TOOL&DIE Authority

Exclusive technical information and timely news by industry experts for tool and die professionals provided by *MetalForming* magazine.

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In and Around the Trade

Oakland University Creates an Open Forum

...for Die Makers, their Customers and Other Key Stakeholders

By Joe Brown

Joe Brown

U.S. and Canadian tooling companies have long been operating in an economic environment rife with disappearing credit lines, protectionist foreign competitors, aloof lawmakers and abundant regulations. We're a nation obsessed with shortcuts and sensationalism—often our own worst enemy. Because of high taxes and rising energy and regulatory costs, U.S. manufacturers face a 17.6-percent structural cost disadvantage when competing against nine other leading industrial nations, including China, Germany, Japan and Mexico (according to a 2008 report by The Manufacturing Institute and the Manufacturer's Alliance/MAPI).

Nobody can deny that North American tooling companies have been taken advantage of, their receivables repeatedly floated out anywhere from 6 to 18 months. These companies have been forced to finance automotive tooling programs while shouldering the brunt of demands for lower costs. All of this, despite having the least amount of wiggle room in profit margins throughout the supply chain.

It's not so much the OEMs who should be scrutinized for allowing this to happen. Instead, focus should be on the Tier One suppliers hired by the automakers to manage the rest the supply chain. Tier One companies often delay payments to improve their balance sheets (see my *TDA* article about off-balance-sheet financing)—albeit with artificial data. Of course, I'm referring to the Tier Two and Tier Three stamping-die builders and the suppliers of die components, molds and precision machined parts who were forced to be a pawn in the greed-filled game of grasping companies guided by mandates of "increasing shareholder value."

Panic and Knee-Jerk Decisions

Major U.S. cities such as Cleveland, Grand Rapids and Minneapolis were built on manufacturing. Other smaller, yet tooling-heavy cities such as Gary, IN, Youngstown, OH, and Duluth, IA, once bristled with the sounds of booming presses and buzzing machining centers. Metal

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Making Sense of Error Proofing

Creative Error Proofing

By Drew Stevens

Drew Stevens

Many of the error-proofing concepts discussed so far in this column, and in my book, *Die Protection for Lean Manufacturing*, target specific faults that can occur during the stamping process, such as misfeeds, parts failing to exit the die, or foreign objects under the stripper. Yet, anyone associated with metalforming knows that there is potential for die damage or quality issues in many other parts of the tool. Sometimes the standard fix for a common problem won't work on a specific die—this is when creativity comes in handy.

For example, often I've installed a thru-beam photoelectric sensor on a die to detect part ejection, only to learn later that the operator used a heavy coolant applied through the beam, causing the sensor to change state. This is dangerous, since the part could hang up in the die yet the sensor would falsely indicate that the part had passed through its sensing area, because of the coolant flood.

Any die-protection specialist will tell you that they've encountered issues for which they just can't seem to find an immediate solution. These scenarios trigger idea generation and creative thinking, out of necessity. In the next few issues of *Tool & Die Authority*, I'll offer a few unconventional error-proofing ideas that hopefully will stimulate some create thinking to help solve those die-protection problems for which there is no easy solution.

Nesting Round Parts in a Transfer Tool

Our first application: Detecting the proper nesting of a round part in a transfer tool. The part must sit flat in the station, and because the station travels, we cannot use sensors with dangling wires. After the transfer arms begin to move out

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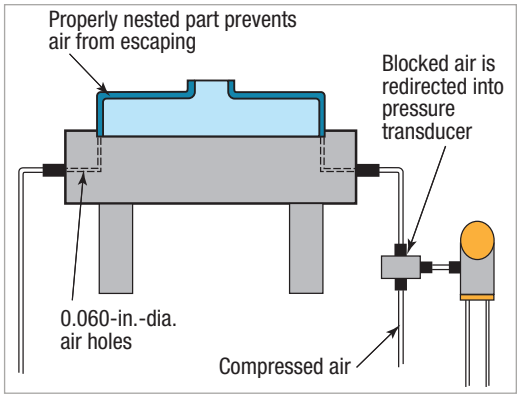
Creative Error Proofing...continued

of the die as the press begins to downstroke, the fingers on the transfer arms must place the part exactly in the center of the die station. If the part sits crooked, the press must stop before the hit to prevent damage to the part or the die, or injury to the operator.

