

PROF. MICHELE CAPUTO -- BIOGRAPHICAL DATA 209



Birthday : May 5, 1927

Birthplace : Ferrara, Italy

Degrees :

1950 Mathematics (laurea) University of Ferrara
 1955 Physics (laurea) University of Bologna
 1959 Geodesy (libera docenza) Ministry of
 Education of Italy

Web-page : <http://digilander.libero.it/idrana/caputo/>

Professional Experience :

Participated to the works of the Italian Karakorum Expedition, to several expeditions of the University of California in the Pacific Ocean and to an archaeological expedition to the island of Icaros (Kuwait) organised by the University of Venice

1950-53 Assist. Prof. Mathematics, Univ Ferrara
 1953-56 Assist. Prof. Inst. Geophys. Univ. Trieste
 1957 Assist. Res. Mapping Charting Res. Lab. Ohio State Univ.
 1958-59 Assist. Prof. in Inst. Geophys. Univ. Trieste
 1959-60 Res. Ass. Inst. Geophys. Univ. Calif. Los Angeles
 1960-61 Assist. Prof. in Inst. Geophys. Univ. Trieste
 1961-65 Res. Assoc. Inst. Geophys. and teacher in Math. Dept.
 Univ. Cal. Los Angeles
 1965-67 Professor in Math Dept. and Geophys. Dept. Univ.
 British Columbia
 1967-72 Director of Institute of Geophysics University of Bologna
 1972-74 Director of the Institute of Physics, University of Bologna
 1974-76 Director of the Istituto Nazionale di Geofisica in Rome.
 1976-83 Professor Phys. Dept. University of Rome.
 1983-87 Harris Professor of Geophysics Texas A&M University
 (endowed chair)
 1987- Professor Emeritus of Geophysics Texas A&M University
 1987- Professor Phys. Dept. University of Rome.

Professional Activities :

- 1966-67 Member of the Geophysics Committee of Canadian Research Council.
- 1975-81 Represented Italy in the Expert Group of the Conference Committee on Disarmament of United Nations.
- 1964-72 Deputy Secretary General of International Union of Geodesy and Geophysics
- 1964-72 Member of the committee on data for Science and Technology of the International Council of Scientific Union
- 1968-76 Chairman of the Italian Committee for data for Science and Technology
- 1968-72 Member of Physics Committee of National Research Council of Italy
- 1971-79 Member of the Committee on Science Teaching of the International Council of Scientific Unions
- 1982-87 Principal investigator of NASA research contracts
- 1997- Chairman of the Environment Commission of Accademia Nazionale dei Lincei

Honours :

- 1957 Fulbright Scholarship to USA
- 1963 Vacchelli Award from Istituto Geografico Militare.
- 1976 Feltrinelli Award from Accademia Nazionale dei Lincei.
- 1975 Award Villa San Giovanni, from the city of Reggio Calabria for work in Geophysics, Geodesy and Seismology
- 1980 Award Alberto d'Este from the city of Ferrara
- 1980 Award from the Society of Engineering Seismology of India
- 1983 Received the Harris Chair in Geophysics at Texas A&M University in recognition and support of outstanding research and teaching
- 1970 Member of Accademia Nazionale dei Lincei.
- 1989 Member of Academia Europaea (London)

Seminars :

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Massachusetts Institute of Technology in Cambridge (1); California Institute of Technology (2); University of Colorado (3); Geological Survey in Menlo Park (California) (2) and Golden (Colorado) (1); University of California at San Diego (2), at Los Angeles (1), at Berkeley (1); USSR Academy of Sciences in Moscow (2); Academy of Science of Georgia (1); Academy of Science of Tadjikistan (1); Accademia Nazionale dei Lincei, Roma; NOAA Washington (1); NASA Galveston USA (1); University of Madrid (Spain) (1); Academy Science Democr. Rep. Germany, Potsdam (1); University of Trieste (1); Texas A&M University (2); Universidad Autonoma Nacional Mexico (1); University of New Mexico (1); University of Nevada at Reno (1); Flight Dynamic Laboratory Dayton Ohio, USA (1); American Mathematical Society (2); Dept. of Evolutionary Biology Univ. Ferrara (1), Libera Univ. Internaz. Studi Sociali (LUISS) (1); Dept. of Molecular Biology, Univ. La Sapienza Rome (1); Dept. Neuroscience Univ. Rome Tor Vergata.

A series of lectures are given in: Japan at the Universities of Kyoto and Tokyo, the Disaster Research Centre, the Geological Survey the Geographical Survey, the Meteorological Agency; at the Seismological Institute of Peking; and also a seminar course at Scripps Inst. of Oceanography, La Jolla. *Written few tens of articles* of various type for the national newspapers: Corriere della Sera, Il Giornale, Il Tempo and also for Gazzetta Padana.

