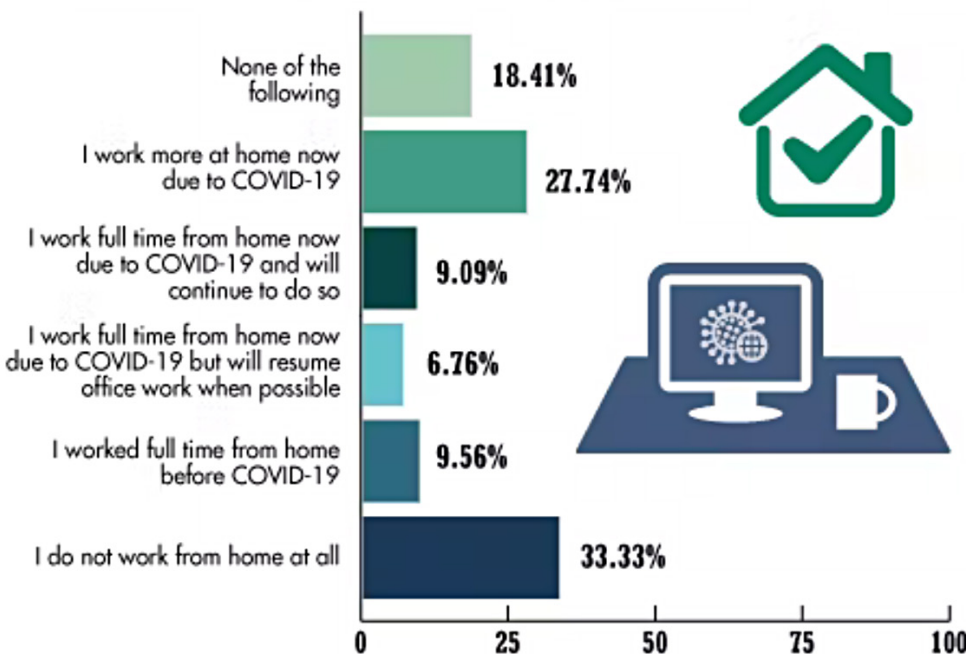
The Impact of COVID-19 on Engineering

When we asked about their job situation, over 40% of the respondents answered that they work more from home because of COVID-19, with around 20% replying they will remain full-time home-office workers going forward (Fig. 2). (Half of those were already working from home prior to COVID-19.) An important thing to consider here is that the number of people working remotely has risen to the point where companies wishing to stay competitive must integrate remote team-interaction tools to enable efficient work integration.

The most important thing to consider, however, is now that these advanced tools are being used, they will not be put aside, even if everyone went back to the office. They offer significant force-multiplication advantages to a development team far beyond the convenience of working together

2. Over 40% of the respondents answered that they work more from home because of COVID-19.

Which of the following apply to your job situation? (Choose all that apply)





remotely.

A team using collaborative design simulation software can outperform a design team working in the same room today. Not only can they work more seamlessly and intuitively, they now have a running documentation of everything being done.

The advantages of using modern design simulation tools are myriad, scalable, and reinforcing. Modern performance demands on electronic systems and the products they empower require optimized circuit and packaging. It's far easier to exchange ideas and act upon them in a software-development environment that allows everyone to see the impact of everyone else's input in real-time.

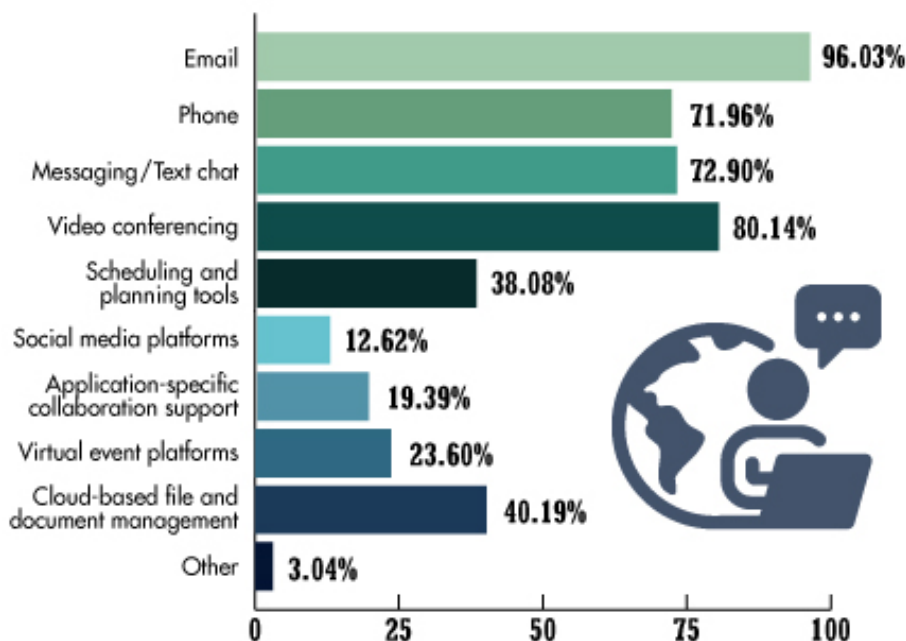
Moreover, these advanced design and development tools are exactly what's needed to optimize products in today's demanding regulatory environment as well. Considering the benefits of collaboration, documentation, flexibility, and remote collaboration, it's obvious that these tools will continue to be used. Those who adopted these tools to address COVID-19 will continue to use them, and their competitors will adopt them as well to stay competitive. Even relatively basic advantages like saving the engineer who previously needed to keep track of the bill of materials in a project have huge implications.

How Collaboration Tools Empower Design

When asked about the kinds of collaboration tools they're using, after e-mail, it turns out that video conferencing is the second most used, followed by the phone and texting (Fig. 3). With regard to more advanced tools, large blocks of respondents said they used scheduling and planning tools, cloud-based file and document management, application-specific collaboration support, and virtual event platforms. Even social media ranked as a collaboration solution that they used on a regular basis.

An interesting way to look at this is to see how the technologies being developed by

What collaboration tools are you using on a regular basis?

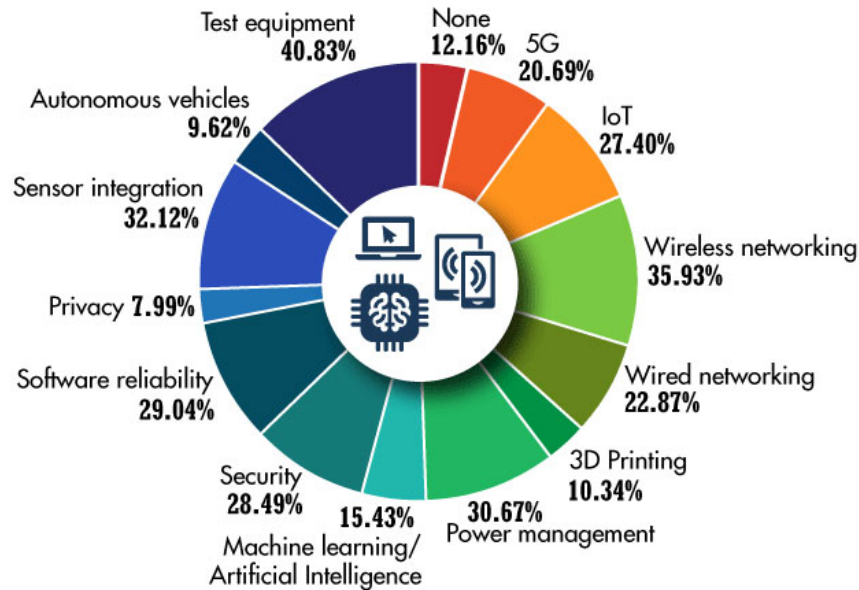


3. Video conferencing is the second-most used collaborative tool.





Which of these technologies have a major impact on your designs? (Choose all that apply)



4. Wired and wireless networking technologies topped the list of technologies that had a major impact on respondents' designs.

our industry are now impacting how we work within it. Improved wireless and edge-based solutions empower remote hardware tools, for example, while improved messaging technology intended for general use also empowers inter-team communications. There's a yin-yang relationship between the technology advances fomenting application development and those behind the creation of the next generation of tools used to apply them.

When we asked about some of the technologies that had a major impact on their designs, topping the list were wired and wireless networking technologies, sensor integration, AI and machine learning, and security (Fig. 4). Interestingly enough, test equipment and software reliability, both engineering-side tech, also were listed as major factors. This underscores the importance of certification, optimization, and verification needed in today's design and development process.

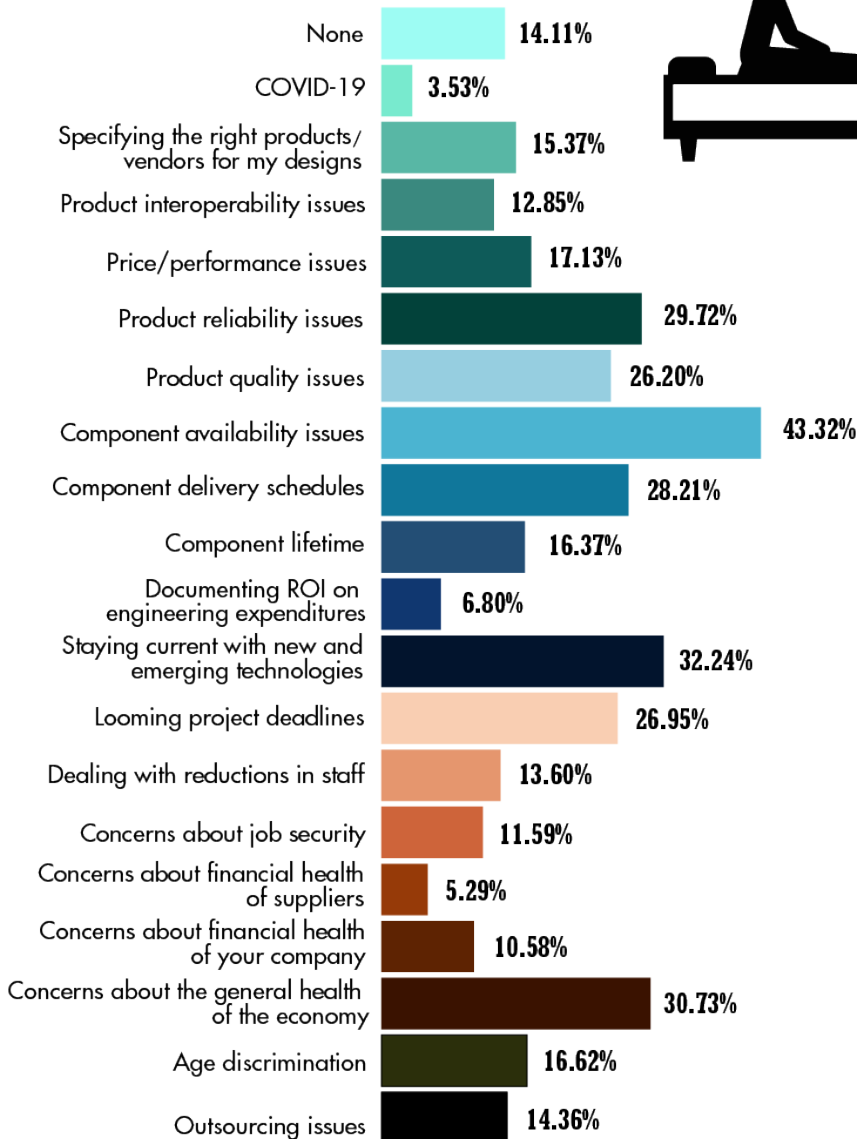
On the practical side, the latest design simulation tools integrate electronic and mechanical design more seamlessly, enabling whole-product design optimization. Simulating various changes in components and attributes, engineers can explore complex electrical schematic iterations in real-time in collaboration with their team. This spurs on more effective buildouts of different layout alternatives and options with various results, comparing the various solutions against the application's performance and regulatory requirements.

