

# **AC 2009-241: CR4 AND GLOBALSPEC®: INVALUABLE TOOLS FOR ENGINEERING EDUCATION**

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# CR4 and Globalspec™: Invaluable Tools for Engineering Education

## 1. Abstract

This paper introduces two websites that can be invaluable to engineering and technical educators. *Globalspec* (<http://www.globalspec.com>) is a web-based engineering tool and engineering search engine regularly used by over 3 million registered engineers, educators and technical people. The second site is *CR4* (<http://cr4.globalspec.com>), a community-based site – associated with Globalspec - where engineering news, industry based engineering forums, and more than 80 engineering blogs reside. Both sites can be used extensively in academic environments. The author has incorporated both sites in regular teaching of courses such as Analog Electronics, Digital Electronics, and Microcontroller Applications. A description of the sites follows.

## 2. CR4

CR4 is an important web community for engineers, engineering educators, students and technical professionals. Nowadays the Internet (especially with the introduction of Web 2.0) is closer to the original idea of its inventor. The web has become a place where anybody can communicate easily and frequently using tools such as blogs, wikis, forums, ePortfolio, podcasts, newsletters, folksonomies (social tagging), general social networking activities, and the like. This development is interesting for the educational community. For the engineering education community, in particular, the many tools and resources available are already having an impact on the future of technical teaching. CR4 has been acquiring importance in this arena because it contains a plethora of knowledge spread in many sections and engineering categories. It is, in essence, a search engine of its user's knowledge and experience.

At this writing the statistics associated with CR4 are impressive: more than 500 posts a day from engineers and other technical users; it has more than 300,000 visitors per month; it hosts 14 specialized forums (such as Education, Electrical Engineering, biotechnology, etc.); it hosts 109 high technical blogs (unmatched in the Internet); more than 100,000 subscribers receive the *CR4 Daily Digest*, a newsletter-type e-mail communication, and over 25,000 registered users. All these numbers make CR4 one of the most active technical communities on the web, where engineering educators, students, the technically savvy, and the curious general public meet every day to share knowledge, to discuss, and to learn. With CR4, engineering groups with diverse interests at physically separate locations can become a close community using online collaboration tools. The author uses CR4, as well as Globalspec, in the classroom for assignments, exploration, research and projects. My students visit these sites regularly as part of their real world education. Some of the CR4 sections which are of interest to the academic community are listed here.

## Blogs

In CR4 there are a great variety of blogs directed by industry professionals that can be used as teaching aids in technical classes. Blogs are important tools in today's turbocharged information age which could be used to expose the students to real life problems and their solutions. This is particularly important when the blogs are directed by people working in the industry, and who are engaged in the latest development in their fields. In my Electrical Technology classes I use CR4 as research tool. Every semester I assign the students to follow a particular blog where they have to participate until the thread is finished. The students are graded on their participation and contribution to the thread. It is important for me to see that the students develop the capability to ask the right questions. Some of the blogs at CR4 where my students have participated are Data Acquisition, Semiconductor Manufacturing, Electronic Components, Appliance technology and others related to the subject matter of the course.

## Latest Engineering News

This section is a daily summary of news related to engineering, engineering education, science and technical matters in general. I recommend to my students to get acquainted with engineering news publish by CR4.

## Questions and Answers

This is probably the most popular section of CR4. Daily, users from all over the world post technical questions that are answered by users and by the engineering staff at Globalspec. Even if I do not formally assign projects for this section, I encourage the students to read and if possible to answer questions related to Electrical Technology. I consider this activities an integral part of the student education.

## Forums

At the time of this writing there are 14 specialized forums in CR4. These forums can be used, just as the questions and answers section as educational tools in classroom. Some of the forum titles are: "Education", "BioMech & BioMed", "Communications & Electronics", "Instrumentation", "Mechanical Engineering", "Electrical Engineering", "Sustainable Engineering", and others.

## Special Sections

There are also some special sections dedicated to topics such as Hobbies, Projects and others.

## 3. Globalspec

Globalspec ([www.globalspec.com](http://www.globalspec.com)) is an Internet-based engineering search engine and the largest online database of technical catalogs. Users can search the huge engineering database of technical components by specifications, part numbers, patents, application notes, government and industry standards, and thousands of manufacturers. Globalspec

simplifies the task of specifying engineering parts and components by using powerful parametric searches. Since its inception in 1996, Globalspec has seen a steady increase in registered engineers and technical buyers that daily use the free service to look for parts and other information for design, testing and other purposes. Globalspec presents detailed product information provided by a broad base of manufacturers of optical components, mechanical parts, electrical products, semiconductors, materials, manufacturing systems, instruments, sensors, process systems and many other industrial products. Also, it a big repository of technical knowledge in thousands of *Learn More...* pages that are available to its users.