Publications : Prof. Caputo is the author of *about 300 scientific papers* (sole author of 2/3 of the papers) and of *several monographs*. Selected list is provided.

He is the *author of several chapters* of book: *Geophysics of the Karakorum*, Edited by A. Marussi, Brill-Leiden Holland, 1964. With N. Alfieri, M. Caputo promoted and directed the survey of the farm fishing ponds, swimming pools and harbours of the Tyrrhenian sea to establish its level from 500 B.C. to 200 A.D. The many papers' book: *Il livello Antico del mar Tirreno*, Olschki, Schmidt Editor, 1972, was published on that research.

Besides his contributions to Geophysics, Elasticity, Mathematics (see the selected list of his papers related closely to Fractional Calculus), Prof. Caputo is an *innovator in following applied science achievements*:

- Wrote the first papers in analytical photogrammetry, about 20 years before its practical development, which led to tomography; – Made the first laboratory photogrammetric survey of a liquid in motion; – Found an upper limit to the gravity absorption; – Found the libration of satellites due to the tidal field of the planet; – Found the Aequatorfluchtkraft (the fleeing force from the equator opposed to the Polfluchtkraft); – Gave the equation of state for the hydrostatic equilibrium of planets which reset the problem of the evolution of the Earth-Moon system; – Computed the splitting of the free torsional modes of planets due to the ellipticity and estimated that due to the rheology; – Set the unified theory of dielectric and anelastic media in the Riemann sheets based on memory formalisms. The rheological models were used at Air Force Institute Techn. of Dayton; – Made the long range forecast of the earthquakes of May 7th and 10th in Central Italy. Made the pattern recognition of the risk areas for large earthquakes in Italy, in Andean region and in China; – Made an extensive use of archeometry in Geodesy and Geophysics, which produced, the ancient level variations of the Tyrrhenian sea and the catalogue of the tsunamis of the Italian coasts; – Introduced the two parameters statistical analysis of earthquakes finding the density distribution of the areas of the faults of seismic regions and the Moment accumulation in California and also the distribution of the fractured asperities of a fault, which gives the fractal dimension of the faults; – Gave a two parameters method to estimate the accelerations of the ground due to earthquakes; – Introduced the use of GPS data for the determination of layered models of the Atmosphere with variable refractivity for the estimate of the pressure, temperature and water vapor content; – Modeled experimentally diffusion in porous media as a memory phenomenon; – Introduced the pattern recognition in the studies of the financial conditions of banks; – Introduced the Memory mechanism in finance and economy which led to the estimate to the relaxation time of economy; – Extended reciprocity theorems to the case of diffusion with memory.

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List of Selected Publications of Prof. M. Caputo
Monographic books:

- *The Gravity Field of the Earth*, Academic Press, New York, 1967.
- *Elasticità e dissipazione*, Zanichelli Publisher, Bologna, 1969.
- *Tsunamis of the Italian Coasts*, with G.F. Faina, Accad. Naz. Lincei, Roma, 1984.
- *Sismologia e segnali precursori dei terremoti*, Calderini Press, Bologna, 1987.
- *Seismology and Rheologica Tectonics*, Università degli Studi di Roma, Department of Physics, 1996-97 (lectures notes).

List of Papers in Journals and Proceedings
on Memory Models Based on Fractional Derivatives

- 1** - M. Caputo:
Linear models of dissipation whose Q is almost frequency independent.
Annali di Geofisica, Vol. 19, No 4, pp. 382-393, 1966.
- 2** - M. Caputo:
Linear model of dissipation whose Q is almost Frequency Independent-II.
Geophysical J. Royal Astronomic Society, Vol. 13, pp. 529-539, 1967.
- 3** - M. Caputo and F. Mainardi:
A new dissipation model based on memory mechanism. *Pure and Applied Geophysics (PAGEOPH)*, Vol. 91, No 8, pp. 134-147, 1971.
- 4** - M. Caputo and F. Mainardi:
Linear models of dissipation of anelastic media.
Rivista del Nuovo Cimento (Ser. 2), Vol. 1, pp. 161-198, 1971.
- 5** - M. Caputo:
Elasticity with a dissipation represented by a simple memory mechanism. *Atti Accademia Naz. Lincei, Rend. Classe Sci. Fis. Mat. Nat. (Ser 8)*, Vol. 45 No 5, pp. 467-471, 1973.
- 6** - M. Caputo:
Vibrations of an infinite viscoelastic layer with a dissipative memory.
J. Acoust. Soc. Amer., Vol. 56, No 3, pp. 897- 904, 1974.
- 7** - M. Caputo:
Vibrations of an infinite plate with a frequency independent Q .
J. Acoust. Soc. Amer., Vol. 60, No 3, pp. 633-639, 1976.

