Q&A Session for Linear Motioneering 101: Linear System Technologies, Engineering, & Applications

Q: What is the smallest pitch you can have for a ball screw / lead screw? What effect does a small pitch have on efficiency?

A: The smallest pitch that we offer on a ball screw driven slide table is 1mm (URS 20). The smallest pitch that we offer on a lead screw driven slide table is .025" (Microstage 25).
In a lead screw the pitch does have an effect on the efficiency. Efficiency is related to helix angle and the friction coefficient. In practice, the only way I can affect the efficiency is to change one of the two primary factors. Going to a different lead on the same diameter will change the helix angle. Higher helix angle means better efficiency up to a point. At around 45 degrees (very high for a screw) the efficiency starts to decline again. The helix angle is calculated from the pitch and the screw diameter.
The other factor we try to affect is the friction coefficient between the nut and screw. The first option is to go with an internally lubricated plastic like acetal with PTFE. That gets our friction coefficient to about .12-.14. Adding PTFE coating on the screw will reduce the coefficient to .08-.10. Lubricating the screw with grease is the best option for reducing friction and gets you down to about .05-.07. Note that 50% efficiency is about where screws go from self locking to back drivable. 70% Efficiency is about the max you can get out of a lead screw at high helix angles and low friction coefficients.

Q: Is the Magnetic Strip moving or does it always stay stationary?

A: The magnetic strip is stationary in that the two ends are fixed to the end plates of the system. The cover band (or sealing strip) is routed through a cavity in the carriage. As the carriages traverses the length of the system the strip is raised off of the magnets in the particular region where the carriage is at that time.

Q: What is the advantage/disadvantage to using ball guide vs. prism guide vs. wheel guide? What are their coeffs/parallelism?

A: In general, the relative strengths and weaknesses are:

Ball Guides
+ High load capacity (moment & payloads), low coefficient of friction
- Cost (for ground screws), noise

Prism Guides
+ High resistance to impact loading, low noise, low maintenance
- Lower speed and load capacity (as compared to ball or wheel guides)

Wheel Guides
+ High speed and accelerations
- Low resistance to shock loading

As it relates to parallelism

We have a number of ball guided systems where the base mounting surface is machined. The ball guide surface is machined parallel to the base mounting surface, thereby assuring good parallelism of the top of the carriage to the mounting surface of the system.
All of the wheel guided systems and prism guided systems that we have do not have the mounting surface of the base machined. The parallelism of the carriage will not be as good as the systems where the base is machined

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Q: How do lead screw supports work? Do they limit travel of the carriage? (On slide 9)

A: Lead screws support work by converting the rotary motion of the shaft into lateral motion of the nut. They act in the same way as a conventional screw would in converting torque into a clamping (thrust) force. Lead screws will not limit the travel of the carriage. They are contained within the footprint of the carriage. In some units, a flange mounted lead nut may be mounted to the face of a carriage. In this case the flange thickness may limit the stroke by this flange thickness.

Q: Are there any accommodations for manually operated ball / lead screws?

A: We do offer a hand wheel option on a number of our systems. The hand wheel is connected directly to the ball or lead screw shaft. The Microstage series is one of the product families that have this option. I'm sure we can provide this on almost any screw driven system if you are interested.

Q: I am looking for a system that could be applied under "drilling mud" conditions. It should be able to lift & lower, regardless of what mud may be caked up on the exterior. I was envisioning you're Structural support system & possibly slide glides to move the apparatus…

A: I would agree with you that the slide guides are most suitable for this application. A magnetic strip or polymer strip would also be required. We would need to know your load and speed requirements to select the appropriate drive mechanism.

Q: What Danaher products are belt driven/wheel guided?

A: Our belt driven /wheel guided product offering includes the WH50, WH80, WH120 and the MLSH60Z and MLSH80Z. These products are covered in our EU catalogue. They will be included in the NA catalogue when it is released (Q1 2009)

Q: Up & down, from the top of the tank (20') to around 3.5-4ft off of the floor. Max travel up & down, less than 16 ft. Any recommendations?

A: We will need more application info to size a system for you. We do have systems with the travel length you need. My suggestion is to call our customer service center and have an applications engineer support your inquiry (540-633-3400)

Q: Could I get a tel # to discuss various applications I am working with?

A: Brian, 540-633-3400 is our customer service center. We have a team of application engineers who will be able to help you. If they require support they contact Pete or myself

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Q: What is the assumed positioning accuracy in Linear Motioneering on Step 2 if you do not select one of the radio buttons?

A: A selection of “No Preference” in Accuracy drives a > 0.005” /12” positioning requirement (all systems remain as candidates for the solution set).

Q: Can you change some of the options manually, and will it change the system for you?

A: A limited number of options can be changed for any given (Environmental) Condition selection. Some Options are be grayed out because they conflict with a specific Condition. For example if you select Clean Room as a condition, under the Cover Options, Bellows and Enclosed seal are not selectable. These features are particle generators and not suitable for a clean room.

If you know the system your interested in you can enter the software through the “Select a Product Family” path. On screen 2 you can select a “Custom” condition and all options associated with that product will be open to you.

Q: In the past I would save the application. When I then recalled what was saved the system returned me to step 6 and I would have to reselect the components again. Has this been corrected?

A: No it has not. We are preparing to release a second version of the utility that includes more product and hope to have the Save feature capture your product selection. Our software team is working on this.

Q: Is there a means of sharing sizing application files between people?

A: Currently, you would have to share your login information with the parties with whom you wish to view your applications.

Q: What are options for two, or three axis scenarios?

A: Linear Motioning only supports single axis sizing. You would need to handle the sizing in 2 different sessions for a two axis system. We do have a number of adapter plates (X-Y) and adapter brackets (X-Z). Our customer service center will be able to determine if the options are available for the Systems you select.