It offers a unique, specialized, searchable database of parts, components and services along with innovative, engineering-only information retrieval capabilities, both of which are unmatched by any other search engine. The utility of Globalspec is threefold. Technical buyers use it as their number one online destination to locate products and services, learn about suppliers, and access comprehensive technical content on standards, patents, specifications, designs and application notes. GlobalSpec's SpecSearch technology lets users search by detailed product specifications in the world's largest parametrically searchable database of technical products, services and related industrial catalogs.

The author makes use of Globalspec in the classroom in homework assignments and design projects where the students must select real mechanical and electronic parts to complete assignments and lab work. Beyond gaining the ability to perform parametric searches to find and select the correct components needed for a new design, engineering students can learn a great deal by browsing through the GlobalSpec site. The site provides many opportunities for users to explore and learn about technical products. The following list introduces some of these tools that can be accessed through the main Globalspec page.

- *Technical Products*, such as transistors, gears or linear encoders can be precisely selected,
- *Learn More... pages* constitute an enormous depository of engineering knowledge that can be easily accessed by students. The young engineer, scientist or technologist can gain a better understanding of the specifications or attributes for a particular component or product by accessing Specifications pages located at the bottom of the "Learn more about" pages.
- [Engineering Web<sup>SM</sup> Searches](#) – Web searches using the GlobalSpec search engine will return results more pertinent to the young engineer compared to the general-purpose search engines. An Engineering Web<sup>SM</sup> search for "Pumps" will return links on industrial pumps, while a search on a general-purpose search engine returns results high heeled shoes. An Engineering Web<sup>SM</sup> search for "strippers" will return links on cleaning agents or chemicals as one would expect, while a search on a general purpose search engine returns results, which educators hope are not of interest to good engineering students.

- *Application Notes and Technical Articles.* The application notes product specific white papers or application notes to gain a better understanding of the use or implementation of a product or component in certain designs,
- *Technical Newsletters.* Globalspec distributes more than 50 newsletters to over 7 million subscribers. The education focused newsletter *Engineering...Beyond the Classroom* is of particular interest to engineering educators.
- *Calculators.* Globalspec site contains an extensive set of science and engineering calculators.
- *Part Number Search.* The site provides a free part-number search utility which is extremely helpful, in particular, for electronic design.

#### 4. Finding Engineering Components with GlobalSpec

For several years the author has been using Globalspec's area-specific advanced search technology, SpecSearch®, in consulting works and I have been teaching these techniques in classes. With Globalspec we can search by specification more than 75 million parts representing over 1.2 million product families from more than 11,500 supplier catalogs. By using the Globalspec search capabilities and tools, engineers can save countless of hours of non-productive time because there is no need to use the old way of manually searching for precise products attributes by browsing print or PDF catalog after catalog for many hours, in order to find the precise electronic part needed for a given project. Often individual suppliers would present their product specifications using different formats or terminology. On GlobalSpec, specifications and features are standardized within an area, which facilitates faster head to head product comparisons.

A typical part search using Globalspec can be summarized in the following steps:

1. Link to Globalspec ([www.globalspec.com](http://www.globalspec.com)). See Figure 1, below.



**Figure 1:** Globalspec Main Page

2. Enter the component you are looking for (Op-amp, Temperature Sensor, Transistor, FPGA, Analog-to-Digital Converter, Bluetooth Chips, etc.) in the “Find” box and select “Go” or enter. Alternatively, a user more experienced with the GlobalSpec site can browse through the taxonomy of industrial product categories.
3. Step 2 will bring an area or product specific advanced search form (or filter) and a list of manufacturers. At this point you may select a company that manufactures the component or you may want to narrow your part search by selecting parameters from the filter, as shown below in Figures 2 and 3. The search specifications shown are for a Power MOSFET where values of the drain breakdown voltage  $V_{(BR)DSS}$  (at least 15.00 volts) and the steady state drain current  $I_{DSS}$  (at least 12.00 mA) are required. Note that all the specifications in the filter have a “No Preference” default value. This feature allows engineers to search for the most important or most needed parameters.

Online Custom

**Enter one or more General Specifications criteria:**

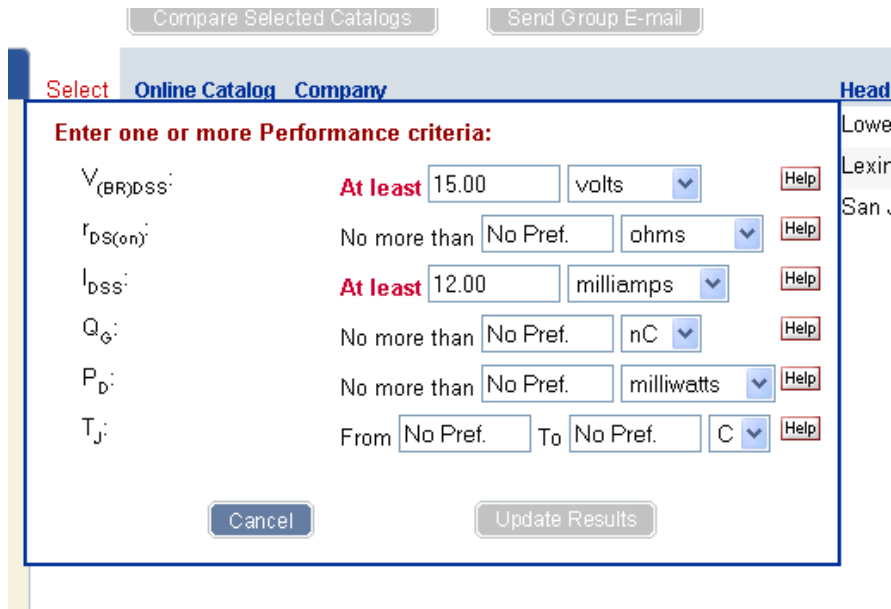
Polarity:  **No Preference** [Help](#)  
 N-Channel  Complementary  
 P-Channel

