President's Message

Happy New Year, colleagues! As we embark on a new year, we strive to accomplish our goals, aspirations, and resolutions, whether personal or professional. We look back at our accomplishments and events that happened last year, build on our lessons learned, and look forward to what the New Year has to offer. The same is true of the ISA North Texas Section, and we look forward to sharing it with you.

Back in October, the section held a technical dinner seminar that was a little unique in the fact that it talked more about steam technology was introduced. The presenter was dynamic and very well educated on steam technology. Our goal is to continue offering technical seminars and learning events throughout the year.

One of my main goals for this year is to get our website up and running providing the section members a proper place to get all the latest information on section happenings as well as viewing archived data from our previous events. However, we lack a webmaster to help get things rolling. If you are interested please see the next article and reach out to any of our volunteers.

As always, I look forward to another productive year and wish everyone continued success in their endeavors.

Kevin Patel, P.E.
President

Webmaster Wanted

As part of our efforts in keeping our section members informed about on-going events and activities, we will be soon be updating our newly provided ISA website. Therefore, we are in need of a new section webmaster. Please contact Kevin Patel if you are interested in becoming our webmaster.

The website, utilizing Ektron, will contain a calendar of events, interesting articles, and news from our section members. ISA has already put together simple to use manual and provided video tutorials on quickly updating and managing content on the website. Please contact me if you would like to volunteer for this important role to help advance our section. You can reach me at knpatel@sig-auto.com or (469) 619-1241.
Building the First Steam Ship

On October 5, 2016 North Texas section hosted a presentation on Building the first steam ship by John Laurence Bush. John gave a detailed historic and engineering perspective into the challenges faced by the pioneers attempting to cross the Atlantic on the first steam ship the so called steam coffin. The event was attended by local chapter members. For more information, including a list of upcoming events, go to www.steamcoffin.com. Steam Coffin is distributed in North America by Independent Publishers Group, and also is available from Ingram and Baker & Taylor.

Call for Job Openings

Job ad submissions are free for members and we can only publish positions that are directly focused on automation, instrumentation and controls. We will include the posting in two issues, and it will remain in the Bulletin archives online once that portion of the website is available. If you are a member and wish to submit a job ad, please send a link to where the job is posted online to knpatel@sig-auto.com.

Job Openings

American Electric Power
- Engineering Senior
  Location: Farmers Branch, Texas
  For job details please follow the link: https://www.aep.com/careers/kenexa/jobDetails.aspx?siteID=5247&areq=144098R

Call for Newsletter Articles

The North Texas Section newsletter is published four times a year (winter, spring, summer, fall) and reaches the North Texas section’s over 200 members. Each issue is approximately 8-10 pages long, and is electronically printed in color PDF format. A notification email goes out to all section members and it will be available for public download at the North Texas section website.

We are always on the lookout for good articles, and we welcome both solicited and unsolicited submissions.

Article submissions should be 500-2000 words in length and be written for a general audience. While it is understood that the articles are technical in nature, the use of technical jargon and/or unexplained acronyms should be avoided. We actively encourage authors to include several photos and/or figures to go along with their article.

We actively welcome articles from all of our members. However, we do ask that articles be non-commercial in nature wherever possible. One or two mentions of company and/or product names for the purposes of identification is acceptable, but the focus of the article should be technical content and not just sales literature. If you are unsure of whether your article idea is workable, please contact our newsletter editor for more information – we are here to help.

Some examples of the types of articles we are looking for include:
- Explanatory/teaching articles that are meant to introduce or explain a technical aspect of automation and/or instrumentation.
- Biographical stories about personalities and/or leaders.
- Case studies about plant upgrades and/or the application of new technologies and techniques. This type of article must include at least two photos along with the article text.
- Pictorial case studies about a plant upgrade consisting of 4-6 photos plus a brief 200-500 word description of the project undertaken. The article should ideally include one to two paragraphs about lessons learned and/or advice for other automation professionals.
Future Technical Presentation

The article below will be presented by the Author himself in Plano, TX on May 19, 2017. We are grateful to Dr Russel for sharing this article.

Process-Model-Based Control

By R. Russell Rhinehart

Can we use engineers’ process models (first-principles models) in process control? The answer is “Yes, we can, and the benefits have been demonstrated.” Techniques that combine the functionality and simplicity that make them industrially practicable are process-model based control (PMBC), generic model control (GMC), and predictive functional control (PFC). There are probably others that I have not explored, yet. Unlike, “big model” APC applications, these model-based controllers can be implemented by in-house engineers, within PLC and DCS computers. These simple approaches typically are multi-input single-output (MISO) structures, and are appropriate where process nonlinearity requires continual retuning of PI(D) controllers.