To sense that the part sits flat in the die, we'll use an air-pressure transducer as a sensor. This type of sensor measures air pressure and sends an output to the press controller when the pressure exceeds or falls below a certain level, as defined by the user. The sensor is, basically, a switch with air fittings and electronics that can measure the flow of air (or nitrogen or any other gas), and, depending on the vendor, will usually have setpoints that the user can program. For example, if a device such as an air-driven conveyor requires a steady 35 psi to operate, a pressure transducer can be connected with an output setpoint of 32 psi. When the pressure drops, the sensor will signal the press or trigger an alarm to alert the operator that parts may be stacking up on the conveyor.

Air-pressure transducers find use in dies to monitor nitrogen manifolds or knockouts. When the pressure drops to a certain level, the sensor stops the press to prevent knockouts or lifters from being stuck without sufficient pressure to fully engage.



Note: If this should happen, ensure that the manifold pressure is completely evacuated before performing any maintenance.

How the Sensor Works in the Die

The figure above shows the die station and the part that needs to sit flat. By drilling two small-diameter holes in the side of the traveling pad and counter-drilling holes from the surface the part sits on, we can blow air from outside of the station up through the pad to where the part should be. Very low air pressure—5 psi—will work. This will reduce the costs associated with using compressed air during a production run, and prevent the part from moving due to the pressure. Another air line will need to be connected to the line going into the die, leading directly to the transducer. When the part is in place, the air will not escape through the holes in the traveling pad, and will instead flow back into the transducer where it can be measured—this is where the setpoint (sensor output) will be set. Using two positions on a round pad should suffice. With the part correctly positioned, air will flow into the sensor and the sensor setpoint will send an output to the press to indicate that the part is placed correctly in the station.

With the sensor removed from the actual working area of the die, we eliminate the common problems associated with various types of sensors, such as errant scrap (slugs or slivers) or coolant causing nuisance faults in the die. On the other hand, the air-pressure transducer must be kept out of the way of the working area of the die to prevent the setpoints from being unnecessarily changed.

Next month, we'll identify creative ways to monitor short feed in very heavy material. **TDA**

*Drew Stevens has been providing sensor-based error-proofing solutions to manufacturers for nearly 10 years. He also is a Journeyman Diemaker and author of the book "*Die Protection for Lean Manufacturing.*" In his role as a die-protection specialist, he develops specialized sensor-based die-protection training and application assistance to metalforming companies.*

Professor Pete's *"Lessons from the Press Shop"*

A Split Decision—Part 2

By Peter Ulintz


Peter Ulintz

Last month we began to troubleshoot the metal stamping shown in Fig. 1, which exhibited splitting (fracturing) in a highly strained area. The manufacturing team concluded that the stamping process was not very robust, since small changes in material properties, lubrication or restraining forces were contributing to the necking and splitting issues.

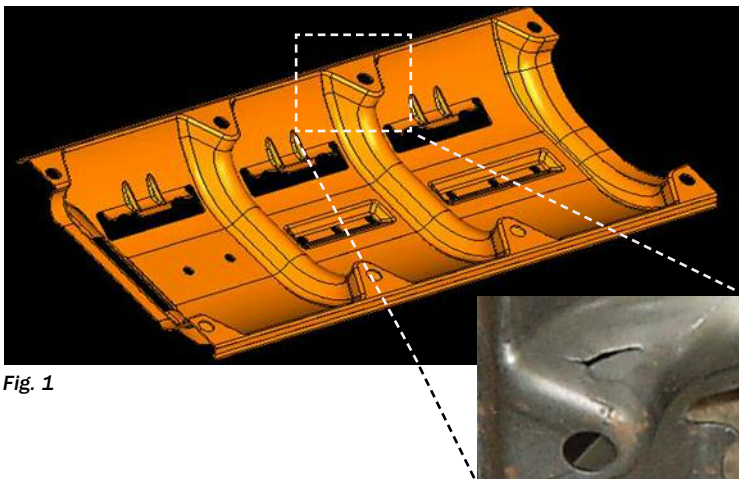


Fig. 1

After careful consideration, the team decided to add material gainers to the blank in the problem areas. Our assignment: Give the responsible die maker the precise location, shape and size of the embossments that will serve as material gainers.

So, where do we begin?