Operating Mode:  **No Preference** [Help](#)  
 Enhancement

Power MOSFET Type:  **No Preference** [Help](#)  
 DMOSFET  Other

Production Status:  **No Preference** [Help](#)  
 Full Production  New Product  
 Discontinued  Other  
 In Development

**Figure 2:** One section (General Specifications) of Power MOSFETs Filter



**Figure 3:** Another Section of the filter (Performance Criteria)

- After selecting the required specifications, a list of manufacturers that sell the specified component will be shown. By selecting one of the manufacturers a *catalog or matching products table* will present the results, as shown in Figure 4. The matching table will show all the components from the selected manufacturer. In our example we found 717 power MOSFETs from STMicroelectronics, Inc. that fit our search criteria. Suppose that you want to narrow the search by selecting an N-type MOSFET with a power dissipation ( $P_D$ ) of no more than 30.00 Watts. This new set of criteria will produce a matching table for STMicroelectronics of only 19 products instead of the original 717. See Figure 5.

Power MOSFET  
STMicroelectronics, Inc.

choices? [Filter your results](#)

15 of 717 that meet your specifications Page: 1 2 3 4 5 6 7 8 9 10 Next»

Selections Now

Product Name	Get Product Information		Contact the Manufacturer			General Specifications						
	Product Spec Sheet	Info on Company Web site	Request for Quotation	Order Sample	Send an E-mail	Polarity	MOSFET Operating Mode	Production Status	Type	$V_{(BR)DSS}$ (volts)	$r_{DS(on)}$ (ohms)	(mi)
000	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a>	• <a href="#">Request quote</a>	• <a href="#">Order Sample</a>	• <a href="#">Send E-mail</a>	N-Channel		Full-Production		60.00	5.00	
002	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a>	• <a href="#">Request quote</a>	• <a href="#">Order Sample</a>	• <a href="#">Send E-mail</a>	N-Channel		Full-Production		60.00	5.00	
320	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a>	• <a href="#">Request quote</a>	• <a href="#">Order Sample</a>	• <a href="#">Send E-mail</a>	N-Channel		Full-Production		100	0.1300	
330	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a>	• <a href="#">Request quote</a>	• <a href="#">Order Sample</a>	• <a href="#">Send E-mail</a>	N-Channel		Full-Production		100	0.1600	
340	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a>	• <a href="#">Request quote</a>	• <a href="#">Order Sample</a>	• <a href="#">Send E-mail</a>	N-Channel		Full-Production		100	0.0700	
320	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a>	• <a href="#">Request quote</a>	• <a href="#">Order Sample</a>	• <a href="#">Send E-mail</a>	N-Channel		Full-Production		200	0.8000	

**Figure 4:** Matching Table for criteria  $V_{(BR)DSS}$  at least 15 V, and  $I_{DSS}$  at least 12.00 mA

Catalog: Power MOSFET  
 from: [Universal Semiconductor, Inc.](#)


Too many choices? [Filter your results](#)

Products 1 - 15 of 19 that meet your specifications Page: 1 2 Next»

		Get Product Information		Contact the Manufacturer		General Specifications		
	Product Names	Product Spec Sheet	Info on Company Web site	Request for Quotation	Send an E-mail	Polarity	Operating Mode	Type
<input type="checkbox"/>	SD1107BD	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a> • <a href="#">View PDF</a>	• <a href="#">Request quote</a>	• <a href="#">Send E-mail</a>	N-Channel, P-Channel*, Comp*	Enhancement	DMOSFET
<input type="checkbox"/>	SD1107DD	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a> • <a href="#">View PDF</a>	• <a href="#">Request quote</a>	• <a href="#">Send E-mail</a>	N-Channel, P-Channel*, Comp*	Enhancement	DMOSFET
<input type="checkbox"/>	SD1107HD	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a> • <a href="#">View PDF</a>	• <a href="#">Request quote</a>	• <a href="#">Send E-mail</a>	N-Channel, P-Channel*, Comp*	Enhancement	DMOSFET
<input type="checkbox"/>	SD1117BD	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a> • <a href="#">View PDF</a>	• <a href="#">Request quote</a>	• <a href="#">Send E-mail</a>	N-Channel, P-Channel*, Comp*	Enhancement	DMOSFET

**Figure 5:** Table for criteria N-type MOSFET,  $V_{(BR)DSS}$  at least 15 V,  $I_{DSS}$  at least 12.00 mA and  $P_D$  of no More than 30.00 watts

- To look at a particular component or part from the matching table, press the *View PDF* or *Go to Web site* link for the part that you need, and you will be in the precise specification page of the manufacturer’s catalog, as is shown in Figure 6. This selection corresponds to the first component listed in Figure 5.