However, since training to implement simple model-based controllers is about one course in addition to that needed for classic control, and since whoever inherits the controller must acquire the training, the answer should include, “I’m not sure that the process industry will make the training investment for in-house implementation. I think that implementation will come from service providers.”

A first-principles model is the basic, undergraduate-level representation of process phenomena. It is not a fully rigorous, most perfect, complete model. The vision is that the same model that is used for process design can be used for on-line performance monitoring, validation of process understanding, training/simulation, real-time process optimization, and multivariable constraint-handling horizon-predictive control. The advantages of using the same one-model for all applications are many:

A. It preserves and promulgates mechanistic process knowledge, as opposed to masking cause-and-effect relations with linearized or empirical relations (such as FOPDT, FIR, ARMA, or NN models). Mechanistic knowledge is essential in rational diagnosis, troubleshooting, safety, and continuous improvement.

B. When a retrofit or new piping configuration changes the process, only one model needs to be changed.

C. All models (such as those in RTO and APC) will be internally consistent with respect to economics and constraints.

D. The nonlinear aspects of the first-principles model keep the model true to the process over a wide operating range. This avoids the continual retuning that is required by linear controllers when the process changes operating conditions.

This article introduces the concept. Visit [www.r3eda.com](http://www.r3eda.com) to access a tutorial which provides details and examples on how to implement process-model-based control (PMBC).

Comparing Control Approaches

Don’t think in terms of PID control. If you do, those concepts will misdirect understanding the different approach in PMBC. In PID, the actuating error, the difference between the set point and the controlled variable, is the basis for control; and the controller gain multiplies the actuating error to determine the basic control action. This leads to steady-state offset, and the integral of the actuating error is used to remove offset. However, this leads to several integral-related problems, such as windup. Derivative action can be used to modify the controller, making the proportional term based on an anticipated error. Although the closed loop mathematical procedure called controller synthesis can combine a simple linear model of the process with a simple control objective and generate the PID rules, PID is not a model-based controller.

Early model-based controllers include the Smith Predictor, Dahlin’s Algorithm, and Internal model control (IMC). Typically, these are all based on linear FOPDT models.

Today, in the process industry APC (advanced process control) would be termed model-based control. Within the academic community it is usually
termed MPC (model-predictive control) or HPC (horizon predictive control). This control approach is typically based on the dynamic matrix, a vector of future responses to a finite impulse influence, and accordingly sometimes called a finite impulse response (FIR) model. Sometimes this is referred to as a “big model” control because it is designed to handle a multi-input multi-output process system.

In the aerospace, electrical, and mechanical fields, there are functionally equivalent controllers termed modern, or ABCD, or state-space controllers. There all are based on linear multivariable models, and the coefficient values are empirically determined by observing the CV response to MV changes. Starting in the refining sector, APC is now accepted in the chemical sector. APC integrates feedforward and feedback control, multivariable, and constraint avoidance. But, these are typically linear models, with little connectivity to the models used in RTO, process analysis, troubleshooting, etc. Being linear, they are only locally valid, and when a process changes throughput or operating state, the model usually needs to be rebuilt from new process testing.

Although those aspects comprise the negatives of linear models, they have the benefits associated with mathematical analysis of stability and other confidence-building proofs. However, nonlinear first-principles models are well accepted in process design, analysis, and economic optimization. So, I believe there is an equivalent level of application confidence, which is superior to idealized mathematical proof.

It does not matter whether the model is derived and coded by the process engineer, or is the object provided by a process simulation/design package, or is a nonlinear surrogate approximation (such as a neural net). All can be used for model-based control.

### Process-Model Based Control

Here is the outline of a simple PMBC approach. Start with a dynamic model of a process, and state it as:

\[
\frac{d\tilde{y}}{dt} = f(\tilde{y}, u, d, p)
\]

The variable \(\tilde{y}\) represents the modeled controlled variable, as opposed to \(y\), the process measured value. The variable \(u\) is the manipulated variable, the controller output; \(d\) represents measureable disturbances, and \(p\) represents model coefficient values.

This differential equation can be solved numerically to determine the modeled \(\tilde{y}\)-value at the next sampling instant, based on the prior values and the influence

\[
\tilde{y}_k = \tilde{y}_{k-1} + \Delta t f(\tilde{y}_{k-1}, u_{k-1}, d_{k-1}, p)
\]

If the model was a perfect representation of the process then the model-predicted value, \(\tilde{y}_k\), would equal the measured CV value, \(y_k\). But, no model is perfect (certainly not an FOPDT model, and not even those attempting to be most rigorous). The process-model mismatch is \(pmm_k = y_k - \tilde{y}_k\).

In simple PMBC, bias the set point for the model with the \(pmm_k\), \(\tilde{SP}_k = SP_k + pmm_k\), then when the model is at the biased SP, the process will be at the SP.

