

## Metaphorical Pachyderm

**W**hat do most control engineers work on? There's really no single answer since control applications are extremely diverse. That diversity is our strength: We learn from one application and apply our communal experience to another.

Among the numerous applications that we work on, there is, in fact, one that is so widespread in its importance and applicability that we scarcely notice it. That application is *pointing*.

Pointing is elemental. As you look at an object and nod your

head up and down or turn it from side to side, you have no problem keeping your eyes focused on your target. Now point at something with your finger and turn your body various ways. Can you keep pointing fairly accurately? It's not

### Contributors



Dawn Tilbury in Kathmandu.



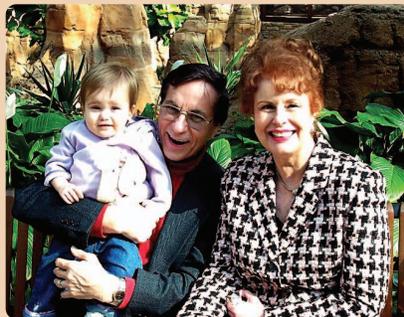
Grant Wang with his wife Lily Sun, son Martin, and daughter Megan.



James DeBruin with wife Dana and daughter Jacqueline.



Jim Hilbert.



Mike and Yvonne Masten with their granddaughter Faith.



Tom Williams and son Alex.

hard. In fact, humans are pretty good at pointing.

But let's make this harder. Now point at something, close your eyes, move around, and try to keep pointing in the same direction. Any luck? Sure, it's not too hard—you keep track of where your feet are and you remember where the original direction is.

OK, one last step to make this a *lot* harder. Stand on a platform that rotates and tilts, have someone rotate and tilt the platform, but try to keep pointing in the same direction—while keeping your eyes shut. Now it's a lot harder to keep track of the original pointing direction. Welcome to *inertial stabilization*, that is, the ability to maintain direction without looking.

Why would you want to be able to point at something without looking? Two reasons. First, in some applications, such as on a submarine, there is nothing to look at to give you angle information. And, second, even if you *can* look, the availability of rate information can help you stabilize the desired pointing direction in inertial space.

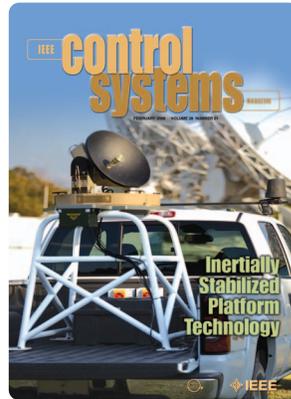
It dawned on me, after a mere 25 years of talking with control engineers working on innumerable defense-related projects, that the problem of keeping things steady in inertial space is the proverbial elephant in the control engineering room. Inertial stabilization is what control engineers have worked on for decades and continue to work on today. It is a problem that will never cease to be important and challenging. And it is the reason for the special section in this issue of *IEEE Control Systems Magazine*.

Transforming the idea of a special issue on inertially stabilized platforms to reality could never have happened without the leadership of Guest Editor Mike Masten. Mike is—or should

be—well known to all IEEE Control Systems Society (CSS) members because he was CSS president in 1996. What I didn't know, but found out in my initial attempt to instigate this issue, is that Mike is an expert on inertially stabilized platforms. Mike's expertise reflects his leadership at Texas Instruments (TI) of a controls



Randal Vanderveer readies his camera for the cover shot.



group as well as his extensive involvement—a 39-year career—in defense-related projects.

Mike invited several of the top experts in the field to contribute to this issue. Jim Hilkert worked with Mike at TI and now has his own company; James DeBruin, who also worked with Mike at TI, now works at General Dynamics SATCOM Technologies; and Grant Wang and Thomas Williams are with Boeing in Anaheim, California. Jim Hilkert's article provides an end-to-end view of the challenges of inertial stabilization, complementing Mike's article on optical systems. The two articles together provide a comprehensive overview of the issues and challenges in the field. The remaining articles focus on applications. James focuses on the challenges that arise in pointing a vehicle-mounted antenna toward a geosynchronous satellite. Finally, Grant and Thomas provide a fascinating overview of the extensive engineering that goes into the stabilized platform that guides an ICBM halfway across the world without external aids.

What is unique and special about this collection of feature articles is that the knowledge and hands-on experience of the authors is evident throughout each article. Everything is about real-world systems that operate and fly. Although many sophisticated ideas are used to make these systems work, the subject of this special section is the antithesis of what is normally called "theoretical."

To complement these feature articles, the ever-popular "People in Control" column includes interviews with engineers working on related technology. Steve Griffin of Boeing SVS in Albuquerque, New Mexico, talks about optics-related projects he's worked on, while James Royalty of Harris Corporation in Melbourne, Florida, talks about his experiences with a wide

range of tracking and pointing systems. Incidentally, James worked with Mike at TI.

This issue also includes an "Applications of Control" article by Corresponding Editor Tyrone Vincent on image stabilization in moving cameras. The "Ask the Experts" column includes an explanation by Dawn Tilbury of how PLC logic and controllers work, as well as my attempt to explain what inertial space is. This issue also inaugurates the "Members Activities" column by CSS Vice-President for Member Activities Claire Tomlin.

We have many exciting articles in the pipeline for 2008. Some of these are longer articles that will continue the modeling series that began in 2007, while others cover a broad range of applications.

Are you thinking of organizing a special issue? Then please contact me to discuss it. In the meantime, I hope you enjoy this very special issue on the elephant in the room. Its recognition is long overdue.

Dennis S. Bernstein