**SD1107/1117**  
 N CHANNEL  
 ENHANCEMENT MODE  
 DMOS POWER FETS

---

**FEATURES**

- Gate Standoff Voltage
- Available in a wide variety of packages
- Low capacitances
- Low ON resistance
- P-Channel Complement Available.

**APPLICATIONS**

- High Speed Pulse Amplifier
- CMOS Logic to High Current Interfaces
- High Speed Switching
- Line Drivers

**ABSOLUTE MAXIMUM RATINGS (TC = 25°C unless otherwise noted)**

Drain-Source Voltage	
SD1107.....	100V
SD1117.....	60V
Drain-Gate Voltage (RGS = 1M)	
SD1107.....	100V
SD1117.....	60V

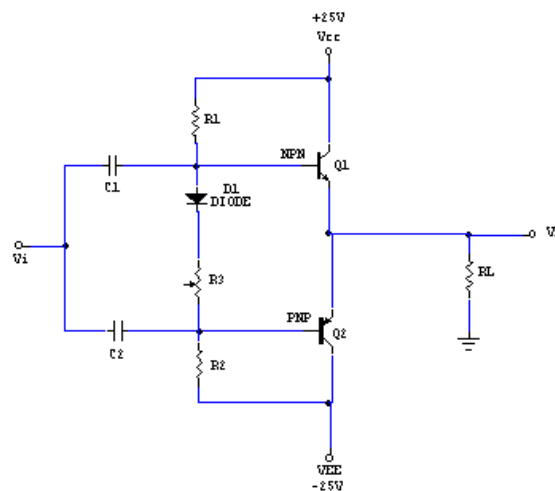
**Figure 6:** Manufacturer’s PDF file of selected part from Figure 5



As you can see, this process takes less time and it is more accurate than catalog searches or searches using generalized web-based search engines.

The author has been using Globalspec in some of the courses taught at Hudson Valley Community College in order to show the students new techniques and new tools to deliver accurate parts for design purposes. The next section of this paper will present a simple student project where the Globalspec search engine plays an important role in *bringing the final product to the market* in a short period of time. In particular, we will detail the solutions to the following project: The design of a Class B Power Amplifier.

## 5. Class B Power Amplifier Design



**Figure 7:** Class B Power Amplifier

Figure 7 represents the circuit of a Class B Push-Pull Power Amplifier. An analysis of this circuit shows that the amplifier has a voltage gain of unity. If we assume that the input voltage  $V_i = 12 \text{ V}_{\text{rms}}$  ( $V_{i(p)} = 17 \text{ V}$ ), then the peak value of the output voltage will be  $V_{L(p)} = 17 \text{ V}$  as well. If we choose  $R_L = 4 \Omega$ , we can determine the output power across the load ( $P_{O(ac)}$ ), the peak load current ( $I_{L(p)}$ ), the dc current from the supply ( $I_{dc}$ ), the dc input power ( $P_{i(dc)}$ ), and the power dissipated by each transistor ( $P_Q$ ) as follows:

$$P_{O(ac)} = V_{L(p)}^2 / 2R_L = 36.125 \text{ W}$$

$$I_{L(p)} = V_{L(p)} / R_L = 4.25 \text{ A}$$

$$I_{dc} = 2 I_{L(p)} / \pi = 2.71 \text{ A}$$

$$P_{i(dc)} = V_{cc} I_{dc} = 67.75 \text{ W}$$

$$P_Q = (P_i - P_o) / 2 = 15.8 \text{ W}$$

In order to build the circuit using real standard parts found in the industry, the students were asked to find the part numbers and the manufacturers of those parts found in the real world. The most important parameters in this simple case are the bias current and the power dissipation of the transistors. We would like to have transistors that can stand a bias current ( $I_{dc}$ ) of at least 2.71 A and transistors that can dissipate at least 15.8 W. To be on the safe side, let's choose as our goal values of 3.00 A and 30.00 W for the current and power respectively of the transistors. We can find the corresponding parts by using the parametric search for Bipolar Power Transistors found in the Globalspec site. Figures 8 and 9 show the parametric search criteria and the resulting matching table generated when selecting Shindenh America, Inc. as the supplier.

