

Fall 2017 Colloquium Series

**SOLAR HEAT UNDERGROUND STORAGE AIR CONDITIONING
- EXPERIMENTAL EVALUATION USING HILL CLIMBING CONTROL -**

Tuesday, November 7 | 3:30—4:30 PM | Brown Hall W210



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Abstract — This seminar discusses the operation of an air-conditioning system, completely powered by geothermal energy, with no other external energy input and no heat pump. This geothermal system can contribute to the reduction of electricity consumption in residences and small businesses, and can retrofit any installation. There is a lot of potentials to use surface geothermal energy because of the soil temperature, to a certain depth, has a constant temperature throughout the year. The soil is a large mass with great heat capacity, and the average temperature of solar irradiation is maintained for such surface geothermal applications, making possible air-conditioning, year-round greenhouse systems, and even electrical energy conversion with thermionic or low-gradient thermodynamic cycles. Practical tests can be easily conducted with water and underground heat exchangers. The seminar will discuss a system designed with a circulating coolant through a serpentine driven by a small hydraulic pump. If the temperature inside the residence is lower or higher than the soil temperature, there is heat exchange between the residence ambient and the soil. Therefore, the surface geothermal energy is used to warm-up or cool-down the room ambient. The prototype described in this paper was implemented with an electronic control to maximize the performance of the heat exchangers, a very practical implementation of hill-climbing control. The seminar will show results from experiments made during four months in the winter and the summer and will conclude with some potential ideas for further development.

Bio — **Marcelo Godoy Simões** received a B.Sc. degree from the University of São Paulo, Brazil, an M.Sc. degree from the University of São Paulo, Brazil, and a Ph.D. degree from The University of Tennessee, the USA in 1985, 1990 and 1995 respectively. He received his D.Sc. Degree (Livre-Docência) from the University of São Paulo in 1998. Dr. Simões was a US Fulbright Fellow for AY 2014-15, working for Aalborg University, Institute of Energy Technology (Denmark). He has been elevated to the grade of IEEE Fellow, Class of 2016, with the citation: "for applications of artificial intelligence in control of power electronics systems."

Dr. Simões is a pioneer to apply neural networks and fuzzy logic in power electronics, motor drives, and renewable energy systems. His fuzzy logic based modeling and control for wind turbine optimization is used as a basis for advanced wind turbine control, and it has been cited worldwide. His leadership in modeling fuel cells is internationally and highly influential in providing a basis for further developments in fuel cell automation control in many engineering applications. Prof. Simões made substantial and lasting contribution to artificial intelligence technology in many applications, power electronics and motor drives, fuzzy control of wind generation system, such as Fuzzy Logic based waveform estimation for power quality, Neural Network based estimation for vector controlled motor drives and integration of alternative energy systems to the electric grid through AI modeling based power electronics control.