Historically, software and hardware design tools addressed electrical and mechanical functions separately, with separate software and hardware packages needed, and little or no interaction occurring between any of the stages. Not only do the latest solutions address the progress in component and systems complexity, they also merge electrical performance and mechanical design as integrated functions. For example, proper component simulation allows for proper thermal and stress analysis of the entire system based on the spacing of the components within the enclosure.

Comprehensive thermal analysis combined with a mechanical stress model showing system tension, flexion, and torsion enables a worst-case modeling scenario that proves



What are the professional issues that keep you up at night?



out the packaging or exposes flaws in thermal management. Iterative design changes can then be made in real-time with input from the whole team based on the simulation results to improve the design.

Looking Forward

When we asked about what professional issues were on their minds, looming project deadlines and component availability issues lead the pack, followed closely by product-related performance, quality, and reliability issues (Fig. 5). A collaborative design environment linked to an intelligent manufacturing process and a comprehensive design-for-manufacture methodology can address all of these issues successfully.

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5. Professional issues were on respondent's minds, along with looming project deadlines and component availability issues.



Credit: Dreamstime, Kasto80

CHAPTER 2:

Electronics and Electrical Engineering Jobs on the Decline—Can They Be Saved?

CABE ATWELL, Technology Editor, *Electronic Design*

Electronics and electrical engineering job outlooks are on the decline due to interests and global materials shortages, but that could change based on several dynamics.

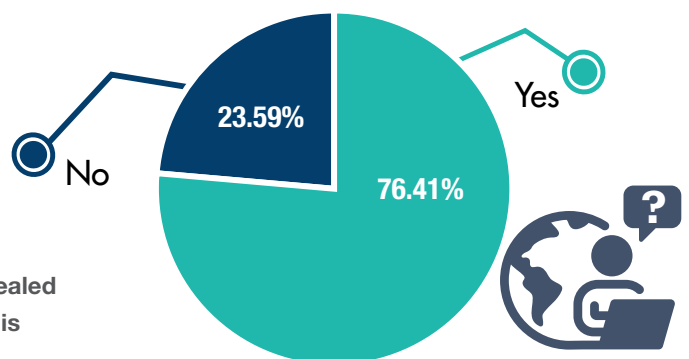
The pandemic has done its best to hinder chip production on a global scale. But while the shortage shows signs of subsiding, semiconductor companies are encountering another problem that could set them back: a lack of qualified electronics and electrical engineers.

The *Electronic Design 2022 Salary & Career Survey* paints a clear picture of the experienced engineer shortage. We asked, “Is your organization having difficulty finding qualified candidates for open engineering positions?” A resounding 77% said yes (Fig. 1).

What’s worse, when we asked what specialties are in need of people, and the deficit is almost even across every focus (Fig. 2).

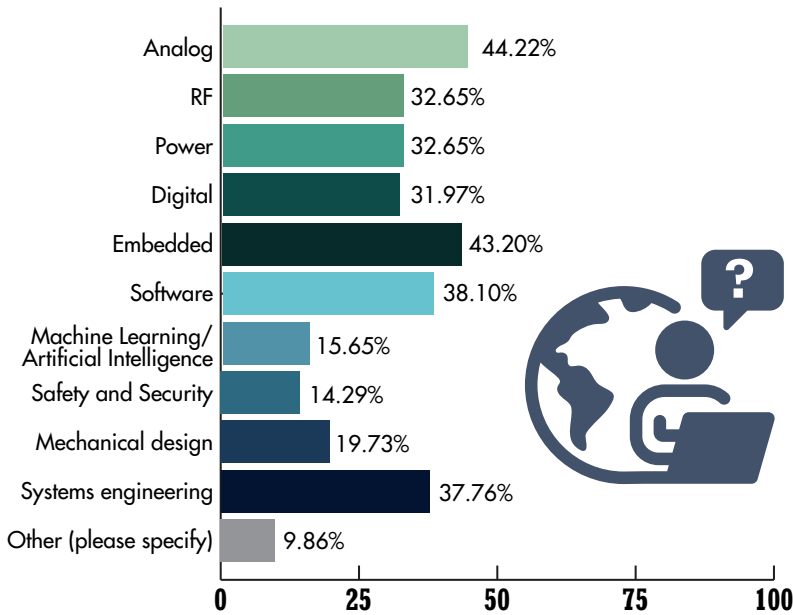
1. This year’s Salary Survey revealed that finding qualified engineers is harder than ever.

Is your organization having difficulty finding qualified candidates for open engineering positions?





For which engineering specialties are you have difficulty finding qualified candidates?



2. Survey respondents ranked analog and embedded engineers, followed closely by software specialists, as the toughest positions to fill.

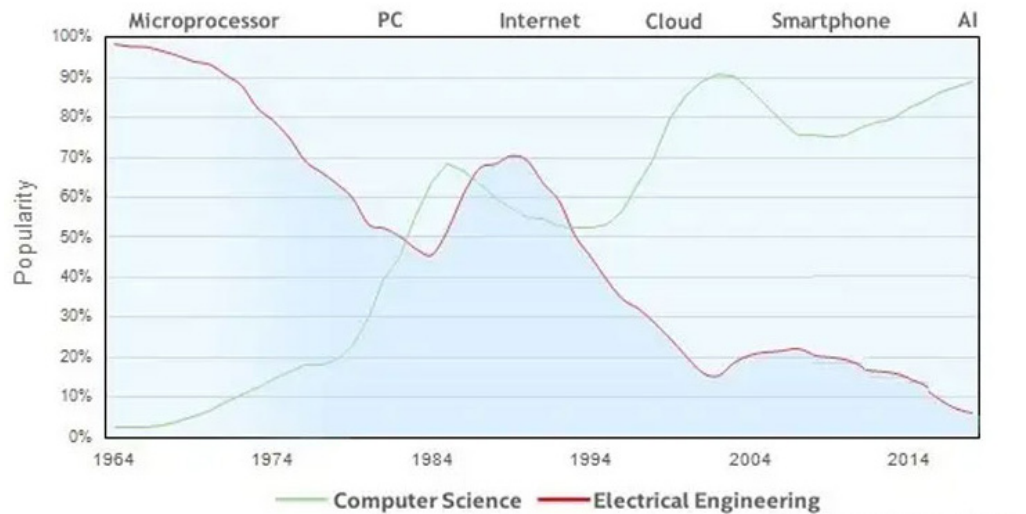
In June of this year (2022), Intel engineer Raja Koduri attended the [IEEE Symposium on VLSI Technology & Circuits](#) and raised the issue of engineer scarcity within the U.S., which painted a negative forecast for the near future (to say the least).

CS vs. EE

That concern was highlighted by a graph (Fig. 3) outlining how computer science (CS) majors' college enrollment has overshadowed those majoring in electrical engineering over the last 50 years. That translates to a 90% uptick in the CS field and a 90% drop for those pursuing an EE degree. The situation is worse for electronics engineers, the workforce responsible for building those electronic devices, which is astounding, given the amount of technology the average person has in their homes.

The lack of desire among young people in the U.S. to become electronic engineers can be explained by many factors, including the lack of popularity and a stronger emphasis on programming. Why bother with circuit design when there's so much more money to be had in programming?

College Enrollment : EE vs CS



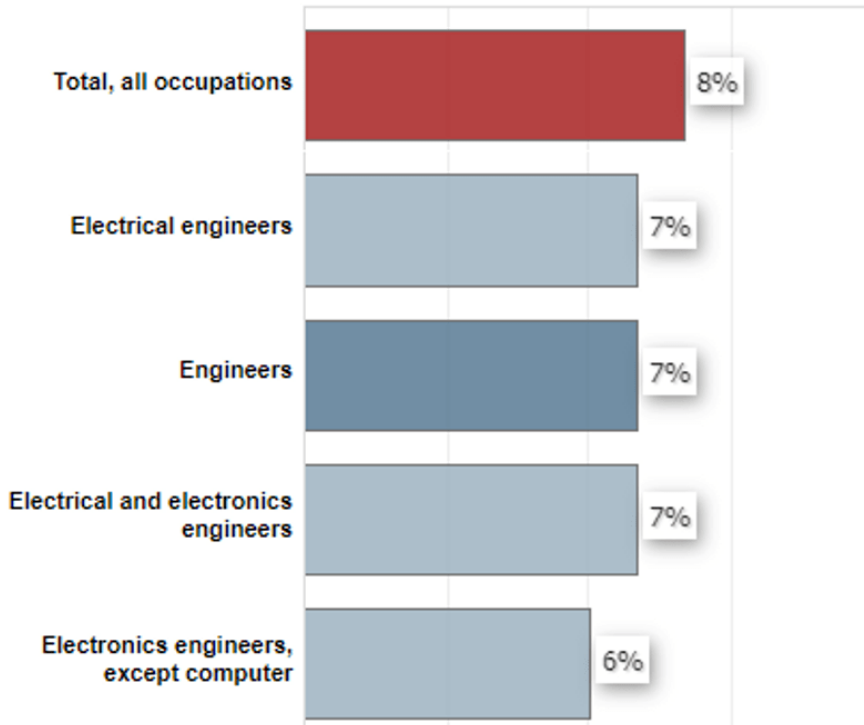
2022 IEEE VLSI Symposium on Technology and Circuits

3. The projected engineering jobs outlook is on the decline, based on several factors highlighted by Intel.



Electrical and Electronics Engineers

Percent change in employment, projected 2020-30



4. The graph, provided by the Bureau of Labor Statistics, shows most engineering jobs will come from companies looking to contract talent.