Parameter	At least	No more than	Unit	Help
$h_{fe}$	No Pref.	No Pref.		Help
$V_{CE0}$	No Pref.		volts	Help
$V_{CBO}$	No Pref.	No Pref.	volts	Help
$I_{C(max)}$	3.00		amps	Help
$f_T$	No Pref.		MHz	Help
$P_D$		30.00	watts	Help
Power Gain	No Pref.		dB	Help
Output Power	No Pref.		watts	Help
$T_J$	No Pref.	No Pref.	C	Help

**Figure 8:** Parametric search criteria.

Catalog: **Power Bipolar Transistors**  
 from: [Shindengen America, Inc.](#)

Too many choices? [Filter your results](#)

Products 1 - 15 of 16 that meet your specifications Page: 1 2 Next»

Compare Selections Now

Select:	Product Names	Get Product Information		Contact the Manufacturer		Polarity	Transistor Grade / Operating Range	$h_{FE}$	$V_{CE0}$ (volts)	$V_{CE}$ (volts)
		Product Spec Sheet	Info on Company Web site	Request for Quotation	Send an E-mail					
<input type="checkbox"/>	FS Series -- 2SC4663	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a> • <a href="#">View PDF</a>	• <a href="#">Request quote</a>	• <a href="#">Send E-mail</a>	NPN	Commercial, Industrial, Automotive	10.00	200	25
<input type="checkbox"/>	FS Series --	• <a href="#">See specs</a>	• <a href="#">Go to Web site</a>	• <a href="#">Request quote</a>	• <a href="#">Send E-mail</a>	NPN	Commercial,	10.00	200	25

**Figure 9:** Matching table for search criteria of Figure 8.

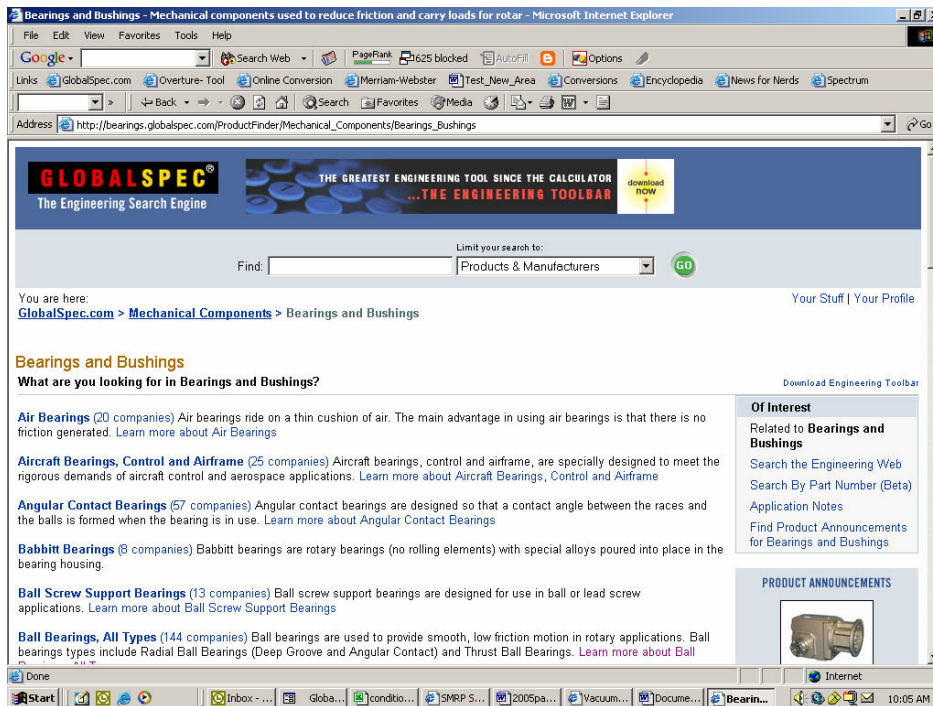
Sixteen part numbers satisfy these criteria. A side effect of using Globalspec for the students is the fact that by accessing the parametric search filters they will be able to discover most of the important parameters of engineering components even if they are only interested in selecting a few parameters, as is the case in this example. We were concerned with finding a transistor with certain bias current and certain power dissipation, but the search filter (see Figure 8 above) contains the description of other important parameters related to power BJT transistors. Searching students or users can access and study help descriptions of each parameter available in the parametric search. This feature of Globalspec is particularly useful in a teaching or academic environment.

There are other features available at Globalspec that can be used as tools for teaching technical matters, as we will see in the next section of this paper.

