Turbo Short Course (**6 CE hours) September 12 2016 – 8:30 am-5 pm**
45th Turbomachinery Symposium, Houston (tps.tamu.edu)
http://tps.tamu.edu/program/turbo/turbo-short-courses

GAS BEARINGS & MAGNETIC BEARINGS FOR OIL-FREE ROTATING MACHINERY

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Gas bearings (GBs) are an efficient alternative for load support of high speed (microturbo)machinery (< 400 kW, +1000°F, +3M DN). These bearings are compliant surface hydrodynamic bearings using ambient air as the working fluid media. Oil-free systems have lesser part count, footprint and weight and are environmentally friendly and (nearly) maintenance free, thus saving costs and resources. Current commercial applications include, air cycle machines, cryogenic turbo expanders and micro gas turbines. Other upcoming applications include auxiliary power units, automotive turbochargers and aircraft gas turbine engines for regional jets.

Successful implementation of GBs in commercial rotating machinery involves a three-tier effort with (a) selecting and designing bearing structural components and solid lubricant coatings to improve the bearing load carrying capacity with reduced friction, (b) having accurate performance engineering prediction models anchored to dependable (non commercial) test data, and (c) integration with secondary flow, operating profile, and the rotor-bearing dynamic system.

The short course provides practicing engineers with a comprehensive review of existing gas bearing technologies including their principle of operation, analysis and experimental verification, comparison amongst other gas bearing types, as well as the integration of gas bearings, foil bearings in particular, into actual rotor-bearing systems (hot and cold). The course also includes an introduction to magnetic bearings and their applications.

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Who Should Attend

The course is designed around the needs of every job function related to integrating oil-free foil bearings into rotating machinery products. This includes design engineers interested in making their next generation machines or improving current machines with a hybrid oil-lubed and foil bearing system. Additionally, consumers of oil-free machines will benefit from understanding the technology's unique characteristics. This course will include material relevant to oil-free compressors, industrial and aerospace gas turbines with hot section bearings, air cycle machines, and more. The course will give enough information to rationally select foil bearings understanding their (current) practical limits

and planning for further qualification and standardization. The short course will dispel several myths related to GFB performance and stress its unique features.

Why You Should Attend
Foil bearings are an enabling technology that benefits from a novel approach for effective integration into an oil-free rotating machine based on the bearing unique characteristics. It is taught by engineers with practical, analytical, experimental and commercial experience with oil-free gas turbines and state of the art laboratory modeling and testing.

The course will utilize common rotordynamics, hydrodynamics, and other physics principals already familiar to the community and show how they apply to foil bearing equipped machines from a theoretical and practical point of view. In addition, the instructors' practical experience will prepare the designer for common pitfalls including realistic performance expectations and typical operational failures, streamlining future projects.

THE PRESENTERS – BIOS

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Luis San Andrés is a renowned analyst and experimentalist in the fields of fluid film lubrication and rotordynamics. Since 2000, Dr. San Andrés has performed research on the analysis and experimental verification of gas foil bearing performance for high temperature oil free turbomachinery and squeeze film dampers for aircraft jet engines. His computational codes, benchmarked against test data, are standards in the rotating machinery industry. Dr. San Andrés and his students have published over 160 papers, several earning best paper awards.
Prof. San Andrés is an ASME Fellow and STLE Fellow, a member of the Advisory Committee for the Houston-Turbomachinery Symposium, and Chair of the Asia Turbomachinery Symposium.

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Mr. Daniel Lubell is a design and test consulting engineer for oil-free and conventional turbomachinery. Over the past 20 years Daniel has worked with industrial and aerospace turbomachinery, and became specialized in oil-free systems

after years of hands-on R&D experience. Daniel has worked with industry leading technology in this area at Capstone Turbine, Honeywell Aerospace, and Calnetix Technologies. He has been a significant contributor to several new centerline designs for both conventional and oil-free systems and is as comfortable with design and test as he is with analysis. Daniel has a Masters of Science in Mechanical Engineering which he earned at the Texas A&M University Turbo Lab in College Station, Texas. Prior to that, he received a Bachelors in Engineering Science from Trinity University in San Antonio, Texas. Daniel, an ASME member, has published papers on squeeze film dampers and foil bearing developments for micro gas turbines.