Higher salaries in programming also serve as a stronger argument than learning the basics of chip design. Companies such as Microsoft, Apple and Google offer [incentives](#) to students and others who pursue a degree in programming, including internships and grants, which puts the dollar sign icing on the software engineering cake.

The [U.S. Bureau of Labor Statistics](#) (BLS) supports that outlook, as both have all but stalled in growth. The slow rate of advancement in most manufacturing sectors is getting much of the blame for the stall in these occupations. This bleak view of the field directly contrasts with industry claims that the U.S. has a massive shortage of skilled electrical engineers.

Companies in the U.S. claim this isn't a problem of falling demand, but a reduced investment in American workers, favoring lobbying Congress for low-cost foreign labor. Others claim that the demand for American electrical engineers will increase if the U.S. insists on building the rockets that launch astronauts, satellites, weather, and GPS equipment in this country instead of contracting with other nations.

The BLS predicts (**Fig. 4**) that most of the opportunities for electrical and electronics engineers will come from engineering services firms as companies look to contracting to save

costs. Some companies also are turning to the current engineering pool to help mitigate the chip shortages, which was pointed out in an article from [Harvard Business Review](#).

Dealing with Shortages

Manufacturing experts state they're adjusting the way companies design their products to mitigate the shortfalls of limited hardware. Among their strategies are to incorporate more software into the components or replace premium components with standard substitutes.

A report released by [Avnet](#), a U.S. component distributor, backs up this claim by stating that 55% of engineers surveyed said they were redesigning hardware due to limited supplies and increased prices. It also points out that those same engineers had to delay the development of new hardware or incorporate standard components into premium designs.

Using those strategies only puts increased pressure on the engineering skills market, which could derail efforts to stay at the forefront of next-gen technology that becomes more complex with every evolution. Some companies, such as AMD, Intel, and NVIDIA, are looking to build their own fabrication and manufacturing plants to reduce costs and increase the production of chips currently being outsourced to countries such as Taiwan and South Korea.

Moreover, the \$2.3 trillion U.S. [infrastructure](#) plan earmarks \$50 billion for semiconductor



R&D and production within the U.S. in an effort to increase supply. Intel is doing something similar in the EU by investing \$33 billion to secure the European market and create 3,300 high-tech jobs in the process.


The strategies put in place will undoubtedly benefit production. However, building new plants and infrastructure are at minimum two years away, and using design stopgap measures is akin to placing Band-Aids on the cracked façade of a dam bursting at the seams. This will place enormous pressure on companies to hire skilled engineers over a shorter time span, as training new talent will only push operations further into the future.

Era of the Contract Engineer?

The effects of the pandemic also ushered in a new modicum of working from home, and hiring freezes have forced companies to alter their strategies to take advantage of contracting engineers to cover the increase in market needs. This process ensures innovation and growth can continue, although the highly sought-after veterans will usually take a reduction in salary due to the non-negotiation practices that typically accompany contract work.

While it may sound contradicting, freelance engineers working contract gigs often find themselves in a position to take on more prominent roles that will benefit them in the long run. It's not uncommon for engineers in these positions to talk with clients on design aspects, engage manufacturers on production runs, and act as liaisons with software engineers.

Being able to multitask, especially on the engineering level, is a skill worth its weight in platinum. Perhaps that's the route new engineers should consider over a long-term career path. How to get today's youth interested in electronics and electrical engineering isn't something tech companies currently have a stopgap solution for, primarily if the money lies in other fields.

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Credit: Dreamstime, Visoot-Uthairam

CHAPTER 3:

Engineers are in High Demand. Most are Not Missing the Opportunity.

JAMES MORRA, Senior Staff Editor, *Electronic Design*

Electronic Design's latest Salary Survey revealed that 70% of engineers expect to see their compensation go up this year, as employers continue to compete over hard-to-find expertise.

As electrical and electronics engineers find themselves in high demand, they're pushing their employers to raise salaries, increase bonuses, and offer other perks to complement their pay increases this year.

Around 70% of respondents say that they will see their compensation grow in 2022, up from about 60% in the same situation just last year, according to data from the latest annual survey from *Electronic Design* and Endeavor Business Media's Design Engineering Group. The results signal that engineers still have a strong hand to play when it comes to getting raises and bonuses, as companies compete over scarce talent to fill open positions.

Only a fraction of the nearly 600 respondents, ranging from rank-and-file design engineers to those in executive and engineering management roles, anticipate a reduction in their overall pay this year.

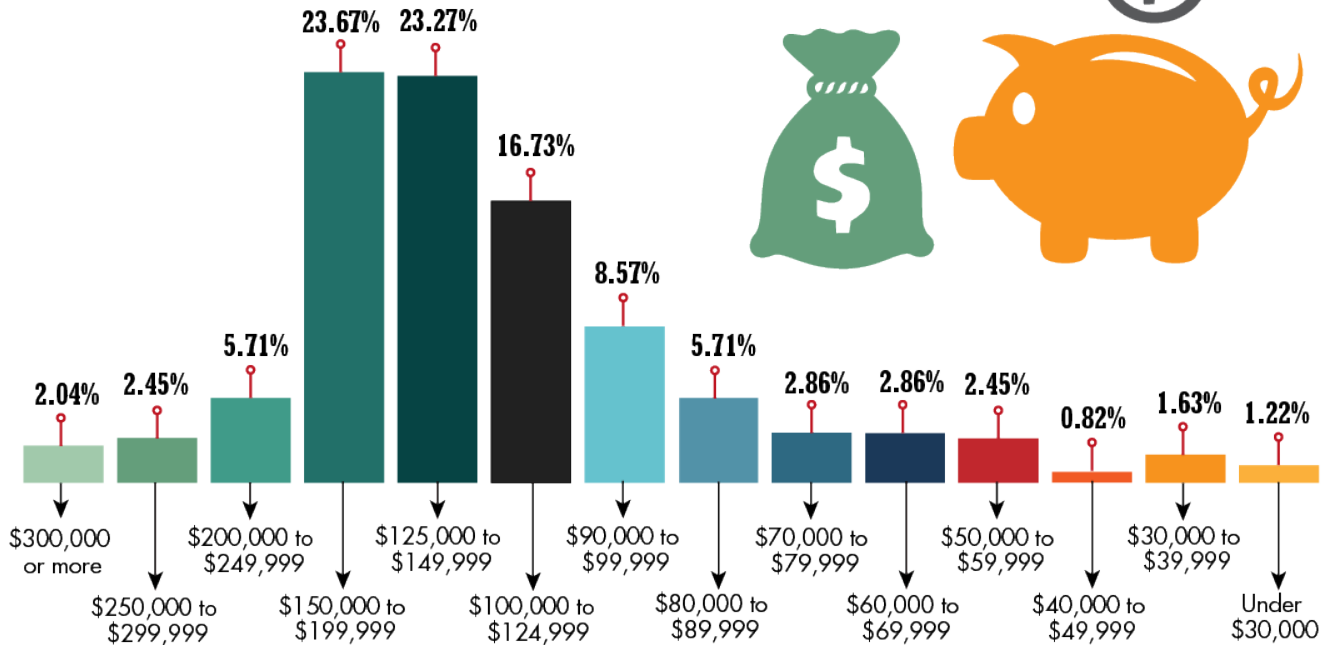
"There will always be new technologies to integrate and old systems becoming obsolete," said one of the respondents to the survey, which polled engineers about their salaries and other forms of compensation. "The opportunities to contribute will never go away."

As most electrical and electronics engineers will tell you, not everyone can do what they do. But while they tend to regard engineering as more of an identity than a profession, they always have money on the mind. Each year, compensation ranks as one of the top factors in their job satisfaction, rivaling the rush that comes with the challenges of designing a new product and the impact their innovations have on the world at large.

While engineers continue to struggle with long hours, tight deadlines, and continuous



What do you expect your total compensation to be in 2022? (Base Salary)



education, they're prospering for the most part, as rising consumer prices and strong demand for workers help drive up wages.

Bonus Points

While the economic fallout from the pandemic weighed on wages in 2020, times are changing. Last year, many employers doled out bigger pay increases to attract and retain skilled engineers in a tight labor market.

Some warned that high inflation threatens to wipe out many of their pandemic-era pay increases. However, the survey reveals that most professional engineers will still see strong gains in overall compensation this year.

Employers are putting more money into the pockets of electrical and electronics engineers apparently across the board. Among the engineers who responded to the survey say that they expect to have a median base salary of \$125,000 to \$149,999 in 2022 (see figure above). More than 60% of respondents said their base salary will fall into the range of \$100,000 to \$199,999, signaling that companies are willing to pay for engineering talent.

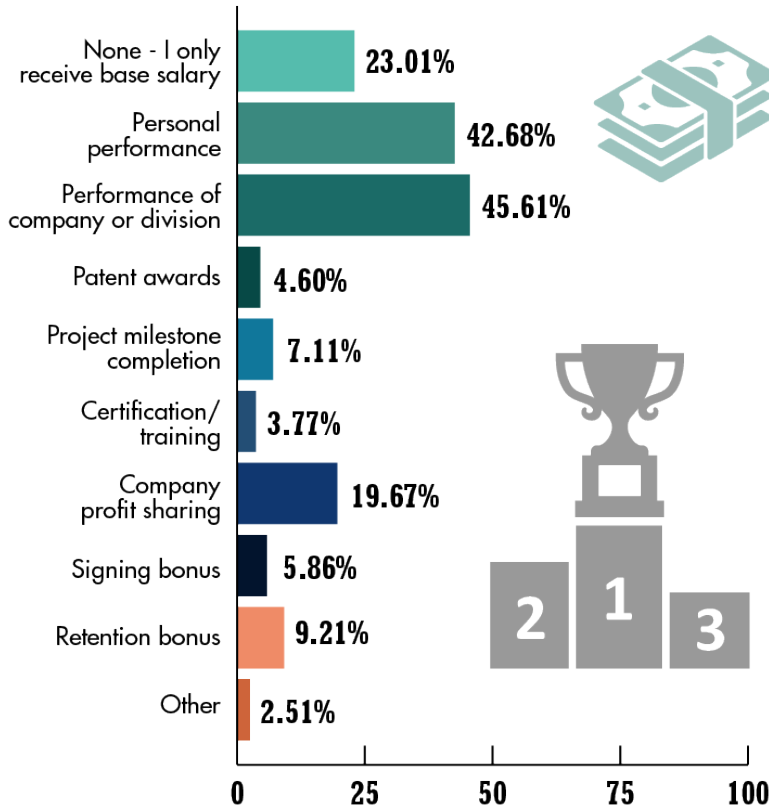
Nevertheless, compensation for engineers is rising at uneven rates in different industries, and it often depends on a wide range of other factors like education, title, experience, age, and geographic location, among others.

