Prof. Giuseppe Marrucci
Emerito di Ingegneria Chimica

The work of Prof. Marrucci in the field of rheology started at the phenomenological level in the sixties, in cooperation with Prof. Gianni Astarita. This activity culminated in the writing of a book (McGraw-Hill, 1974), one of the first on the subject. Already in the early seventies, however, the main scientific interest of G. Marrucci shifted towards molecular modeling of polymer rheology, as he was convinced that only molecular modeling could provide an understanding of the nonlinear constitutive behavior of polymeric systems.

His modeling activity first concentrated on dumbbell models of the polymer chains. A result of that work which has been often quoted afterwards is the expression for the free energy of polymer chains in terms of trace of stress (Trans. Soc. Rheol., 1972). To that time can also be ascribed what is perhaps the first numerical simulation of Brownian Dynamics for a bead-rod model of flexible chain (J. Polym. Sci.; Phys.Ed., 1974). Already in the late 70's he focussed on the problem of entanglements with a work on rubbers containing entanglements (Rheol. Acta, 1979). He then provided a molecular explanation to the Weissenberg effect (JNNFM, 1986) based on the tube model, and relevant modifications to the tube model itself were made by inclusion of dynamic dilation (J. Polym. Sci.; Phys. Ed., 1985), and of stretching (Gazz. Chim. It., 1988; J. Polym. Sci.; Phys. Ed., 1991). Next, he introduced the concept of convective constraint release (CCR) (JNNFM, 1996), which solved the problem of the excessive shear thinning predicted by the basic Doi-Edwards theory. Further developments followed (Macromol. Symp, 1997; JNNFM 2000, J. Rheol, 2001; JNNFM, 2002; Phil. Trans. Roy. Soc. A, 2003; Macromolecules 2004; Science 2004). The concept of applying a force balance on entanglements lead to a new simple strain measure (J. Rheol., 2000), as well as to a network model of reptating chains suitable for Brownian simulations (J. Chem. Phys., 2001; Europhys. Lett., 2002), known as NAPLES code, and further developed by Yuichi Masubuchi. Another intriguing subject recently examined was the nonlinear rheology of polymers with localized interactions (Macromolecules, 1993; JNNFM, 2000).

A different aspect of molecular modeling was that applicable to rigid rodlike polymers, which could generate nematic phases. The interest of Prof. Marrucci in this subject goes back to the seventies with a seminal paper on the influence of flow on phase equilibria (J. Polym. Sci.; Lett., 1977). Later, the rodlike molecular model was successfully used in understanding the phenomenon of negative normal stresses in lyotropic LCP's (Macromolecules, 1989). All along the nineties, LCP rheology and defect structures were studied and, often, successfully modeled. The state of the art has been reported in several reviews (e.g. Adv. Chem. Phys. 1993).

Prof. Marrucci won the first Weissenberg award (1998) of the newborn European Society of Rheology, and in 2003 he was the 2nd foreign recipient of the Bingham Medal, recently opened to non-Americans. In 2003 he has been elected foreign associate of the National Academy of Engineering (USA) with the following motivation: "For contributions to the molecular modelling and thermodynamics of polymeric systems and for furthering our understanding of their transport processes".

Member of several Italian Academies, he remains active in the University of Naples as Emeritus (after his retirement in 2010), mostly coworking with Prof. Giovanni Ianniruberto. His most recent works are, among other things, on impermanent networks (e.g., Macromolecules, 2015), and on monomeric friction coefficient reduction in fast flows (e.g., Macromolecules 2019). The list of recent publications is available by clicking on "Profilo" and "Pubblicazioni".