Prof. **Guglielmo Rubinacci**
Emerito di Elettrotecnica

Graduated in Electronic engineering, 1975, Università di Napoli, is professor emeritus of Electrical Engineering at the University of Napoli Federico II. As a Fulbright-Hays Fellow he was a visiting scientist at MIT in 1980/81. He was the Dean of the Faculty of Engineering of the University of Cassino from 1996 to 2003. He spent periods of study and research in particular at the Max Planck Institut fur Plasmaphysik, Garching and the Istituto Gas Ionizzati, CNR, Padova. He has been a researcher at the Università di Napoli (1982/85), professor in charge and associate professor of electrical engineering at the Universities of Calabria (1979-84), Salerno (1984/88) and Napoli (1988/90), full professor at the University of Cassino (1990-2004), Research affiliate at MIT, Cambridge, USA (2015-17). Coordinator for several years of PhD programs in Electrical Engineering, I was a member of the board of the PhD degree in mathematical and physical sciences for advanced materials and technologies of the Scuola Superiore Meridionale in the years 2020 – 2022. He acted as a principal investigator and coordinator of European and national research projects. He was the member of the Engineering panel of experts GEV09 of the Italian Research and University Evaluation Agency (ANVUR), for the evaluation of the production of the Italian research community in the period 2004-2010 and 2011-2014. He has been involved in many international projects in the field of Fusion as INTOR, NET, RFX, Ignitor, JET, ITER, DEMO.

CV:

https://www.docenti.unina.it/#!/professor/4755474c49454c4d4f525542494e4143434952424e474c4c3532443138463833394b/curriculum

Pubblications -

google scholar:
https://scholar.google.com/citations?user=lprWKx8AAAAJ%20Link%20su%20iris/unina:%20https://www.iris.unina.it/cris/rp/rp04926?sort_byall=2&orderall=DESC&open=all&user=lprWKx8AAAAJ#all

Iris/unina: https://www.iris.unina.it/cris/rp/rp04926?sort_byall=2&orderall=DESC&open=all#all

Several relevant pubblications

- N Isernia, N Schwarz, FJ Artola, S Ventre, M Hoelzl, G Rubinacci, F Villone, Jorek Team, Self-consistent coupling of JOREK and CARIDDI: On the electromagnetic interaction of 3D tokamak plasmas with 3D volumetric conductors, *Phys. Plasmas* 30, 113901 (2023)
- C. Forestiere, G. Gravina, G. Miano, G. Rubinacci and A. Tamburrino, Static Surface Mode Expansion for the Electromagnetic Scattering from Penetrable Objects, (2023) *IEEE Transactions on Antennas and Propagation, doi: 10.1109/TAP.2023.3285356*
- C.Forestiere, G. Miano, G. Rubinacci, M. Pascale, A. Tamburrino, R. Tricarico, and S. Ventre, Magnetoquasistatic resonances of small dielectric objects, (2020) *Phys. Rev. Research* 2, 013158
- S.L. Chen, F. Villone, Y.W. Sun, G. Rubinacci, S. Ventre, B.J. Xiao, Z.P. Luo, Y. Guo, H.H. Wang, T.H. Shi, Disruptive plasma simulations in EAST including 3D effects, (2019) *Nucl. Fusion* 59 106039
- C. Forestiere, G. Miano, G. Rubinacci, A. Tamburrino, R. Tricarico, and S. Ventre G., Volume Integral Formulation for the Calculation of Material Independent Modes of Dielectric Scatterers, (2018) *IEEE Transactions on Antennas and Propagation*, 66 (5) , pp. 2505-2514.
- C Forestiere, G Miano, G Rubinacci, L Dal Negro, Role of aperiodic order in the spectral, localization, and scaling properties of plasmon modes for the design of nanoparticle arrays, (2009) *Physical Review B* 79 (8), 085404
- G Rubinacci, S Ventre, F Villone, Y Liu, A fast technique applied to the analysis of resistive wall modes with 3D conducting structures, (2009) *Journal of Computational Physics* 228 (5), 1562-1572

  A Tamburrino, G Rubinacci, A new non-iterative inversion method for electrical resistance tomography (2002) *Inverse Problems* 18 (6), 1809
- R Albanese, G Rubinacci, Integral formulation for 3D eddy-current computation using edge elements, (1988) *IEE Proceedings A-Physical Science, Measurement and Instrumentation, Management and Education-Reviews* 135(7), 457

Scientific activity

Rubinacci has made seminal contributions to the field of computational electromagnetics and its application to nondestructive evaluation (NDE) and to the study of thermonuclear fusion devices.

He has made theoretical studies and practical applications on the numerical formulation of the electromagnetic fields problem in terms of the Edge-based finite elements. Although spanning trees is a classic issue in the frame of circuit modelling and simulation, their use is electromagnetics was introduced for the first time in a series of papers by R. Albanese and G. Rubinacci. In the numerical formulation of the field problem, they exploited for the first time in electromagnetics the graph structure of the edge-based finite element mesh. The tree-cotree technique was first proposed by Albanese & Rubinacci for regularizing discrete vector potential formulations in 1988. The papers outline the so called “tree-cotree gauge.” This concept is at the heart of the most part of successive developments of the theory and application of the edge elements for field computations. The paper on the integral formulation for 3D eddy current computation using edge elements based on this approach is considered very innovative and is, perhaps, among the most cited papers in its field.

Another area where the scientific interests of Rubinacci were concentrated has had the studies on the electromagnetic interactions of thermonuclear plasmas with the surrounding passive structures. These problems are being studied as part of an international project to design and build an experimental fusion reactor based on the "tokamak" concept. Albanese and Rubinacci developed an integral formulation that is now widely accepted as one of the most effective methods for modeling the interaction. In this context, the contributions of Rubinacci were also related to the study of the evolution of plasmas in the presence of passive 3D structures. Modeling of plasma evolution in the presence of complex 3D structures was a particularly useful result obtained by Albanese, Rubinacci and Villone as part of an international undertaking to demonstrate the feasibility of using nuclear fusion as a source of energy. The numerical model, again based on the integral formulation of the eddy current problem and the code CARIDDI, is considered to be one of the most effective models to date; the compression of the full matrix representing the integral operator, in collaboration with S. Ventre, enables this model to study reactor configurations that could not be studied heretofore.

Rubinacci has made equally significant contributions to the area of inverse solutions, particularly as they apply to NDE. He is the coauthor of several papers proposing pioneering methods for solving the direct problem of computing the field associated for a given flaw in complex 3D conducting specimens. These methods, which allow realistic flaws to be modeled, have been extensively validated with experimental data. The computational methods, known for their speed and precision, are considered to be among the best of numerical models for simulating cracks and other types of flaws in 3D geometries.

A particularly novel approach proposed jointly with A. Tamburrino is a “non-iterative” inversion method that represents a radical departure from the usual method of relying on the minimization of an error functional relating to the difference between the computed data and measurements for estimating the shape of the flaw. The classical methods involve the use of a direct forward model in an iterative framework. The repeated use of the forward models results in excessive computational effort. Furthermore, the result can be affected by the presence of local minima in the functional error space. The method proposed by Tamburrino and Rubinacci allows one to determine if a given elementary voxel is a member of the conducting domain or otherwise. The computational burden of the numerical algorithm scales linearly with the number of voxels of the domain. This method has opened the door for a whole new class of methods for solving the inverse problem, i.e. the identification of defects in real time.