Immediately, we discover that we don't have time for trial-and-error evaluations in the press because the press is running another production job. The die maker informs us that he'll need to know what modifications are required by tomorrow afternoon. Otherwise, the changes cannot be incorporated for the next production run.

We'll need computer-aided-engineering (CAE) tools to help meet these demands for timing and accuracy. In this case, the appropriate CAE tool is sheetmetal-forming simulation. When used properly, metalforming simulations provide accurate results, often in a matter of hours. If we accomplish that, the die maker would certainly have the results he needs by tomorrow afternoon.

This first task: Create an accurate 3D model of the tooling surfaces. If

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A Split Decision—Part 2...continued

the tooling design was originally verified using computer simulation, tooling surface models may already exist. However, we must proceed cautiously when using design-verification models for problem solving. These models are created long before the tooling is actually machined and built. Often, the production-tool surfaces will differ considerably from the CAE models, especially if there were problems during die tryout.

To ensure accurate modeling of the production process, be sure to scan tooling surfaces in 3D to create new tooling surfaces, or to compare the existing models. This can be accomplished with a coordinate-measuring machine, white-light scanning or laser scanning. Once the tooling surfaces have been accurately modeled, they are used as input for the simulation software.

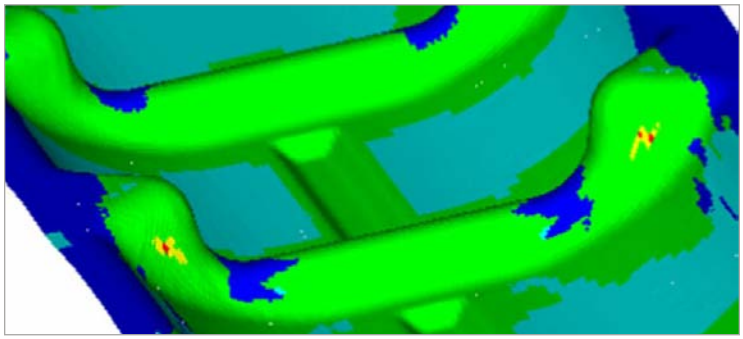

Fig. 2

Material-Property Modeling

The next step is to accurately model the material properties. All commercial simulation software programs have material libraries that contain a variety of generic material models. These models usually represent typical or nominal properties for a given material type. When troubleshooting problems in the press shop, you must obtain actual material properties for accurate results. This data can be obtained from simple tensile tests, performed either inhouse or sourced to a laboratory, for a nominal fee of approximately $150.

Having obtained accurate tool-surface data and material properties, we now can proceed with our simulation. The initial simulation results (Fig. 2) come close to matching the failures we see in the actual stamping (Fig. 1), so we're ready to develop the material-gainer sizes and locations.

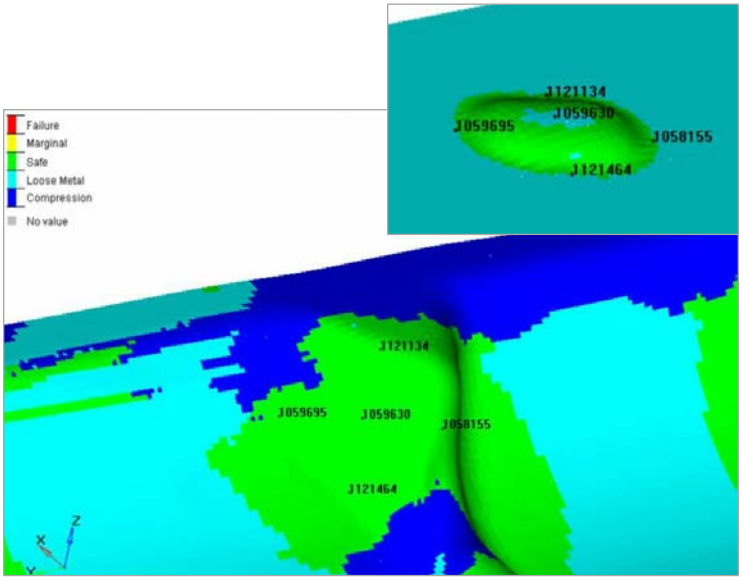

Fig. 3—Node locations on the blank and the deformed part.

Just a Little T & E

Determining material-gainer size and location will require a little trial and error. The best way to track results is to identify a few nodes on the blank using the finite-element mesh. In this instance, we used five nodes (Fig. 3). We track the nodes during the forming simulation until we achieve the desired results—no failures.