"Technology is constantly evolving," said one of the engineers who responded to the survey. "Those that can train themselves in a skill that is or will be in high demand will do well."

The vast majority of employers plan to pay out bonuses this year, supplementing engineers' salaries with a median bonus of \$2,000 to \$2,999. About 21.5% of respondents are in store



Of the bonuses and other direct cash payments over and above base salary that you receive, please specify the primary reason(s) for them?



for \$5,000 or more in bonus pay this year.

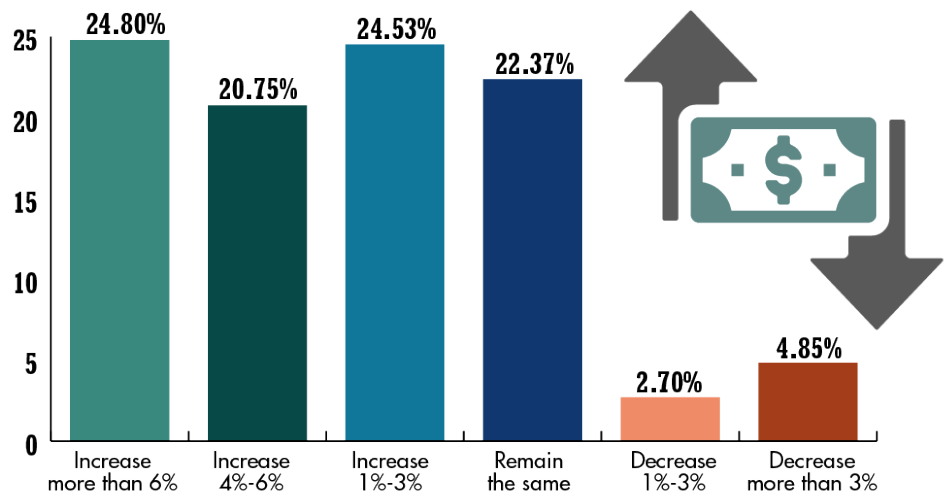
Lots of factors are at play when it comes to calculating bonuses. Many of the respondents (42.7%) get bonus pay based on their personal performance, while others (45.6%) said that their bonus depends on the company’s performance. Still others (19.7%) indicated that they partake in profit sharing. It’s relatively rare for engineers to get bonuses for anything else, such as finishing a design, hitting a project milestone, or being awarded a patent.

Only around a third of respondents said they expect stocks to be part of their compensation package this year. About 15% noted their employers offer purchase plans so that they can buy stock at a discount. And approximately 13% of professional engineers are counting on \$10,000-plus in stock awards in 2021, according to the survey.

In terms of compensation, about 25% said that it will rise by more than 6% this year—almost double the total in 2021—signaling that companies are raising engineering pay even as the global economic outlook darkens.

According to the results, around 45% report they will see wage growth of between 1% and 6% in 2022. But as inflation rises rapidly, these paychecks will not go as far as they used to—or as far as they want.

How will your total 2022 compensation (salary, bonuses, etc.) compare to what you earned in 2021?





About 22% said their compensation will be unchanged, whether because of economic pressures, business challenges, cost-saving measures, or other factors, such as older workers reaching the top of their pay range or retiring. Only about 8% of engineers said their wages will decrease this year, about the same percentage as last year.

The gains in compensation come as companies confront what they claim is a widening talent shortage. The apparent shortage of engineers—or at least the perception of it—has been worsening for years at this point.

In 2020, 54% of survey respondents said their companies were having hiring troubles. In 2021, the figure soared to 67%. Now, over 76% say they're struggling to find qualified candidates for open positions.

And while many engineers complain that they have to move into management or executive roles to start seeing strong gains in compensation, the shortage of engineering talent is paying off for workers with the skills sought by companies.

As one pointed out, "I think companies are starting to realize they need to pay better to keep their top talent."

Staying Competitive

While many engineers feel as though they deserve to be making more money, around 90% say they would recommend engineering as a career path to young people looking for competitive pay and room for growth.

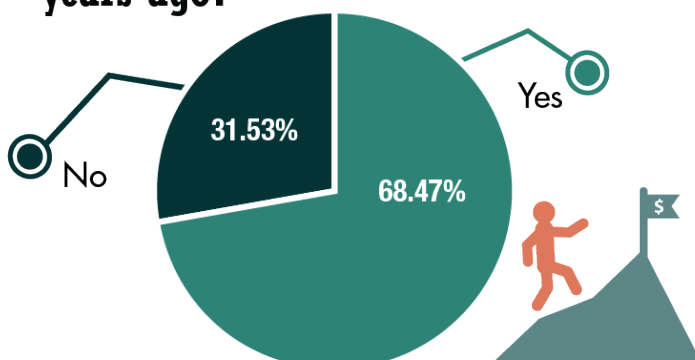
Said one respondent, "The need for engineers will always be there and, if history proves anything, new fields of engineering will be developed in future generations."

Around two-thirds of engineers say their employers sufficiently compensate them for their work, a slight increase compared to last year. But many can't shake the feeling that the grass is greener on the other side of the electronics industry.

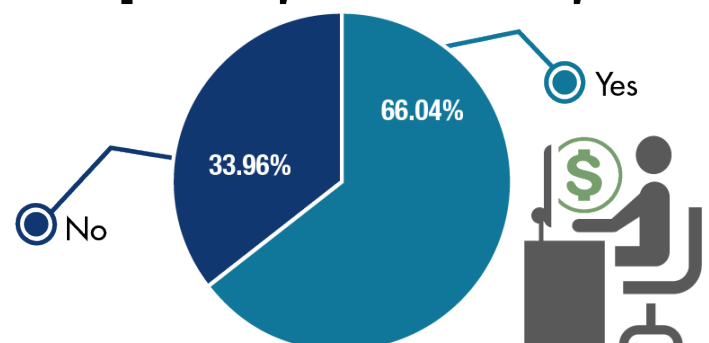
About 36% feel their compensation is as competitive as what other companies are paying for the same job, while only 25% said they're probably better compensated than their peers at other employers.

Over 39% indicated that their compensation is likely less competitive than what other

Do you believe that a career path in engineering and the potential for salary advancement is as promising today as it was five years ago?



Do you feel your company adequately compensates you for the work you do?





firms are willing to pay this year.

While most respondents said that their companies pay them what they're worth, others feel that they deserve to be making more money—in some cases a lot more. Many think that their salaries are out of step with the level of education that's required for the job, the level of expertise they need to bring to the table, and the increasingly wide range of responsibilities and technologies they must stay on top of to succeed.

Among the one-third of respondents who feel short-changed by employers, more than half believe they're entitled to a raise of 10% to 25%, while around 30% indicate that they should be paid more than 25% over their current salary.

Employers also are increasing non-wage compensation and offering other perks to keep engineers from leaving for other jobs. Many are putting up the money for continuing education, as the engineering shortage pushes them to nurture new skills internally, and even reimbursing for tuition. Some respondents say they're also footing the bill for travel to in-person industry conferences and training courses to keep them up-to-date.

Covering the cost of healthcare continues to be one of the top priorities for employers, according to respondents, and many also are paying for work-from-home-related expenses and resources, including internet.

While electrical engineering can be a grind at times, most professionals said there is room for growth. The potential for salary advancement in engineering, said 68.5% of respondents, is at least as favorable as it was before the pandemic.

As one put it, "Business majors are not going to design these things."

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Credit: Dreamstime, Visoot-Uthairam

CHAPTER 4:

Are Management Issues Unique to Twitter?

WILLIAM G. WONG, Senior Content Director, *Electronic Design*

Twitter appears to be dropping or driving off many of its staff, but is this circumstance isolated to just one company?

Elon Musk's takeover of Twitter has been one of the most anticipated and discussed near-term events. Musk's actions after the acquisition have substantially changed the company, including firing a significant portion of its staff and implementing requirements such as forcing office work with minimal exceptions.

Our annual Salary Survey indicated that over three-quarters of the companies were more focused on employee retention than last year. Twitter obviously isn't as interested in overall retention at this point and many other tech companies have announced significant layoffs or planned layoffs.

Twitter's potential implosion will have a major overall effect on social media, but social media is a small fraction of the collaboration tools being used by engineers and programmers in general (Fig. 1). Twitter is only one of many social-media platforms mentioned in the survey. We also found that more than three-quarters of the respondents were using collaboration tools with vendors and third-party companies. Likewise, using these collaboration tools is on the rise.

One of Musk's other changes is an across-the-board return to the office with few exceptions. COVID-19 turned work-from-home from an exception, at less than 10%, to the norm (Fig. 2). Many jobs can't be done remotely; however, in our industry, a majority of chores are able to be handled remotely. In general, a reduction in distractions thanks to working from home has improved efficiency once participants are provided with master collaboration tools. These are even useful if workers are in an office.

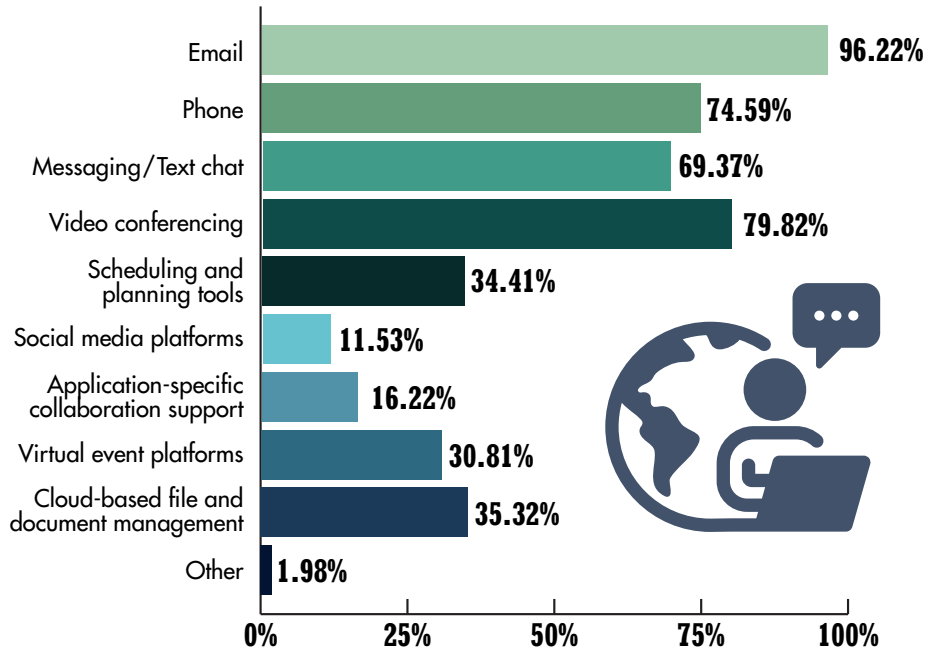
For example, tools like Zoom and Microsoft Teams have moved to the forefront due to the dominance of remote work. It also has changed the way marketing, engineers, and programmers interact. For example, it has made it very easy for us at Electronic Design to provide video interviews because the use of video conferencing has become ubiquitous.