## 6. Product Exploration and Learning with GlobalSpec

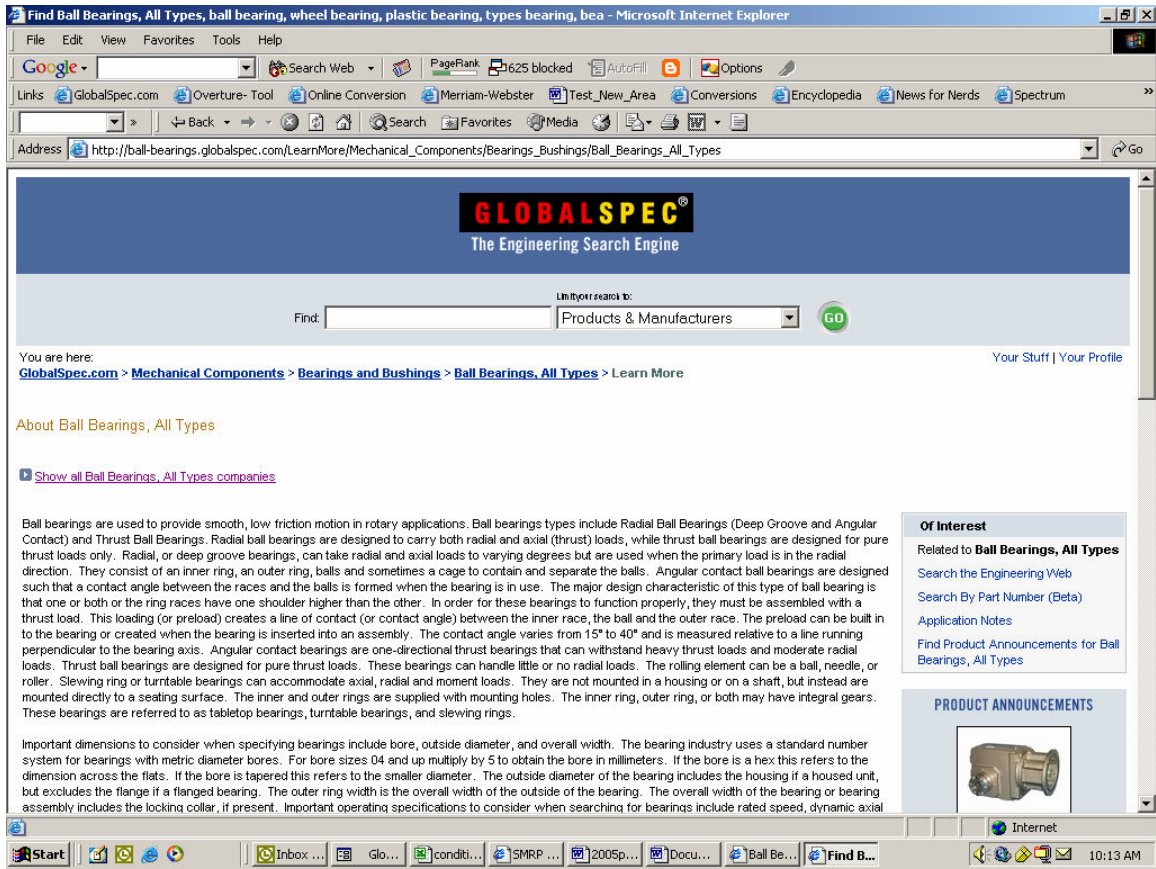
Beyond gaining the ability to perform parametric searches to find and select the correct components needed for a new design, engineering students can learn a great deal by browsing through the GlobalSpec site. The site provides many opportunities for users to explore and learn about technical products. The following sub-sections introduce some of these tools that can be accessed through the main Globalspec page.

- 1.) Product Categories – Product or components are organized in a technology based taxonomy or directory. A tour through the sections such as [Bearings](#) , [Motors](#) , [Temperature Sensing](#) , [Diodes](#) or [Vacuum Equipment](#) will provide a new engineer or student an indication of the common types of components used in industry along with short descriptions of these products or components. The following figure shows products related to Bearings and Bushings:



2.) “Learn more about” pages – By drilling down deeper into specific categories and selecting a “Learn more about” link for an area, students can delve further into a particular component, service or product type. “Learn more about” pages provide a more in-depth description with additional details of the product or component.

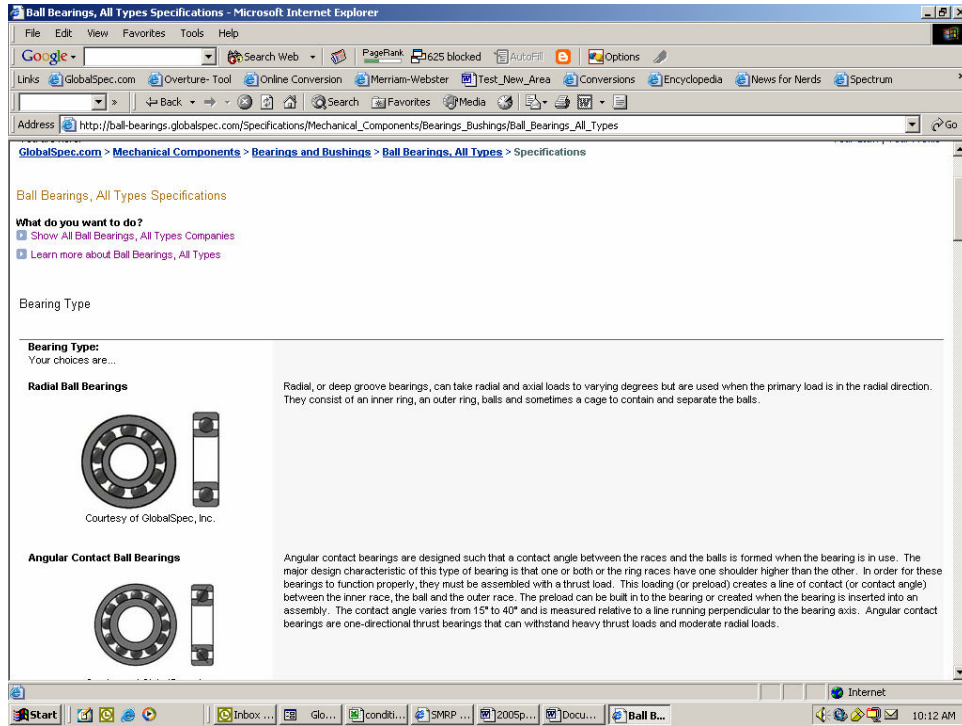
a. [Learn more about Ball Bearings](#). See the following figure:



- b. [Learn more about DC Motors](#)
- c. [Learn more about Dial Thermometers](#)
- d. [Learn more about Diodes](#)
- e. [Learn more about Vacuum Flanges and Fittings](#)

3.) Specification Pages or Help Links – The young engineer, scientist or technologist can gain a better understanding of the specifications or attributes for a particular component or product by accessing Specifications pages located at the bottom of the “Learn more about” pages (use Ctrl+End or scroll to the bottom the Learn more about page selected). Often an engineer or student new to an area does not know where to start or how to narrow searches because the specifications or attributes are unfamiliar. Help links to these specifications guides are also provided in the parametric advanced search forms.

- a. [View Ball Bearings Specifications](#). See the following figure:



- b. [View DC Motors Specifications](#)
- c. [View Dial Thermometers Specifications](#)
- d. [View Diodes Specifications](#)
- e. [View Vacuum Flanges and Fittings Specifications](#)

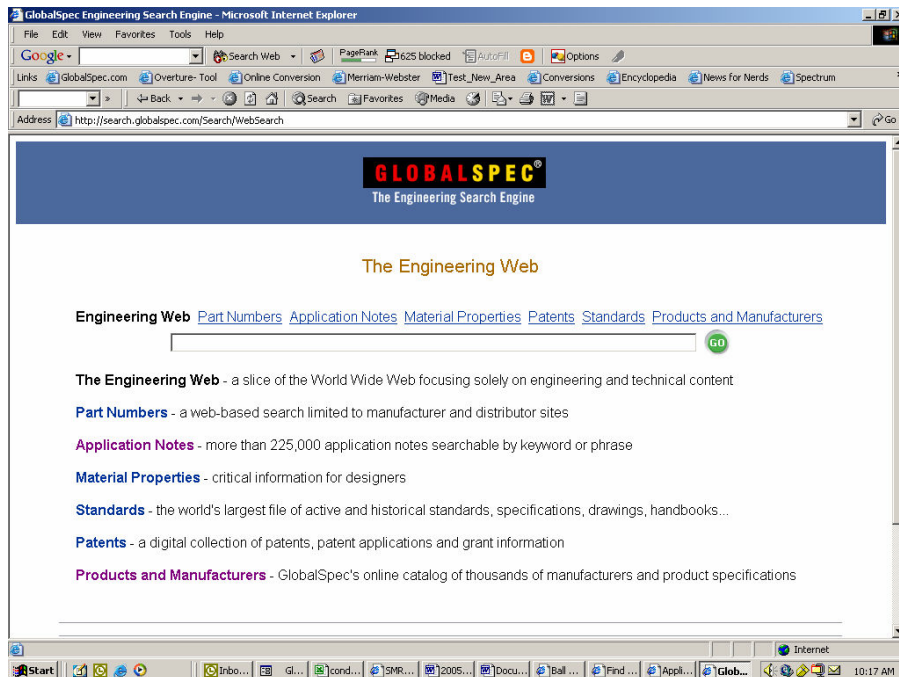
- 4.) [Application Notes](#) – Users can also search for product specific white papers or application notes to gain a better understanding of the use or implementation of a product or component in certain designs, under specific industrial conditions or within larger engineering systems. These documents may list detailed design specifications, as well as data describing how the product functions in different situations.