The five nodal locations selected will allow the gainer to be accurately described. Next we can determine the height, shape and angular location, and pass the data to the die maker in the tool room. Since our initial simulation showed good correlation between the computer model and the simulation results, the die maker can proceed with a high level of confidence.

Until next time, class dismissed. **TDA**

Pete has worked in the metal-stamping industry for more than 30 years. His background includes tool and die making, tool engineering, engineering management, advance process planning and product development. Pete also is a monthly columnist for PMA's MetalForming *magazine's Tooling By Design column. He oversees the website, Tooling by Design.* ***www.toolingbydesign.com***

Danny's Dish—Your Entrée to the World of Sheetmetal

The Sound of One Hand Clapping

(or, Are You Really an Author if No One Reads What You Write?)

By Danny Schaeffler

Danny Schaeffler

I just came back from a summer vacation to Washington DC. We saw all of the historic sites—the White House, the U.S. Capitol, the Smithsonian museums, etc. I was fascinated with all of the history that was available to absorb. But wait, didn't I learn all about this in middle school? I had to pass tests to get to the next grade, so I'm assuming I did.

Why don't I remember much of it, aside from being more chronologically enhanced than ever before? Because in school, I passively soaked in what I needed to in order to pass the tests. But, as an adult lucky enough to view history firsthand in D.C., I was able to actively bask in the quantity and quality of the experience and relate it to the daily thoughts of my family, my job, my country and where we stand in the world.

What's the point? For the year that *Tool & Die Authority* has been published, I've been writing about topics I thought would interest you. But if I'm talking about surface issues and you're dealing with sourcing advanced high-strength steels, I've managed to waste your time, and mine.

So, here's a proposal for an experiment. We are going to move you from the sidelines as a passive reader of *Tool & Die Authority* to an active participant in the article-writing process. Now you get to choose the topics of future articles. Just e-mail our editor, Brad Kuvin (bkuvin@pma.org), with your ideas, and I'll do my best to meet your expectations.

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The Sound of One Hand Clapping...continued

Don't worry; we're not going to lead you into the wilderness without a guide. Listed below are a dozen article ideas—let us know if any of them strike your fancy. And, certainly feel free to let us know other article topics that also reflect your day-to-day tool and die challenges.

- Sheetmetal: Where to go for technical information.
- Sheetmetal: Analytical tools to determine what defects are present.
- Sheetmetal: Analytical tools for problem solving.
- Sheetmetal supplier company support: Information that should be readily available.
- Sheetmetal supplier company support: What to expect from field-service engineers.
- Sheetmetal supplier company support: Producer vs. processor differences.
- Advanced High-Strength Steels: Metallurgical differences with conventional high-strength steels.
- Advanced High-Strength Steels: Cost differences with conventional high-strength steels.
- Advanced High-Strength Steels: Application differences with conventional high-strength steels.
- Advanced High-Strength Steels: Forming/processing differences with conventional high-strength steels.
- Advanced High-Strength Steels: Differences between dual-phase and TRIP steels.
- Advanced High-Strength Steels: What's available, and where.

The only thing growing faster than the instant communications offered by web companies like Facebook and Twitter are the hills you need to climb to see the light of a new day. Here's your chance to make your voice heard so that the information presented to you by *Tool & Die Authority* offers immediate use to help solve your day-to-day challenges. We look forward to hearing from you.

Bon Appétit! **TDA**

Danny Schaeffler is the president of Engineering Quality Solutions, an independent resource for product applications assistance to materials and manufacturing companies. EQS focuses on helping companies make more cost-effective use of the sheetmetal specified for each application. Projects have included tooling buyoff assistance, field formability analyses (FLD and strain analysis), and defect identification and root cause analysis. Danny oversees the blog, The Future is Forming.

www.EQSgroup.com

Quinn's Efficient Die Making Tips

How Does Tooling Price Impact Piece Price?

By Bob Quinn

Bob Quinn

Recently, I and others at my tool and die shop decided to update our quoting system. Being more of a tool guy than a production guy, I wanted to gain a better understanding of how tooling price affects the potential for our customers to win jobs. The better we can understand what it takes for our customers to win jobs, the better we can help them win those jobs. I started checking around and learning how companies quote production jobs and, as a result, we added a module to our quoting system to rapidly calculate piece price on the production parts, even though we have no real obvious need for that information.