Preparation and support are key to the success of remote work. For example, [Green Hills Software](#) had already been [working on a hardware testing farm](#) that was designed for remote operation (Fig. 3). This is akin to the dark factory or dark warehouse, where robots are remotely managed. Likewise, digital twins are

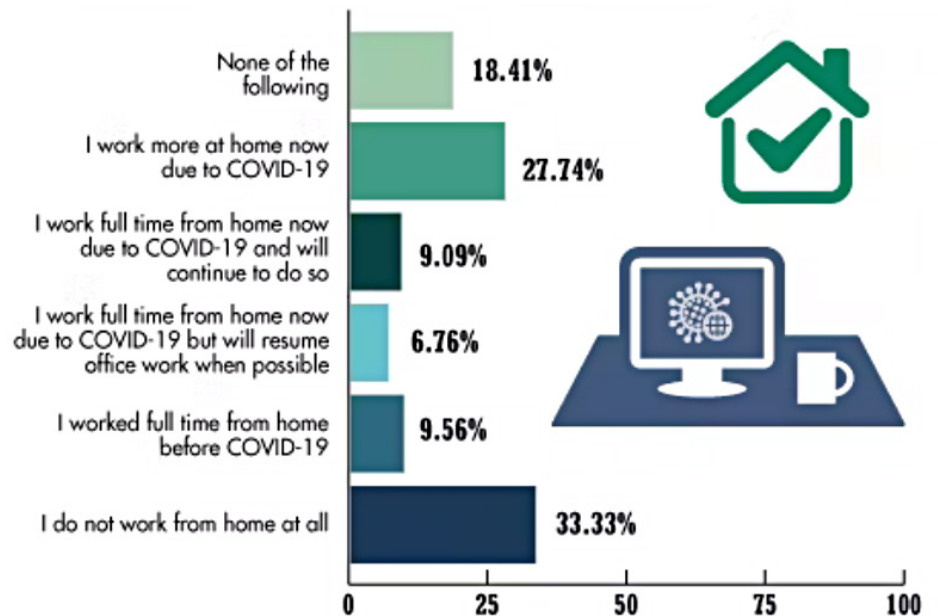
1. Email, telephone calls, texting, and video conferencing make a bigger impact on engineers and developers than social media like Twitter.

What collaboration tools are you using on a regular basis?



2. COVID-19 turned work-from-home from the exception to the rule. It appears that work-from-home will remain the norm even as many companies force workers back to offices.

Which of the following apply to your job situation? (Choose all that apply)





3. Green Hills Software's remote test network enables engineers and programmers to test applications on the collection of hardware from any location.

designed to provide remote tracking and management of real hardware. There are many benefits to this approach that essentially complement remote work.

Work-from-home is a benefit being sought by many engineers and programmers who are changing jobs, and it's an option offered by numerous companies. This could be one aspect triggering the migration of technical employees away from Twitter. Moving toward new opportunities is something many such employees are looking for; moving away from a "challenging" work environment is another.

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Credit: Istockphoto

CHAPTER 5:

A Fresh Perspective On Traditional Issues

BOB VAVRA, Senior Content Director, *Machine Design* and *Power & Motion*

Power & Motion's annual Salary & Career Survey features a younger group facing the same engineering challenges.

The annual *Power & Motion Salary & Career Survey* has a younger perspective in 2022 as a new generation of engineers in fluid power and electric motion control design and management are shaping the discussion.

Past surveys have tended to skew toward experienced workers. [In 2021, for example, 59% of respondents](#) were over the age of 50. In 2022, 71% of the respondents have been in engineering less than 10 years and 84% are under the age of 45. Their educational experience also is somewhat different—while 28% have a bachelor's degree and another 30% possess a post-graduate degree, 22% have an associate's degree and 18% have attended college.

Despite the demographic differences with past survey groups, their outlook on engineering and manufacturing in a post-pandemic, economically challenged world is largely the same. They see great value in their work and in the field of engineering, they recognize the challenges of staying current with the swift adoption of digital technology and their performance concerns center on product reliability, quality and customer service.

Facing the Challenges

Survey respondents cited a wide array of business and professional challenges in the past year. While no one issue dominated the survey, the top concerns were focused on product reliability and the value of their finished products. The lingering COVID-19 pandemic and finding the right product to specify for their designs were also among the things keeping engineers up at night.

One overarching comment from respondents was the issue of time. A respondent said his challenge was “getting the adequate amount of time to get future-proof design knowledge and the willingness of management to learn and innovate and invest into technology.”



Approximately how long have you worked in engineering?

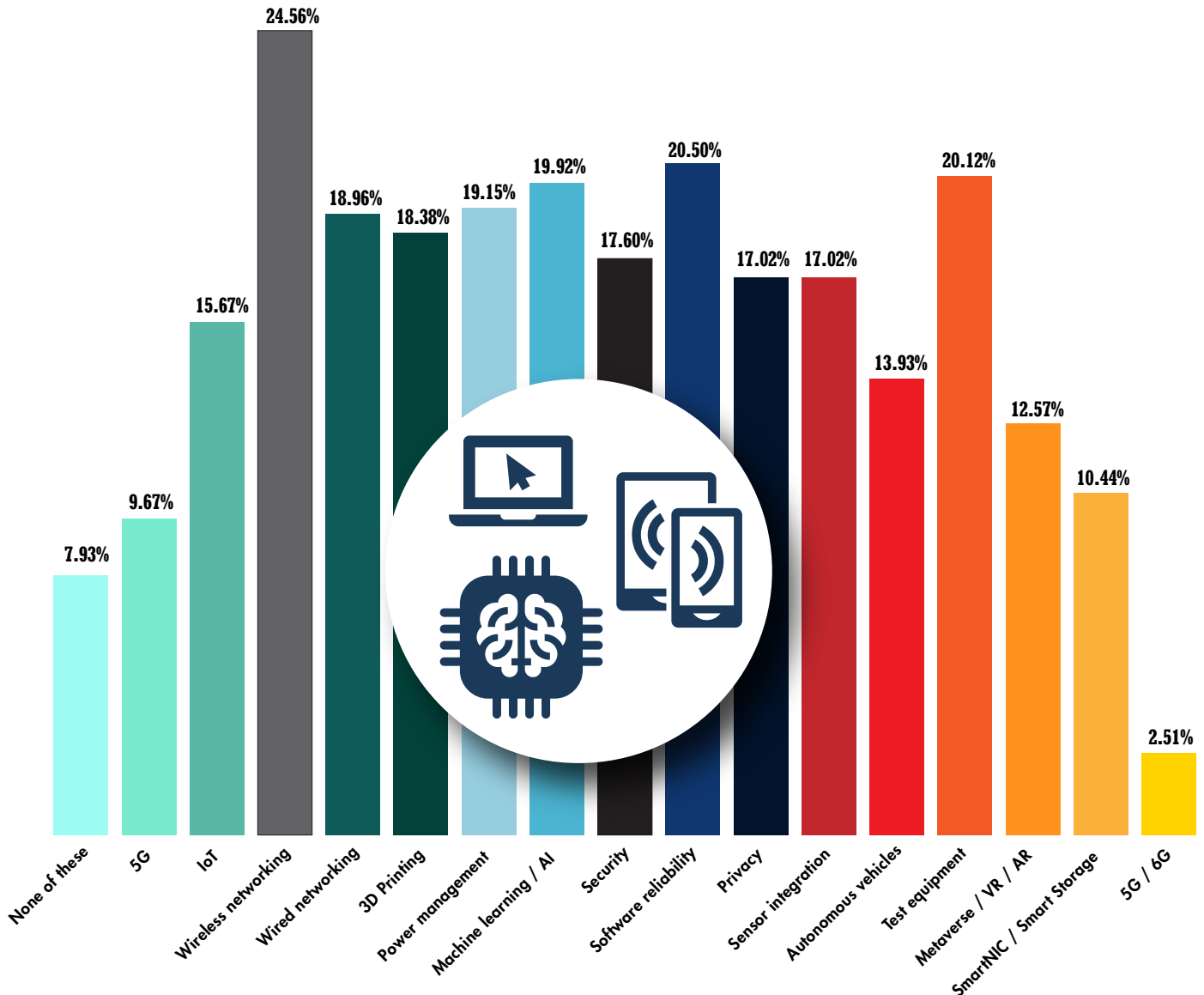


- Less than 1 year **1.38%**
- 1-4 years **33.93%**
- 5-9 years **37.87%**
- 10-14 years **8.48%**
- 15-19 years **3.75%**
- 20-24 years **3.35%**
- 25-29 years **4.34%**
- 30-34 years **2.96%**
- 35-39 years **1.97%**
- 40 years or more **1.97%**

The adoption of technology has been a major issue in the fluid power industry, and implementing those innovations is another challenge of both time and available skills. One respondent noted the challenge of “finding the time to educate, improve, stay current while still performing all my work duties and maintaining work-life balance and supporting my family.” Another noted the “constant additional high amount of time and work parallel to ongoing tasks and prioritization of tasks.”

Technologies which are impacting designs were wide ranging with wireless networking as the only one which approached 25% among survey respondents. Test equipment and software reliability were cited by at least 20%

Which of these technologies have a major impact on your designs?





of respondents, and machine learning, power management and wired network were next on the list. One anomaly among the Power & Motion survey results that reflects on the younger skew of this year’s survey: the recognition of augmented reality and the emerging concept of the metaverse. It was cited by 12.5% of engineers—more than four times higher than any other result from similar surveys conducted by sister publications to *Power & Motion* within Endeavor Business Media’s Design & Engineering Group.