Choose a simple control objective: Desire that the modeled value move toward the biased SP at a rate proportional to the deviation. Desire that

\[
\frac{d\tilde{y}}{dt_{desired}} = \frac{\tilde{SP} - \tilde{y}}{\tau}
\]

And solve for the MV value that makes the model so behave.

\[
u = f^{-1}(\tilde{y}, \frac{d\tilde{y}}{dt_{desired}}, d, p)
\]

This controller removes offset, does not have windup, preserves the process knowledge, has only one tuning parameter, \(\tau\), and is valid over as wide a range as the model is valid. Tau is the user-desired time-constant for the rate of return to the set point. The value of \(\tau\) should not be a mystery to any process.
operator who knows what a reasonable response rate would be. Once tuned, it remains tuned for the entire operating range.

**Candidate Applications**

Candidate processes for simple PMBC would be those that are:

- nonlinear or nonstationary requiring continual re-tuning of a controller,
- where the first-principles model is understood and accepted,
- which have a single controlled variable,
- which have an explicit inverse, and
- where models are used in other applications (such as process monitoring or RTO).

And certainly, the technique can be extended to MIMO processes that need optimization to compensate for constraints.

I have taught these techniques in my advanced process control class, and one student started a business applying it. I left industry with a vision that process models could have control application benefits, and discovered many practicable approaches. However, I suspect that manufacturing industry will have the view, “We don’t invent technology. We use it to manufacture our products.” Accordingly, rather than training process engineers to implement model-based control, I think that implementation will be by service providers, as is the common model for MPC applications.

**Author’s Bio**

Russ Rhinehart, has experience in both industry (13 years) and academe (30). He was Head of the School of ChE at OK State U., president of the American Automatic Control Council, and Editor-in-Chief of ISA Transactions. He is a Fellow of ISA, a CONTROL Automation Hall of Fame inductee, and received numerous teaching and innovation recognitions. Russ authored textbooks on engineering statistics and nonlinear regression modeling, and is developing one on optimization. His “retirement” career is professional education; supported by a web site to disseminate best-in-class techniques for modeling, optimization, and control. You are invited to visit [www.r3eda.com](http://www.r3eda.com), or contact him at [russ@r3eda.com](mailto:russ@r3eda.com).

**2017 Golf Tournament Save the Date**

We are happy to announce the details of this year’s golf tournament. Save the Date:

**WHEN:**    Thursday, May 25, 2017 @ 1:00 pm  
**WHERE:**    Texas Start Golf Course  
             1400 Texas Star Parkway  
             Euless, Texas 76040

The North Texas ISA once again seeks your participation in our annual fund-raising golf tournament. Come individually or with a complete team. Your entry fee will cover green fees, golf cart, range balls, dinner and prizes.

The 2017 golf tournament will be held at the Texas Star Golf Course in Euless. Texas Star is a serene public golf course with a private feel and with 275 acres of plush fairways, magnificent views, stacked rock ponds, waterfalls and natural woodlands.

We would love to have you and any guests for Dinner and Beverages even if you don’t plan on playing. $20 will cover dinner and beverages for non-players.

The tournament will be played as a 4-man Florida Scramble and we will utilize a shotgun start beginning at 1:00pm. Registration and free range balls will begin at 11:30am. Following the tournament dinner, beverages and awards will be provided.

Please contact Bobby Brooks via Email at bbrooks@eadslink.com or via phone at (214) 341-3401 or (214) 725-4775 for any questions regarding the event.
2017 ISA North Texas Section Student Scholarships

The ISA North Texas Section is pleased to announce the 2017 ISA WWID Student Scholarship Program. Eligible students can win up to $1000 in scholarship money to help them pursue higher education.

Students can apply by filling out the application form, accompanied by a copy of their academic transcript. See the application form on Page 7.

The division is pleased to continue to providing up to $2000 of scholarship money to encourage ISA members and their family to pursue higher education.

Applications are due by email by March 1, 2017. Winners will be notified by April 1, 2017, and will be required to provide a photo and short biography that can be used for publicity reasons. Scholarship money will be deposited directly to the student’s school financial account after the winner is contacted and has supplied the required photo/bio.

Scholarships will be awarded at the sole discretion of the ISA North Texas scholarship committee, with preference being given to students enrolled in technical programs that lead to careers in engineering and automation.

Please email completed application form along with a copy of academic transcript to rspencer@eadslink.com.

All applications must be submitted by email (with PDF scans of documents). We do not accept submissions by postal mail.

Newsletter Advertising

The North Texas Section newsletter is an excellent way to announce new products and services to the North Texas members. With a distribution of 200+ professionals in the automation, instrumentation and SCADA fields, the newsletter is an effective targeted advertising tool.