Almost immediately, we experienced a perfect example of how this extra knowledge can help. The scenario: We received a part to quote that was needed in a left- and right-hand version, so a two-out die was requested. After studying the part more closely, we realized that the only difference between the left- and right-hand parts was the location of a couple of holes.

So, we looked at the tooling from two standpoints: a two-out die as the traditional method, and as a one-out die using two sets of punches for an interchangeable version of a die. Since the one-out die would not be making two parts at the same time, initially that seemed to be a poor approach. Also, the two-out die better utilized the material, and it would make two parts per press stroke.

However, after running both sets of parameters through our quoting program side by side, it became clear that no one version of the die was better than the other for all production scenarios. Running cost estimates for a projected production run of 215,000 pair/yr., the two-out die proved to be the most cost-effective solution. However, at a production run of 50,000 pair/yr., the one-out die with interchangeable punches resulted in a better total purchase-order (PO) amount—the tooling plus production cost.

Fig. 1 illustrates the swing in cost. An interesting note: The tooling price as a percentage of the total PO amount is 34 to 84 percent of the total PO amount, depending on volume.

When doing these calculations, you must know how the customer views the situation. Some customers look at it from the perspective that they only can guarantee orders for one year's production, and they only look at the total PO amount for tooling plus one year's production. In this case, the numbers tend to favor a lower tooling cost. Other customers want to look at four years of production, in which

Total Purchase Order Amounts for a Four-Year Program

1-Out Method				
	25K/yr.	50K/yr.	100K/yr.	215K/yr.
Tooling Cost	$50,840	$50,840	$50,840	$50,840
Production Cost	$27,265	$50,367	$96,409	$203,227
Total PO Amount	$78,105	$101,207	$147,249	$254,067
2-Out Method				
	25K/yr.	50K/yr.	100K/yr.	215K/yr.
Tooling Cost	$71,720	$71,720	$71,720	$71,720
Production Cost	$16,985	$28,493	$51,514	$104,746
Total PO Amount	$88,705	$100,213	$123,234	$176,466

Fig. 1

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How Does Tooling Price Impact Piece Price?...continued

case the volume of parts is quadrupled and the tooling price becomes less of a controlling factor.

We did another study looking at a random sampling of six production jobs. We looked at the total production volumes and the tooling prices for each job, and ran some calculations (Fig. 2) to see how a 30-percent reduction in tooling price would affect overall job costs. The net results were an average total PO savings of 12.6 percent, hence the continual push from our customers for lower tooling prices.

Tooling Cost	5 Years' Production Sales	Total Purchase Order Amount	Original Tooling Percent	Tooling Price After 30% Reduction in Tooling Cost	New Total Purchase Order Amount	Percent Total Reduction
$31,500	$60,400	$91,900	34.3%	$22,050	$82,450	11.5%
$25,600	$90,800	$116,400	22.0%	$17,920	$108,720	7.1%
$25,200	$42,200	$67,400	37.4%	$17,640	$59,840	12.6%
$29,000	$12,200	$41,200	70.4%	$20,300	$32,500	26.8%
$32,200	$67,400	$99,600	32.3%	$22,540	$89,940	10.7%
$48,800	$180,300	$229,100	21.3%	$34,160	$214,460	6.8%
				Average Total PO Reduction Based on a 30% Reduction in Tooling Cost:		**12.6%**

Fig. 2

To put things into perspective, it can be said that tooling cost, on average, accounts for about one-third of the total PO amount. This ratio can vary tremendously based on the specific type of work your company is doing, so it's important to look at these numbers yourself and have a solid understanding of how tooling prices affect your total purchase-order amounts. The lower the volume the more important the tooling cost, but there is no hard and fast rule.

For next month's column in *Tool & Die Authority*, I will interview Bob Gunst, president of Jacar Systems, a manufacturer of transfer systems for metal stampers. We will discuss, among other issues, some of the myths associated with transfer tooling.

Until next month, happy stamping! **TDA**

Bob Quinn has been a tool and die shop owner for 15 years. He is an inventor, programmer, designer, and tool and die maker. The focus of his efforts over the years has been to develop and implement advanced methods and technologies to improve die-build efficiencies. In short, a lean tool-build specialist. Bob Quinn is president of die designer and builder RCM Inc. **www.rcmtool.com**

Oakland University Creates an Open Forum...continued

shavings jumped around machines where carbide and steel would meet. But, many of these manufacturers now stand hollow, emptied by the auction-going, opportunistic manufacturing-business owners fortunate enough to have remained in business.