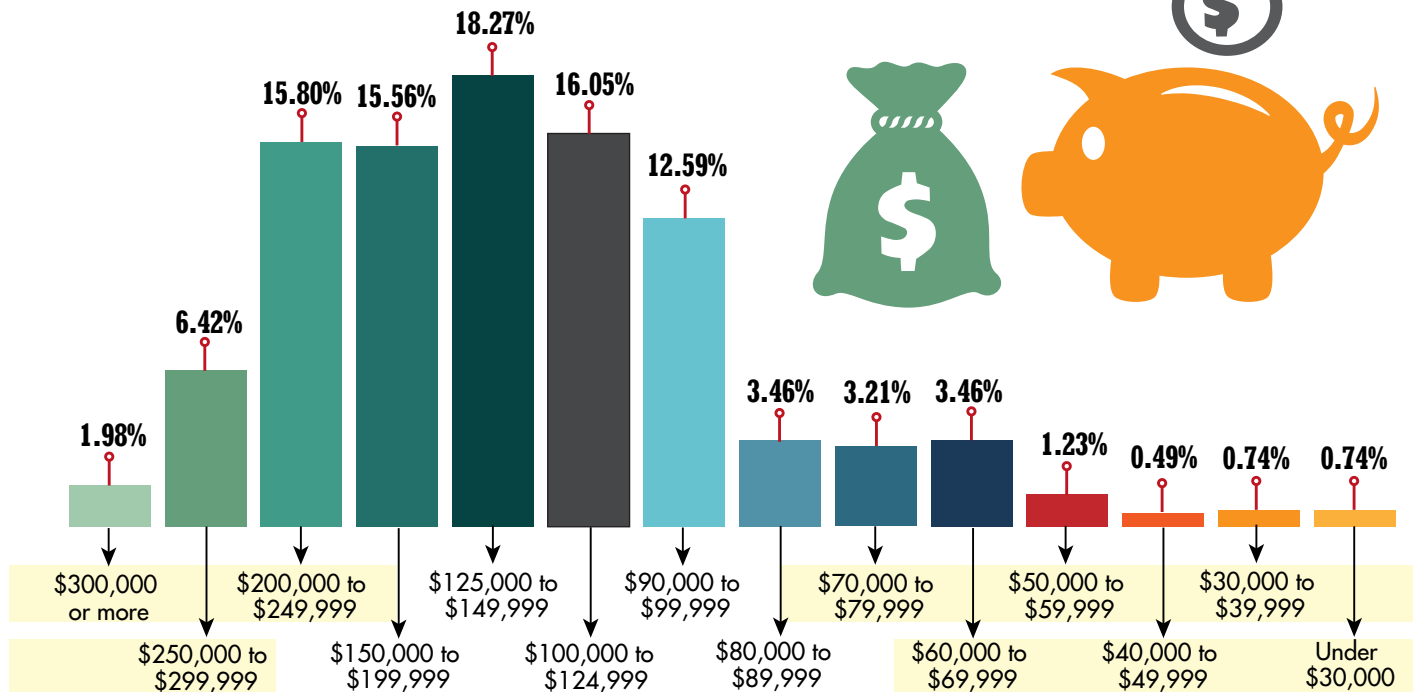
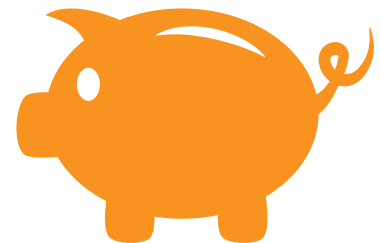
That was reflected in the comment of one respondent: “The increasing depth of engineering knowledge and ease of using recent technologies would require tech savviness,” he said. “There are at least three approaches to measure tech savviness: assessing what a person knows, what a person does (or reports doing), and what a person feels (attitudes, especially tech savvy self-assessments).

“Generally, this would mean more training on hands-on experiences which is, more often than not, time consuming as well as money consuming,” he added. “These efforts definitely have to be rewarded for any organization to attract good hands and meet up with the current technological demands.”

Compensation and Recruitment

With a more diverse group of respondents, the levels of compensation in the 2022 Salary & Career Survey also demonstrate a wide range. A year ago, 46% of engineers reported a salary between \$100,000 and \$150,000; in 2022, that number fell to 34%. But salaries above that level rose to 40% of respondents, and 16% were between \$80,000 and \$100,000.

What do you expect your total compensation to be in 2022? (Base Salary)



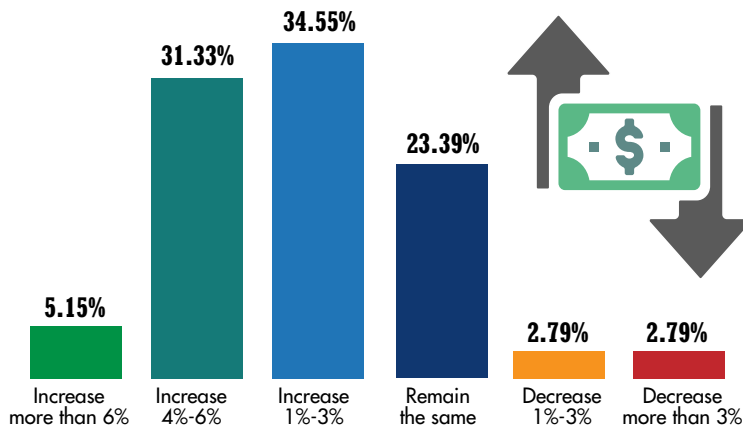


The upward pressure on salaries driven by the continuing shortage of engineers is evident in respondents' views on future compensation. Salaries will continue to rise in 2022, with 71% of respondents expecting some sort of salary increase, and almost 37% expect that increase will exceed 4%. The engineers also feel well-appreciated for this work; 87% said they are adequately compensated for the work they do, and 95% declare themselves satisfied with their profession.

Finding the engineers to continue industry growth remains a challenge. The survey found:

- 85% believe there is an engineering shortage.

How will your total 2022 compensation (salary, bonuses, etc.) compare to what you earned in 2021?

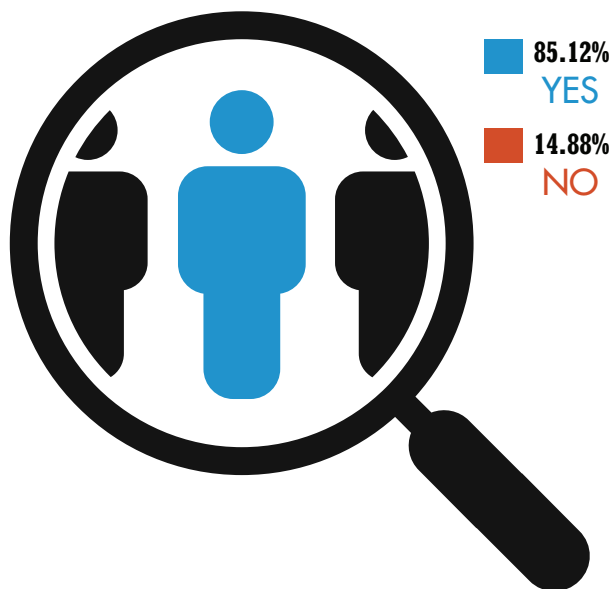


- 83.8% said their company is having difficulty finding candidates for engineering jobs.
- More than half of companies said they are seeking engineers with about 3 years of experience, and another 41% are looking for about 5 years of experience.
- Engineering companies are seeking a diverse group of engineering specialties. Mechanical design and power management are the most sought after specialty, but technologies from software to machine learning to safety and security are needed as well.

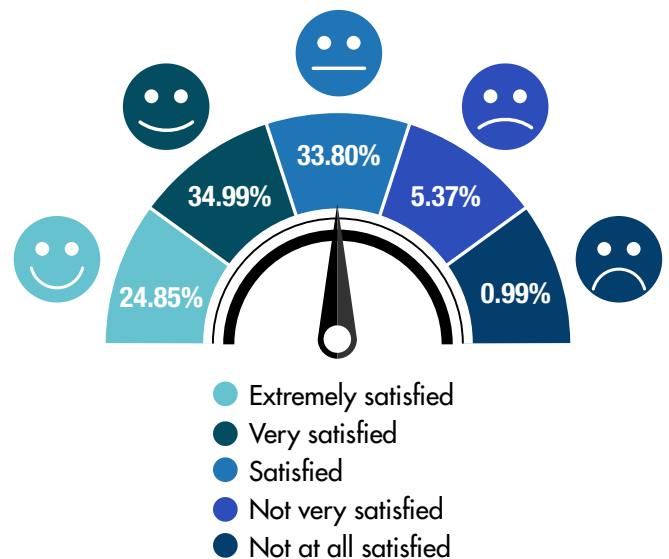
Continuing Education

In the past, the challenge of staying current with technology traditionally meant attending trade shows to scope out new products and participate in seminars to get more information about innovative technologies as well as partake in continuing education at universities or events.

Do you believe there is an engineer shortage?



How satisfied are you in your current position?





The pandemic changed the equation.

Remote sources of learning and information are in wider use among engineers in a digital age, and those resources gained even more acceptance during the pandemic. Engineering videos, white papers, webinars and seminars all were cited by at least 25% of respondents as a source for continuing education. Other in-person events, such as in-person trade shows or user group meetings, fell back during the moratorium on travel and in-person events.

In the interim, more than 35% of respondents said their company paid for registration at online trade shows, more than 28% pay for engineering association dues and engineering textbooks, and 26.6% have paid for college tuition.

That interest in continuing education comes at a time when engineers recognize the need to continue to adapt their knowledge to changing technology. “A lot of engineering industries adjusted to the decrease in demand during the pandemic and are now going back to full operation,” said one respondent. “With that, they have the opportunity to either continue to use the same technology or venture into new ones.”

That quest will continue, added one respondent, “because human progress will never stop, and human progress will never happen without progress in engineering.”

WEBINAR: A DEEP DIVE INTO THE SALARY SURVEY

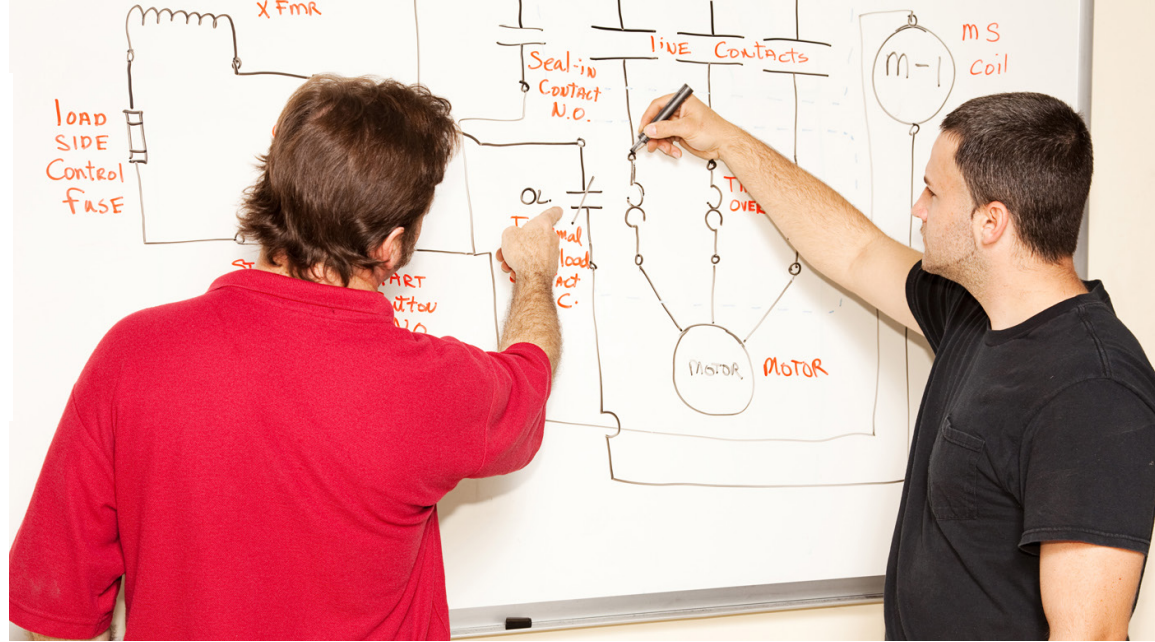
On Nov. 21, editors from *Power & Motion* and sister publication *Machine Design* conducted the webinar ‘The State of Engineering in Fluid Power and Motion Control.’ The editors discussed the results of the *2022 Salary & Career Survey*, examined some of the more interesting trends revealed by the data and looked at how this data will impact the industry and topics editors will follow in the coming year.

