PHASE PLANE METHOD FOR LIFETIME DETERMINATION OF SINGLE AND DOUBLE EXPONENTIAL DECAYS

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Brief description: An observed luminescence (fluorescence or phosphorescence) decay curve can be due to the luminescence or photochemical degradation of the analyte and impurities in the solvents, and decay of the scattered stray radiation from the source. In these cases, the observed decay behaviour is not simply the summation of the sample decay plus the background decay; there is some degree of convolution. In addition, distortions in the data may arise from several factors, including the wavelength-dependence of the excitation profile, the dependence of the response of the detector on the energy of the incident photons, scattered exciting light, etc. This program uses the phase plane method for deconvolution of single and double exponential decays.

In the program, the phase plane method can be used in a 5-parameter or 5-parameter version to calculate lifetimes in single or double exponential decays, respectively. Distortions in the data are also considered. The convoluted observed decay can be expressed as \( D(t) = Z(t)E(t) + aE(t) \), where \( Z(t) \) corresponds to a single or double exponential, \( E(t) \) is the background contribution to the convoluted decay, and \( aE(t) \) considers distortions in the experimental data. Depending on whether a single or double decay is being analysed, \( D(t) \) can be linearized as a function of 2 or 4 independent variables. After introduction of the experimental luminescence data (intensity vs. time), the program computes the values of the variables at each time, and then by application of standard linear least-squares methods, the best values of the lifetimes, pre-exponential factors and distortion factors can be calculated easily.

Potential users: Spectroscopists.

Fields of interest: Chemical analysis and spectrochemistry.

This application program has been developed in BASIC for the Apple Macintosh Plus computer, to run under Macintosh 5.0. It is available on 3.5-in floppy discs. The memory required is 492K.

Distributed by the contributors [Tel. Spain (34) 52 28 13 00].

Documentation is minimal, but no user training is required. The program has been fully operational for 1 year. The source code is not available, but the contributors are willing to answer user enquiries.