<http://application-notes.globalspec.com/Search/ApplicationNoteSearch>



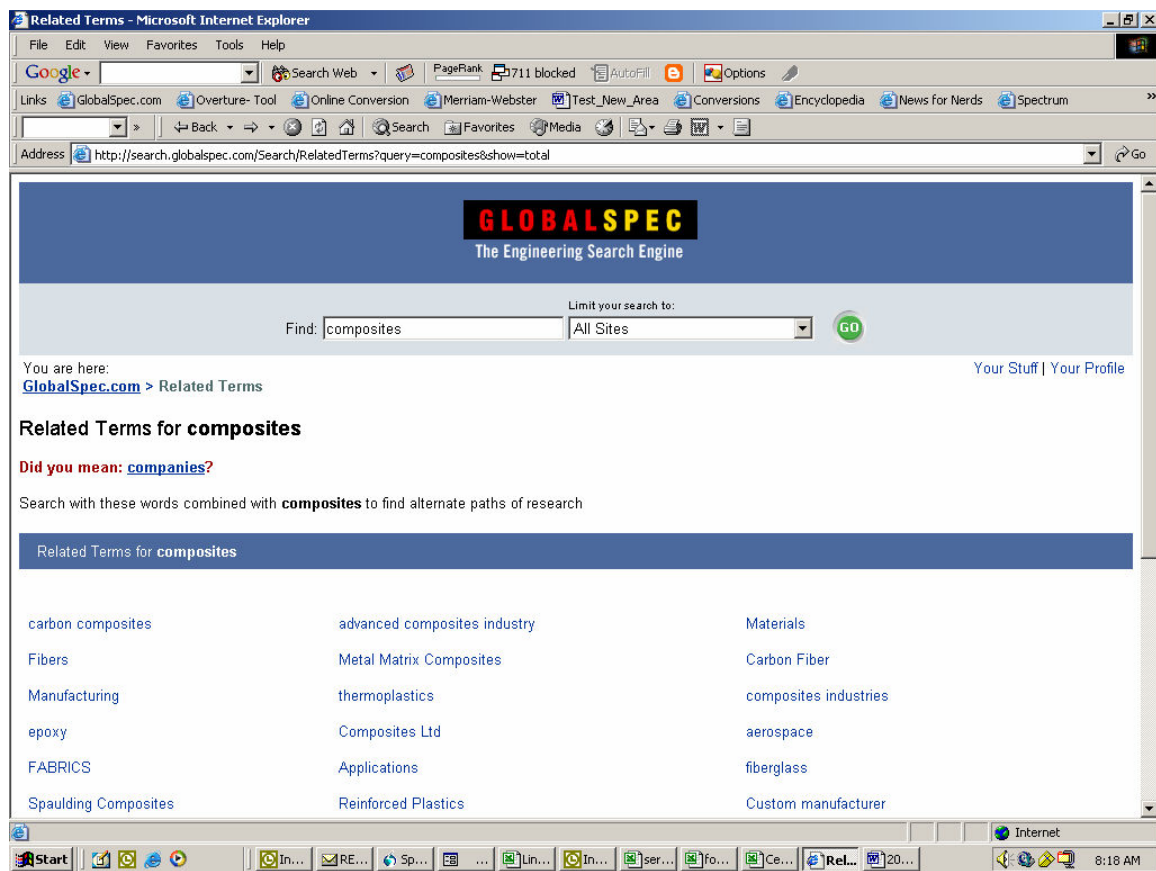
- 5.) [Engineering Web<sup>SM</sup> Searches](http://search.globalspec.com/Search/WebSearch) – Web searches using the GlobalSpec search engine will return results more pertinent to the young engineer compared to the general-purpose search engines. An Engineering Web<sup>SM</sup> search for “Pumps” will return links only on industrial pumps, while a search on a general-purpose search engine returns results high heeled shoes as well. An Engineering Web<sup>SM</sup> search for “strippers” will return links on cleaning agents or chemicals as we would expect, while a search on a general purpose search engine returns results, which educators hope are not of interest to good engineering students.

<http://search.globalspec.com/Search/WebSearch>





7. [Technology Exploration Tools](#) - The GlobalSpec search engine also provides a “Refine Your Results” tool for exploring the space around or within a technical subject area or topic. For example, after performing an Engineering Web search on the term “composites” and clicking on "more" in the “Refine Your Results” box, the student or users will get list of links on related terms. Students or engineers learning about a subject can drill down into specific subsets of a technical topic such as “metal matrix composites” or branch out into links on terms that are related to the initial subject area such as “fibers” or “adhesives”.



## 8. Conclusion

In conclusion, engineering hubs and search engines such as GlobalSpec provide a wealth of tools to enable engineers to perform their jobs more efficiently. The GlobalSpec website also contains many resources to useful in educating engineering and technology students. Proficiency in online searching of industrial components is a useful skill for new engineers to acquire and can be integrated into engineering curricula.



## 9. References

1. Boylestad, Robert L. and Nashelsky, Louis. *Electronic Devices and Circuit Theory*, 7<sup>th</sup> edition, Upper Saddle River, NJ: Prentice Hall, 1999.
2. <http://www.globalspec.com/SiteMap>

## 10. Biographical

Abraham Michelen is a full professor in the Engineering Technology Department at Hudson Valley Community College. Abe has a Ph.D. in Electrical Engineering from Rensselaer Polytechnic Institute as well as M.S. degrees in Nuclear and Electric Power Engineering.