While many North American tool and die shops have scrambled to set up shop in China, South Korea and other low-cost countries, others--whom I salute—rather than overreacting and hitting the panic button have buckled down and readied themselves for a battle. Many believe that the only way to regain their mojo is through legislative actions.

Additional help also is on the way from the business school at Oakland University (OU), in Rochester, MI.

Stepping up to the Plate

Just a stone's throw away from Chrysler's Auburn Hills World Headquarters, Oakland University houses the Center for Integrative Business Research and Education (CIBRE). CIBRE kicked off its 2009 program with a forum on May 14, 2009, titled "Preservation and Prosperity of the U.S. Tool & Die Industry." Led by Dr. Mohan Tanniru, Dean of OU's School of Business Administration, the forum attracted a mixture of tooling-related company owners, presidents, consultants, writers and specialists who discussed the factors prohibiting growth and job creation in the tool, die, mold, metal-stamping and precision-machining industries.

Said one forum attendee, the owner of a Southeast Michigan machine shop: "Through the help of Dr. Tanniru and Oakland University, we hope to prove to the community, the tool-and-die industry and our government that we not only can compete, but can start winning back jobs from the low-cost countries."

Despite popular belief, the North American tool-die industry can be a growth industry, with a little integration of technology and some innovative thinking. The success of Dr. Tanniru's program at OU should help shape a model of "how to do it" that other organizations around the country can mimic, to help transform the industry back to prosperous, job-creating times. The symposium provided a vehicle of dialogue, problem-solving, opportunity and innovation between the OEMs and the tooling suppliers.

At the forum, representatives from at least a dozen lower-Tier tooling companies told me that despite their cost-cutting measures, innovations, new ideas and products, it remains difficult to reach the OEMs to communicate, share ideas and bridge gaps.

On the other hand, CIBRE, utilizing its vast resources and connections as a public university, successfully provided a platform for discussion between the OEMs and their Tier 2 and Tier 3 suppliers. The forum created optimum networking opportunities for like-minded individuals. As expected, each attendee knew at least one other person in the room, but nobody knew everybody. The discussions provided solid footing for what will be new business relationships for most.

I witnessed renewed optimism and a structured approach utilizing university-level resources. There's no doubt that this was not the first group to ever meet with the greater good of the tooling industry on the agenda—nor will it be the last. However, it's rare that a business school as renowned as that at Oakland University would make certain resources, relationships and assets available.

Forum attendees divided up into smaller groups, to undertake some of the initiatives discussed. Overwhelmingly, the need to educate the general public and educate the educators was listed as job number one. Other initiatives:

- Create dialogue between tool, die and mold suppliers, Tier 1 companies and OEMs.
- Help Oakland University educate and contribute business resources to a craft-oriented industry. For example, it could ask graduate or undergraduate business students to work on finding efficiencies in cost structure and study work-flow processes.

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Oakland University Creates an Open Forum...continued

- Formulate a strategy to overcome the negative image and misperceptions of manufacturing.
- Seek ways to bring white-collar and blue-collar workers together to collaborate through a nontiered format for automotive and nonautomotive tooling opportunities.
- Find ways for Oakland University to help small manufacturers obtain funding to retool for new industries. For example, through CIBRE, two Metro Detroit machine shops were able to apply for a Department of Energy grant.

Says Dr. Tanniru: "How can a business school be an economic partner in a struggling region, and across industries such as tool and die shops and mold builders? Businesses should not feel like they do not have access to the resources universities provide. We have a pool of talent for whom we're eager to provide opportunities, internships and experiential learning. The more we as a university use students to consult and build theories, the more we engage them and students become the vehicle that bridges the gap." **TDA**

Joe Brown has been working in the sales, marketing and public relations side of the tool, die and stamping industry since 2002. His background is primarily in marketing and business administration. Recently he has created a platform for those involved in the industry to share their hopes, ideas and concerns with a rapidly growing tool and die industry blog. He received his BA from Michigan State University and a MBA, from Wayne State University. Joe Brown oversees the website and blog, Will the Tool & Die Industry Ever Recover?
www.toolanddieing.com