

## **Brief Biography of Yannis A. Phillis**

Yannis A. Phillis is professor emeritus and former rector at the Technical University of Crete. He received his diploma in electrical and mechanical engineering from the National Technical University of Athens, Greece, in 1973 and the M.S., Engineer Degree, and Ph.D. degrees from the University of California at Los Angeles (UCLA) in control systems in 1978, 1979, and 1980 respectively. From 1980 to 1986, he was assistant professor at Boston University, Boston, MA. Since 1986, he has been with the School of Production Engineering and Management, Technical University of Crete, Chania, Greece where he was rector for 12 years and past director of the CAM Laboratory. In 1992 and between 2005 and 2007 he was visiting professor at UCLA's Chemical Engineering Department. In 2008 he was Onassis Foundation Senior Visiting Fellow in the US. In 2013-2014 he was Prometeo Senior Research Fellow in Riobamba, Ecuador. His research interests are in stochastic control, manufacturing, sustainability, and climate change.

Dr. Phillis is a member of the editorial board of several technical journals. He is the recipient of numerous honors among which Harry Kurnitz Literary Award at UCLA, 1978 and 1979; Professor of the Year Award at Boston University, 1986; Award by the Academy of Athens for creating the 80-acre Park for the Preservation of Flora and Fauna at the Technical University of Crete, 2007; Fellow of the Venizelos Research Institute in Greece, 2006; Awards by the Municipalities of Chania and Assini, Greece in 2005 and 2008 respectively for his service to society, science, and letters; Lifetime Achievement Award at the World Automation Congress 2010, Kobe, Japan; and Academic Alumni Professional Achievement Award, UCLA, 2013. He has published over 130 scientific papers, several technical books, and fifteen poetry collections and novels. He is an award-winning writer in Greece and the US. He is a Fellow of AAAS; Fellow of the European Academy of Sciences; Member of the European Academy of Sciences and Arts; Member of Poets and Writers, USA; and Member of the P.E.N. Club.

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# WAC Lifetime Achievement Keynote

*Title*

## **On a mathematical theory of sustainability assessment and decision making**

*Abstract*

Sustainability assessments of an entity, be it a nation, a city, an energy or a transportation system etc., rely on data to evaluate human welfare and environmental integrity. Each of these two fundamental components is a combination of more specialized indicators organized into various hierarchical levels. For example, the human dimension of sustainability encompasses socio-economic, technological and political aspects which are further elaborated using different groups of indicators. Most assessment models normalize indicators from their physical domains into a common interval representing a range from the lowest to the highest levels of sustainability. Most aggregation models utilize simple linear or geometric expressions to arrive at numerical values ranging from zero to one. Other approaches employ fuzzy reasoning or multicriteria techniques to do the same. However, no general theory has been developed to model sustainability assessments.

In this talk such a theory will be presented based on certain intuitively appealing postulates. These postulates lay the mathematical foundations of a sustainability theory and lead to a simple model based on shifted geometric means combining basic sustainability indicators into an overall index. The model has a number of desirable properties and generalizes the commonly used weighted arithmetic and weighted geometric means. The model is augmented with a sensitivity analysis which pinpoints those indicators with the highest potential of improving sustainability, thus, providing decision-makers with an important tool to aid policies. Applications include sustainability assessments of countries, cities, energy, transportation, agriculture and corporations. Rankings and sensitivity analyses occasionally reveal surprising results such as unexpectedly low rankings of highly developed countries which demonstrate that sometimes development has no robust foundations.