Q: I may have used the wrong term, by pitch I meant threads per inch, so by smallest I meant most travel per revolution. Sorry for the confusion.

A: I hope my answer above gave you what you needed. The values I gave you, 1mm for a ball screw driven system and .025" for a lead screw driven system are the amounts that the system will advance linearly with one revolution of the screw shaft.

Q: Which drives are the smoothest (stick-slip no more than 0.001 mm)?

A: We are certainly familiar with stick-slip. It is most prevalent in a lead screw driven system. It is related to the difference between the static friction and the dynamic friction. It typically takes more torque to get the system in motion than it does to maintain motion at a low speed. We would see this as a drive torque variation in a lead screw driven system. A non-preloaded ball screw would have the lowest torque variation.

Q: What is the web site of the preview?

A: http://linearmotioneering.com/Main2.aspx

Q: You mention 3D cad. Many of our customers are still on 2D. Can we get DWG format also?

A: Yes. There are 8 different 2D formats available.

Q: Is the IDC actuator line being morphed into the Thompson line, if not what is the relationship between the two product lines and is there a difference as to when one should be used over the other?

A: The IDC product is supported by the Kollmorgen business unit. The Thomson Products are supported by the team that presented the Webinar. We made a conscious decision to include the IDC slide tables in LinearMotioneering as both Kollmorgen and Thomson are Danaher companies.

Q: Does Danaher provide motor couplings that make motors remotely replaceable with manipulators, or; what couplings do you offer that are the easiest to replace the motor?

A: Replacing a motor remotely would require significant manipulation (extensive software & hardware development). I am not aware of any system that can accomplish this. We do offer bellows and/or spider couplings on our systems. In general, bellows couplings are used for servo applications (accurate positioning) and spider couplings are used for transport applications. Both are fairly simple to change in the field.

Q: Will your software recommend what Newton meters are needed for a servo motor? Will it recommend a gearbox or not?

A: Yes. On step 8 (right after the solution set) click the “Motor Sizing Information” in the lower left hand corner of the page. Peak and Continuous Torques are displayed. The software does not recommend or consider a gearbox during the sizing exercise.

Q: Do screw supports move relative to the base machine? IE: do they move when the carriage passes?

A: An equal # of screw supports is located on either side of the carriage. They nest together and are deposited into notches that are machined in the bottom of the base as the carriages moves from one end to the other. While one side is depositing the screw supports into the notches in the base, the other side of the carriage is collecting the screw supports (much like a series of shopping carts being nested inside each other). They are spring loaded. The spring acts to allow them to fall into a notch when they are being dragged along. When they are collected this force is overcome and they disengage from the notch that they were residing in.

Q: Does your software give reflected inertia so we can calculate the inertia matching ratio?

A: Yes. System inertia can be found by clicking “Motor Sizing Information”
step 8.

Q: This was about the preselected option on the soft wear for guides, covers etc. Can you choose not to have a cover when recommended and will the system then automatically put you into a system that will better deal with the environment?

A: There are some options here, let me explain, first a direct answer: No. If you selected, for example, Moderate to Heavy Dust Particulate Count the software will not allow you to de-select an enclosed seal option. You can however, proceed through the software with a “Clean” condition selected. When you’ve identified the system you want to use, copy the part number then click the Home tab on the tool bar. This takes you to the opening page. Under the Select a Product Family pull down the menu, identify your system family (3 character prefix), highlight it, and click continue. Again, identify your system, enter the system length and click continue. The page opens up to the Environmental screen. Under Conditions click “Custom”. Any combination of options can be selected (all options available to that product family are active).

Q: Have your components ever interfaced with automotive valve train systems?

A: I am not aware of any applications where we have interfaced with automotive valve train systems. I'd recommend trying a linearmotioneering session whereby you input your application requirements as a starting point. If you feel the software doesn't cover the challenges of the application (operating temperature, vibration,..)

Q: How do you eliminate lubricant or polymer outgassing in high vacuum environments. Also, do any of your drives prevent backdriving when the motor power is removed?

A: Typically we do not eliminate lubricant, we use vacuum approved grease. On the polymer out-gassing question, with some of our systems we have the opportunity to substitute our standard linear bearings (which have a polymer bearing cage) with an all steel linear bearing. Vented hardware will be used in all cases where out-gassing is an issue.
We have also in the past provided our customers with actual polymer parts to test and evaluate. In this way they can determine if the material is suitable for the application.

Q: What volumes are considered for pursuit of "white sheet" design applications?

A: We evaluate each application / opportunity on a case by case basis. It needs to make sense for both parties to engage in a "white sheet" design because both parties invest heavily in this relationship. It is based more on annual sales $ rather than volume. If I had to give you a number I would say $250K is probably a good starting point. It would depend on how "custom" the solution would need to be, tooling costs,etc. We try to lean on our standard components and systems along with previously developed custom solutions to solve your problem

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Q: Is the relationship of travel life to load similar to that for ball bearings?

A: Yes it is. It is based on hertzian contact stresses and is quite predictable

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Q: Is this software web based?

A: Yes. The software is web based. No desktop version exists.

Q: What material is used for the support member?

A: I am assuming you mean the structural support. In most cases (95% of our products) it is aluminum. This is due to the fact that aluminum can be extruded in very long lengths with “manageable” distortion. If you were referring to the screw supports, these are made from an engineering plastic

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Q: Do you provide load-deflection characteristics for the system?

A: Not directly. What is published is a minimum span distance between mounting supports to maintain the listed load rating (Linear Units Catalog). What the Linear Motioneering software does is calculate each systems deflection based on your stroke entry, load data, and span value, and, compares that to the maximum allowable value in the software database (in two planes). Those systems that pass the condition move on as candidates for the solution set.
