

Smart Bearing Technology

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Abstract:

The experimental development of the **S**mart **E**lectro-**M**agnetic **A**ctuator **J**ournal **I**ntegrated **B**earing (SEMAJIB) is presented. The SEMAJIB is a smart high performance integrated bearing that combines a fluid film bearing (FFB) with an electro-magnetic actuator (EMA) in one integrated device. In all cases, the fluid film bearing shall carry the load, whereas the electro-magnetic actuator can be used as a pure controller or both as a controller and a load carrying element. In the latter case the electro-magnetic actuator can be considered as an active magnetic bearing (AMB). This paper summarizes the development of the SEMAJIB as a compact integrated bearing. It is shown that the SEMAJIB can easily transgress the multiple critical speeds of the 2-inch laboratory rotor, as well as suppress not only the first mode oil whip, but also the second mode oil whip, and additionally can control the rotor unbalance. The use of PD, H ∞ and Fuzzy Logic control to control the SEMAJIB is presented and compared. It is shown that the SEMAJIB is a high performance bearing that is versatile and can replace tilting-pad bearings in high performance rotating machinery.

Bio:

Dr. Aly El-Shafei is a Certified Vibration Analyst, Category IV. He holds a Ph.D. from the Massachusetts Institute of Technology (MIT) and is a world renowned expert on vibration analysis, rotordynamics and machinery diagnostics. In addition to serving as Managing Director at RITEC, Dr. El-Shafei is also a Professor of Vibration Engineering at Cairo University, Egypt. Prof. El-Shafei chairs the ISO working group ISO/TC108/SC2/WG10 He is also known worldwide for his work on Squeeze Film Dampers, and the developing of new technology for the control of rotating machinery vibration. Prof. El-Shafei is the recipient of the distinguished Grand African Innovation Award in 2017. Dr. El-Shafei has received 3 US patents and has published more than 80 papers on rotordynamics and machinery diagnostics. Prof. El-Shafei has held positions as the Chairman of the Mechanical Design and Production Department at Cairo University 2011-2014, Executive Director of the Science and Technology Development Fund (STDF) 2008-2011, Assistant Minister of Science and Technology 2006-2008, Group Technical Director, Ezz Group, 1994-1997.