8 - M. Caputo:

Which is correct stress strain relation for the anelastycity of the earth's interior? *Geophys. J. Royal Astron. Soc.*, Vol. 58, pp. 432-435, 1979.

9 - M. Caputo:

A model for the fatigue in elastic materials with frequency independent
Q. J. Acoust. Soc. Amer. Vol. 66, No 1, pp. 176-179, 1979.

10 - M. Caputo:

Elastic radiation from a source in a medium with a frequency independent
Q. J. Physics Earth , Vol. 29, pp. 487-497, 1981.

11 - M. Caputo:

Relaxation and free modes of a self-gravitating planet.
Geophys. J. Royal Astron. Soc., Vol. 77, pp. 789-808, 1984.

12 - M. Caputo:

Generalized rheology and geophysical consequences.
Tectonophysics , Vol. 116, pp. 163-172, 1985.

13 - M. Caputo:

Linear and nonlinear inverse rheologies and geophysical consequences.
Tectonophysics , Vol. 122, pp. 53-71, 1986.

14 - M. Caputo:

Wave-number independent rheologies in a sphere. *Atti Accademia Naz. Lincei, Rend. Fis. (Ser. 8)*, Vol. 81, pp. 175-207, 1987.

15 - M. Caputo:

Rheologies quasi wave-number-independent rheologies and splitting of the spectral lines. *Atti Accademia Naz. Lincei, Rend. Fis., (Ser. 8)*, Vol. 87, pp. 507-526, 1988.

16 - M. Caputo:

The rheology of an anelastic medium studied by means of the observation of the splitting of its eigenfrequencies. *J. Acoust. Soc. Amer.*, Vol. 85, No 5, pp. 1984-1987, 1989.

17 - M. Caputo:

Reply to Comments on " The rheology of an anelastic medium...."
by R.L. Weaver [*J. Acoust. Soc. Amer.* Vol. 88, No 3, p. 1642, 1990].
J. Acoust. Soc. Amer., Vol. 88, No 3, p. 1643, 1990.

18 -M. Caputo:

The splitting of the free oscillations of the Earth caused by the rheology.
Atti Accad. Naz. Lincei, Rend. Fis.(Ser. 9), Vol. 1, pp. 119-125, 1990.

19 - M. Caputo:

Three-dimensional rheology, In: R. Sabadini et al. (Editors):
Glacial Isostasy, Sea Level, and Mantle Rheology. Kluwer Acad. Publ.
Netherlands, pp. 301-320, 1991; See also: *Atti Accademia Naz. Lincei*,
Rend. Fis. (Ser. 9), Vol. 2, pp. 97-105, 1991.

20 - M. Caputo:

Free modes splitting and alterations of electrochemically polarizable
media. *Atti Accad. Naz. Lincei, Rend. Fis. (Ser. 9)*, Vol. 4, 89-98, 1993.

21 - M. Caputo:

The splitting of seismic rays due to dispersion in the Earth interior.
Atti Accad. Naz. Lincei, Rend. Fis. (Ser. 9), Vol. 4, pp. 279-286, 1993.

22 - M. Caputo:

The stress field in the crust and the sinking of mountains.
J. Physics Earth, Vol. 41, pp. 109-126, 1993.

23 - M. Caputo:

Distance measurements and splitting of electromagnetic waves in water
caused by dispersion. *Atti Accademia Naz. Lincei, Rend., Fis. (Ser. 9)*,
Vol. 5, pp. 103-113, 1994.

24 - M. Caputo:

The Riemann sheet solutions of anelasticity. *Annali di Matematica Pura
ed Applicata (Ser. 4)*, Vol. 166, pp. 335-342, 1994.

25 - M. Caputo:

Mean fractional-order-derivatives differential equations and filters.
Annali Univ. Ferrara, Sez. VII, Sci. Matematica, Vol. 41, pp. 73-83, 1995.

26 - M. Caputo:

Distance measurements and splitting of electromagnetic waves caused by
the dispersion and GPS retrieval of the model atmosphere. *Atti Accad.
Naz. Lincei, Rend. Fis. (Ser. 9)*, Vol. 6, pp. 19-36, 1995.

27 - M. Caputo:

Modern rheology and dielectric induction: multivalued index of refract-
tion, splitting of eigenvalues and fatigue. *Annali di Geofisica*, Vol. 39,
No. 5, pp. 941-966, 1996.