The newsletter is published quarterly, on the following approximate publication schedule:

- Winter Issue – published in December/January
- Spring Issue – published in March/April
- Summer Issue – published in June/July
- Fall Issue – published in September/October

Advertising in the newsletter is offered in full page, half page and quarter page formats. Advertisements can be purchased on a per issue basis or for four issues at a time. The newsletter itself is distributed as a full-color PDF, so both color and black/white artwork is acceptable.

The current advertising rates are as follows:

Per Issue:
- Full page, full color (7” x 9”): $200
- Half page, full color (7”x4.5” or 3.5”x9”): $100
- Quarter page, full color (3.5” W x 4.5” H): $50

Per year (4 issues):
- Full page, full color, 4 issues (37% discount): $500
- Half page, full color, 4 issues (31% discount): $275
- Quarter page, full color, 4 issues (25% discount): $150

Other sizes of advertisements are available, but are priced on an individual basis. Contact us for more information.

Please book advertising space as early as possible before the intended publication date. Artwork for advertisements should be submitted a minimum of two weeks prior to the publication date; earlier is always better than later. Artwork for advertisements can be submitted in EPS, PDF, PNG, JPG or GIF formats. EPS, PDF and PNG formats are preferred. Images should be at least 300dpi resolution if possible.

The ISA North Texas Section is run on a non-profit basis for the benefit of its members. Monies raised from the sale of advertising in the newsletter are used to help offset the cost of section programming and events. Like its parent organization, the ISA, the North Texas Section is a non-profit member-driven organization.

For more information, or to discuss other advertisement sizes not outlined above, please contact the newsletter editor Nawaz Akhtar at nawaz@aftechno.com.
North Texas ISA Scholarship
In Honor of Scott Kalmus

The North Texas ISA section will award two students $1000 scholarships.

Requirements
Student must be enrolled for the 2017 spring semester in an accredited university, college or technical school in an engineering or technical trade curriculum. The student or parent must be a current member of ISA.

Join ISA today so that your child/student will be eligible.

ISA.org
Applications are to be submitted via email to
rspencer@eadslink.com by midnight March 1, 2017

Application:
Name:_______________________________________
School:______________________________________
Student Financial Account number:__________________
Address School Financial office: ____________________
ISA Membership #:____________________________
Course Description:_____________________________
Include Copy of School course Transcript

Selection
The selection committee will meet the last week of March to select two scholarship winners. Only applicants who submit a completed application form and transcript will eligible. Awarded scholarship funds will be deposited directly to the student’s school financial account.

Please direct all questions to Rob Spencer at The Eads Company,
rspencer@eadslink.com, North Texas ISA Education Chairman, Past Section President, Assistant Golf Tourney Chairman
New North Texas Section Members
Recently joined May 2016 to January 2017

June 2016
Arifuddin Mohamemd - Arlington, TX
Razin Zuhair - Arlington, TX
Blaine Russ - Farmers Branch, TX
Anshul Adkar - Plano, TX
Liang Li - Dallas, TX

July 2016
Justin Jacobs - Ardmore, OK
Marlon Hodge - Carrollton, TX

August 2016
Gregory Bills - Irving, TX
Mr. Jeffory Scott Brown - Waco, TX
Jahmaal Onoh - Richardson, TX
Huy Nguyen - Irving, TX
Luther Meyer - Houston, TX

September 2016
Colin Sikorski - Irving, TX
Jody Cruzan - Carrollton, TX
Samuel Makinye - Waco, TX

October 2016
Rajeev Kulkarni - Plano, TX
Jim Alexander - Wichita Falls, TX
Duffy Chisholm - Borger, TX
Randy Brooks - Harrold, TX

November 2016
Eduardo Santana - Dallas, TX
Robert Cleghorn - Marietta, OK
Chris Mueller - Fort Worth, TX

December 2016
Keith Demele - Lewisville, TX
Murali Sankar Harikrishnan - Frisco, TX

January 2017
Robert Crone - Cedar Park, TX
David Macelvaine - Irving, TX

ISA North Texas Section Contacts
For more information about ISA membership, the ISA North Texas section or the upcoming section events, please do not hesitate to contact any one of us.

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Open – seeking volunteer

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About the ISA North Texas Section
The ISA North Texas Section is the local section of the International Society of Automation for the North Texas area. ISA North Texas Section holds regular meetings, sponsors a variety of educational endeavors, encourages an open exchange of career opportunities, and promotes the goals & objectives of ISA. For more information see https://www.isa.org/north-texas/.

About the ISA
Founded in 1945, the International Society of Automation is a leading, global, nonprofit organization that is setting the standard for automation by helping over 40,000 worldwide members and other professionals solve difficult technical problems, while enhancing their leadership and personal career capabilities. Based in Research Triangle Park, North Carolina, ISA develops standards; certifies industry professionals; provides education and training; publishes books and technical articles; and hosts conferences and exhibitions for automation professionals. For more information see www.isa.org.