Bob Vavra, senior content director for *Machine Design* and *Power & Motion*, moderated the discussion with Rehana Begg, senior editor with *Machine Design* and Sara Jensen, technical editor for *Power & Motion*. The discussion provided further details and examination of the reader survey, how it compares with past years and how it relates to other issues facing the engineering industry.

Register for the webinar to watch it on demand at: www.powermotiontech.com/21250187.

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CHAPTER 6:

2022 Salary & Career Report: Continuing Education

DAVID MALINIAK, Senior Editor, *Microwaves & RF*

What's the current state of continuing engineering education? Our 2022 Annual Salary and Career Report survey provides a snapshot and hints at some trends.

When asked about the biggest challenges in staying current with relevant engineering information, one respondent to our *2022 Salary & Career Report* survey replied, "It's having adequate time to get future-proof design knowledge and the willingness of management to learn, innovate, and invest in technology." That's a representative example of the attitude among engineers about refreshing and/or continuing their engineering educations. There's certainly no shortage of new technologies to stay abreast of, making continuing education a perennial requirement.

In our survey, we asked you to update us on your current level of education and how you prefer to learn about new technologies and skills. Does your employer encourage continuing education by footing the bill, and if so, in what modes? And how does the coronavirus pandemic figure into the picture? In this article, we'll look at these topics with facts, figures, and anecdotal responses.

Education Levels Declining

First, let's look at where you stand with your respective highest levels of education and see how that compares with the 2021 survey responses. The leading response was a master's degree (32% vs. 46% in 2021), followed by a bachelor's degree (22% vs. 19%). Over 13% claim a bachelor's degree plus some amount of graduate studies. However, at 11%, the number of respondents holding a doctoral degree has dropped from 14% in 2021.

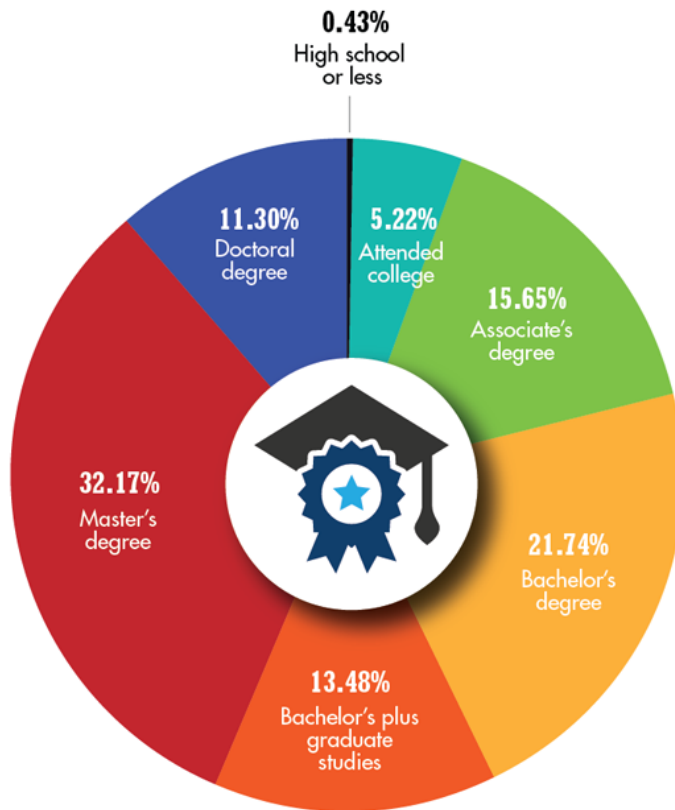
Thus, these survey results suggest that overall, the levels of education among you are declining a bit year on year compared to 2021 at the higher levels of academia.

A Bevy of Educational Options for Engineers

Whether you pursued an engineering career with little or no college-level education or



Which one of the following best describes your highest level of education?



went all the way to a PhD, you still need to keep on top of technology's evolution as you make your way in the industry. So, as we do each year, we asked, "What are some of the ways in which you continue your engineering education?"

The results, as usual, were a mixed bag. Curiously, though, more categories of educational options have fallen off in usage since last year's survey than those that have grown. More than anything other than the anecdotal responses to the survey, this fact points to the time crunch engineers are under in their day-to-day lives.

Vendors to the OEM electronics industry have always done a great job at cranking out videos, white papers, and webcasts to educate engineers on their latest and greatest innovations. All of those mediums are free to consume, and webcasts can usually be viewed on demand if you've missed the live events.

This year's leading category among continuing education options is seminars—nearly 51% of respondents rely on them for information on new technologies. That's a drop-off from 63% in 2021. About 48% favor white papers (down from 67% in 2021), while 47% like engineering publications (down from 71% last year). Webcasts are down to 42% from 58% last year.

Use of engineering textbooks has fallen way off from 56% in 2021 to just 35% in 2022. And eBook usage also has dropped from 42% last year to 35% this year.

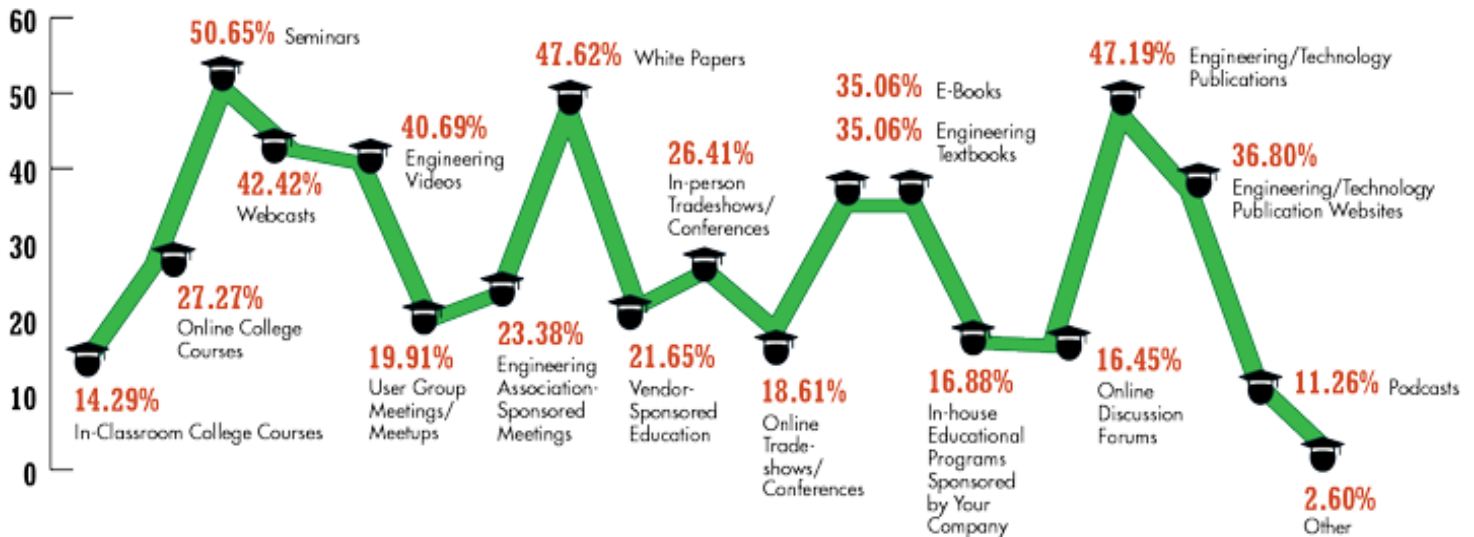
Among the education options, which more respondents say they're looking to in 2022 compared with 2021, are in-classroom college courses (over 14% in 2022 vs. 11% in 2021), online college courses (27% vs. 20%), user group meetings/meetups (20% vs. 17%), engineering association-sponsored meetings (over 23% vs. 17%), and in-person trade shows and conferences (26.4% vs. 26%).

It's interesting that the in-person modes of continuing education—things like in-classroom college courses, user-group meetings, and meetups—comprise most of the education categories seeing more usage this year than last year. Even though COVID-19 is still with us in its various strains, it seems that more engineers are willing to take the risks that come with being out and about and in groups. Hopefully, that trend will continue as we turn the calendar over to 2023 and beyond.

It's About Time

Our survey indicates that fear of contracting disease is no longer the big barrier to continuing education that it was in 2020 and part of last year. Lack of time is what stymies engineers the most. "It's a challenge to find the time to educate

What are some of the ways you continue your engineering education?



myself, improve, and stay current while still performing all my work duties and maintaining work-life balance and supporting my family,” said one respondent. Another chimed in with “Too much time is consumed by trivial tasks at work.”