28 - M. Caputo:

The Green function of the diffusion of fluids in porous media with me-
mory. *Atti Accad. Naz. Lincei, Rend. Fis. (Ser. 9)*, Vol. 7, pp. 243-250,
1996.

- 29** - M. Caputo: 216
 Rigorous time domain responses of polarizable media.
 Annali di Geofisica, Vol. 40, No 2, pp. 423-434, 1997.
- 30** - M. Caputo:
 Evolutionary dynamic equilibrium equations between demand and offer.
 Atti Accademia Scienze Ferrara, Vol. 75, pp. 167-198, 1997-98.
- 31** - M. Caputo:
 3-dimensional physically consistent diffusion in anisotropic media with memory. Atti Accademia Naz. Lincei, Rend. Fis. (Ser. 9), Vol. 9, pp. 131-143, 1998.
- 32** - M. Caputo:
 The density distribution of the fractures asperities on the surface of a fault. Physics of the Earth and Planetary Interiors, Vol. 109, pp. 9-23, 1998.
- 33** - M. Caputo:
 The set-valued unified model of dispersion and attenuation for wave propagation in dielectric (and anelastic) media. Annali di Geofisica, Vol. 41, No 5-6, pp. 653-666, 1998.
- 34** - M. Caputo:
 The Fisher equation in the light of memory.
 Atti Accademia Scienze Ferrara, Vol. 76, pp. 21-36, 1998-99.
- 35** - M. Caputo:
 Physically consistent diffusion in media with memory.,
 Il Nuovo Cimento C, Vol. 22, No 3-4, pp. 253-261, 1999.
- 36** - M. Caputo:
 Diffusion of fluids in porous media with memory.,
 Geothermics, Vol. 28, pp. 113-130, 1999.
- 37** - M. Caputo:
 The skin effect of the anelastic Earth.
 Pure and Applied Geophysics, Vol. 156, pp. 371-393, 1999.
- 38** - L. Belfiore and M. Caputo:
 The set-valued index of refraction of dielectric and anelastic media.
 Annali di Geofisica, Vol. 43, No 2, pp. 207-216, 2000.
- 39** - M. Caputo:
 Models of flux in porous media with memory.,
 Water Resource Research, Vol. 36, No 3, pp. 693-705, 2000.
- 40** - M. Caputo:

Distributed order differential equations modelling dielectric induction and diffusion. *Fract. Calc. and Appl. Anal.*, Vol. 4, No 4, pp. 421-442, 2001.

41 - M. Caputo:

Distance measurements with electromagnetic wave dispersion.

In B. Benciolini (Ed.), *Hotine-Marussi Symposium on Mathematical Geodesy*, Springer Verlag, Vol. 122, pp. 48-60, 2001.

42 - M. Caputo and J. Kolari:

An analytical model of the Fisher equation with memory function, In: *Alternative Perspectives on Finance and Accounting*, Vol. 1, 1-14, 2001.

43 - M. Caputo:

Economy equilibrium equations with memory. *Proc. of the Meeting: L'eredità di Dario Graffi*, *Atti Convegni Accademia Nazionale dei Lincei*, Vol. 177, pp. 191-220, 2002.

44 - M. Caputo:

Memory in the abortion rates in Italy,
Atti Accademia Scienze, Ferrara, Vol. 80, pp. 57-80, 2002-03.

45 - M. Caputo and W. Plastino:

Diffusion in porous layers with memory.
Geophysical J. International, Vol. 158, pp. 385-396, 2004.

46 - F. Ceasarone, M. Caputo and C. Cametti:

Memory formalism in the passive diffusion across a biological membrane. *J. Membran Science*, Vol. 250, pp. 79-84, 2005.

47 - M. Caputo:

The memory function of the gross national product induced from its variation due to a step of the prime rate. *Economia Politica*, Vol. 3, pp. 365-379, 2005.

48 - G. Iaffaldano, M. Caputo and S. Martino:

Experimental and theoretical memory diffusion of water in sand.
Hydrology and Earth System Science, Vol. 10, pp. 93-100, 2006.

49 - M. Caputo:

Memory, reciprocity and double Green function in diffusion, elastic and electromagnetic fields. *Intern. J. Appl. Math.*, Vol. 19, pp. 489-504, 2006.

50 - M. Caputo and G. Di Giorgio [Essays in memory of M. Arcelli]:

Monetary Policy, Memory and Output Dynamics.
In: F. Neri and G. Di Giorgio (Editors): *Monetary Policy and Institutions*. LUISS University Press, Roma, 2006, pp. 165-176.