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## A biophysics problem: Computational difficulties and their solution

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r The problem is in the field of controlled drug release. Many mechanisms have been examined along time in this area but L here we consider one which is based on the osmosis effect, as described in A G Popescu et al., Romanian J. Biophys. 20:223-234 (2010) and references therein. These authors investigate the time evolution of a spherical liposome with a semipermeable coat and containing a solution of some pharmaceutical drug, when this is immersed into a bay of a solvent. Due to the osmosis, the liposome is swelling from the initial radius  $R_0$  up to a critical value  $R_c$  at which the surrounding membrane becomes so stressed that a pore of radius rc is produced on its surface. A second stage then begins where some part of the drug content Q is released through the pore and thus the liposome is relaxed until reaching the original radius. A new cycle of the same type can begin with the only difference that now the input Q is smaller than before, and this is repeated as many times as Q is sufficient for ensuring a swelling up to R. As mentioned in the quoted paper, the two-stage cycle is mathematically characterized by a differential equation for R (swelling) and a system of three such equations for R, r and Q (relaxation). The numerical solution of the latter rises difficulties because this is stiff and then it asks for a high stability method. The Runge-Kutta methods are of two types, explicit and implicit. The explicit methods are easy to use but with low stability properties while vice versa holds true for the implicit methods. A method which brings the qualities of the two under the same umbrella is presented. It is of a special type in the sense that its coefficients are equation dependent, not constant, as in the standard literature on Runge-Kutta methods. The method is applied on the considered problem and the results confirm that the osmosis-based mechanism deserves indeed serious attention in the area of controlled drug release.

## Biography

L Gr Ixaru is a Professor of Computational Physics and a member of the Academy of Romanian Scientists. He has written three books and more than 70 scientific papers in well reputed journal. He was distinguished with some national and international prizes and served as a member in the editorial boards of two high standard journals.

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