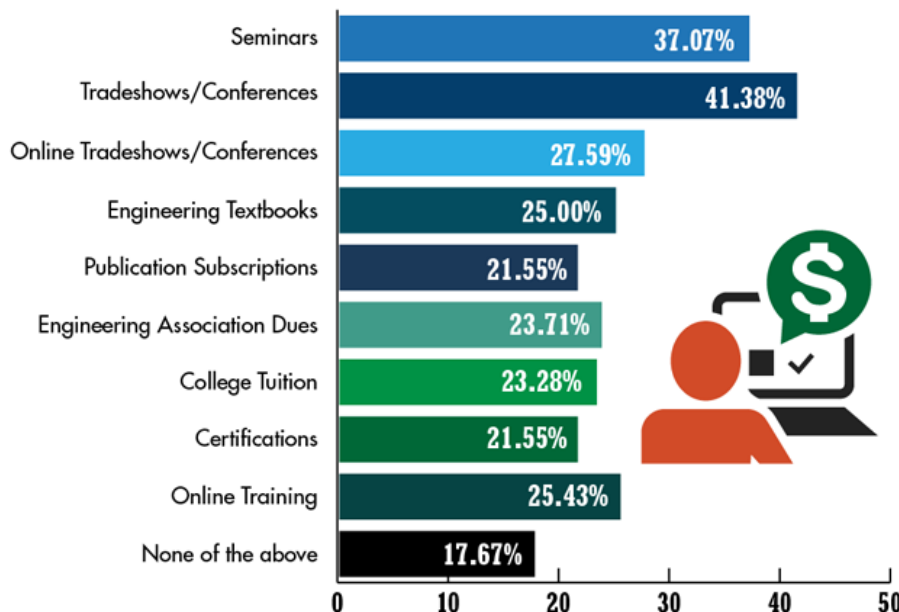
As noted above, work-life imbalance is an ever-present issue for engineers, and not everyone wants to take home training materials or extracurricular reading. “Balancing work and life while keeping up with new trends is very difficult,” offered one respondent. Indeed,

many respondents would rather do it on company time, but it’s just not possible: “I have over an hour commute each way, which is time I can’t spend studying.”

Another oft-cited roadblock is the sheer volume of material to be sifted through and prioritized. “Parsing which technological advances are relevant to my company, and how soon they will be available or reasonably priced, is part of the problem” said one respondent. Meanwhile, another laments that “I cut a large swath from RF to digital to embedded software to CAD. It is hard to stay current across all of it.” Still others cite the combination of the pace of change in the industry and the number of topics to keep abreast of.

To be sure, there’s no shortage of information to be had. Some

For which of these forms of education does your company reimburse costs to engineers? (Select all that apply)





respondents mentioned the need to vet information, both in terms of accuracy and its relevance to current projects.

Employer Support is a Mixed Bag

Finally, we asked whether your employer invests in its engineering staff through reimbursement of the costs of continuing education. Our 2021 survey showed a broad downward trend in support for employees. This year, the results have unfortunately declined again in most categories.

First, the good news: Here are some examples of cases in which employers are being more generous. When it comes to the cost of online tradeshows and conferences, 30.5% of employers helped this year vs. 20% last year. They were a bit more generous for engineering textbooks (27% vs. 25.5%) and with engineering association dues (25% vs. 21.5%).

But sadly, in many other modes of education, employers in 2022 are less supportive of their staffs' professional growth. Seminars (33% in 2022 vs. 38% in 2021), in-person tradeshows/conferences (37% vs. 39%), college tuition (26% vs. 31.7%), certifications (23% vs. 29%), and online training (26.6% vs. 32%) have all seen declines in the number of respondents saying their employers helped foot the bill.

Even though employer support is down for many facets of continuing engineering education, only 14.5% of 2022 respondents told us that their employers didn't support continuing education at all. In 2021, 27% said they got no help in any respect. So, overall, it seems that more employers are helping in some way than not at all, and likely in lesser amounts when they do.

Without a doubt, staying on top of technology trends and project-relevant information is a difficult endeavor. Here's hoping you're able to maintain and expand your knowledge base sufficiently in 2023 to keep you at the top of your game.

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CHAPTER 7:

Keeping Up: Survey Hears from Engineering on Skills Competency

REHANA BEGG, Senior Editor, *Machine Design*

Machine Design's 2022 Salary Survey polled engineers about their preferred methods for ongoing education.

In an ever-changing field of technology, engineers expect continued learning to be part of the job. Flexibility in engineering often means improving current skill sets and cultivating new ones. And if being able to adapt to changing situations is among the most important skills an engineer can possess, what do engineers perceive as the obstacles to building those skills?

Machine Design's 2022 Salary Survey, which polled a cross-section of readers, offers a glimpse into the challenges engineers face and the opportunities employers can seize to help right-size their staffing efforts.

More than 40% of all participants in this year's survey have at least a bachelor's degree or higher level of education. This foundational education is often not enough to support ongoing job requirements or competency. Typically, engineers will look to continuing education and training while performing professional duties to stay current.

Focusing on the education-related survey questions, we highlight a few insights into ongoing education formats and the respondents' preferences.

You Get What You Pay For

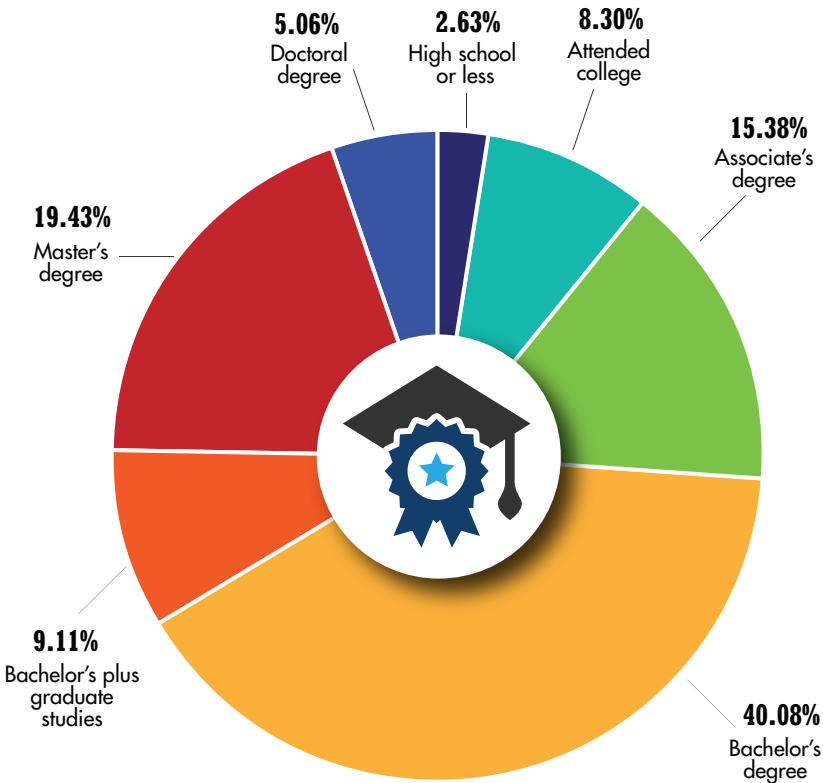
The survey asked: "What are some of the ways you continue your engineering education?"

Respondents replied: Engineering videos (43.55%), seminars (34.48%), webcasts (37.10%), engineering/technology publications (35.48%), engineering/technology publications websites (31.05%), white papers (33.47%), as well as in-person trade shows and conferences (29.64%) ranked favorably amongst respondents. Low on their list of preferences were in-classroom college and employer-sponsored courses (15.73%), online discussion forums (15.12%) and podcasts (12.10%).

Respondents were then asked to indicate which of the education forms are paid for by their employers. In line with engineers' learning preferences, the survey showed that



Which one of the following best describes your highest level of education?



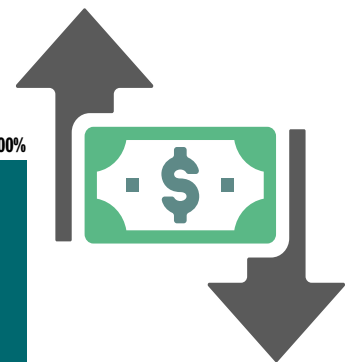
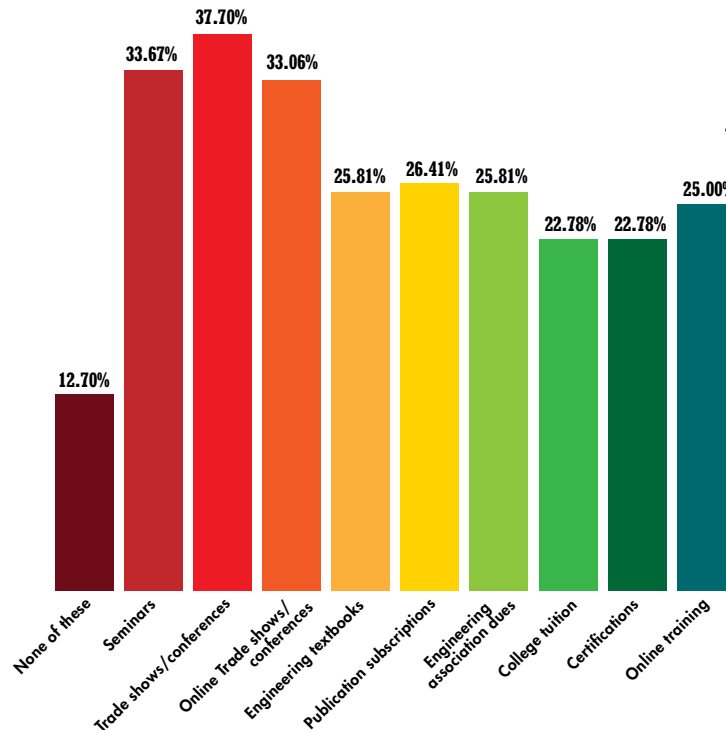
employers were likely to pay for employees' attendance at trade shows and conferences (37.7%), as well as seminars (33.67%). Only 22.78% paid for certifications or college tuition, and 25.81% paid for engineering association dues.

Keeping Up

Asked what the biggest challenges were in staying current with engineering information relevant to your work, the most common answer was time. But if respondents were feeling time-strapped, they were further challenged to find information applicable to their job responsibilities. Sifting through useful, relevant information from an abundance of online sources, finding summarized information on emerging technologies and finding specialized courses were just a few of the impediments noted.

Concerns about knowing rapidly changing technology and which is most relevant to the company was a common refrain. "Parsing which technological advances are relevant to my company, and how soon they will be available or reasonably priced," noted one respondent. Another pointed to the fact that the cost of new technology

For which of these forms of education does your company reimburse costs to engineers?





“is seen by management as too high to incorporate.”


At least a couple of respondents alluded to the generational divide amongst engineers and their ability to adapt technological advancements to their current work environments. “As you get older, you tend to be a little slower to learn new skills, and you need to put more effort into learning and improving,” expressed one respondent. “Young talent is abundant, and they have the advantage of age,” said another.

A Question of Trust and Transparency

There were other interesting comments that fed into the survey. One concern was that some publications miss the mark on serving the needs of their engineering audiences, and took umbrage with “dishonest technical publications that try to steer industry toward certain trends.”

Several others said the tasks of “finding accurate information and reviews along with adequate customer specifications” were arduous. “Finding accurate information and reviews along with adequate customer specifications,” was another sentiment echoed on this theme.

All told, perceptions matter. Engineers, like most employees, want to be heard. They want to contribute and want to be part of something meaningful. It all speaks to the appreciation they have for the efforts their employers make to their livelihood and the measure of effort they are willing to invest in their professional growth.

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What are some of the ways you continue your engineering education?

