



University of Pavia

Ph.D. School in Electrical and Electronics Engineering and Computer Science

SEMINAR

Curvature-Dependent Electrostatic Field A Principle for Modelling Membrane MEMS Devices with or without Fringing Field Effect

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Abstract: The evolution of engineering application is increasing shifting towards the embedded nature, resulting in low-cost solutions, micro/nano dimensional and actuators being exploited as fundamental components to connect the physical nature of information with the abstract one, which is represented in logical form in a machine. In this context, the scientific community has gained interest in modeling membrane Micro-Electro-Mechanical-Systems (MEMS), leading to a wide diffusion on an industrial level owing to their ease of modeling and realization. Physically, once the external voltage is applied, an electrostatic field, orthogonal to the tangent line of the membrane, is established inside the device, producing an electrostatic pressure that acts on the membrane, deforming it. Evidently, the greater the amplitude of the electrostatic field is, the greater the curvature of the membrane. Thus, it seems natural to consider the amplitude of the electrostatic field proportional to the curvature of the membrane. Starting with this principle, second-order semi-linear elliptic models in 1D and 2D geometries with and without fringing field phenomenon, obtaining important results regarding the existence, uniqueness and stability of solutions as well as evaluating the particular operating conditions of use of membrane MEMS devices have been obtained and studied. In this context, the idea of presenting this seminar (structured into two sections) matures to discuss the similarities and differences between the analytical and numerical results in detail, thereby supporting the choice of certain membrane MEMS devices according to the industrial application. Finally, some original results about the stability of the membrane in 2D geometry are presented and discussed.

Bio: Mario Versaci received a Master Degree in Civil Engineering and a Ph.D. in Electronic Engineering from the "Mediterranea" University of Reggio Calabria, Italy, in 1994 and 1999, respectively. In 1996 he obtained the "Diplome d'Etude Approfondites" in "Genie Electrique" at the Ecole Polytechnique de Grenoble, France. In 2013 and 2018 he received the Degrees and Master Degree, both with "Summa cum Laude", in Mathematics, from Messina University, Italy. Actually, he is Associate Professor of Electrotechnics, "Mediterranea" University where he also serves as Scientific Director of the Laboratory of Electrotechnics and NdT, His scientific interests range from NdT/NDE to controlled thermonuclear fusion; from image/signal processing to MEMS. He has established collaborations with many international research institutes. He was organizing and program/scientific committee member for several international Conference. He is an Editorial Board Member for Mathematics MDPI and he serves as Editor and co-Editor for several international Journals. He is a Member of the Italian Society of Applied and Industrial Mathematics (SIMAI) and he is also IEEE Senior Member and Member of the Accademia Peloritana dei Pericolanti (Italy).

Organizers

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Seminar in English

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