

# Some tuning techniques of parameters to frequencies in Runge-Kutta(-Nystrom) methods for oscillatory problems.

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An important class of initial value problems which arise in many physical problems consists of ODEs whose solutions are known to be periodic, or to oscillate with a known frequency. The most detailed informations about oscillatory problems concern the angular frequency and the phase of the oscillation; if the location of the frequencies are known in advance, we can tune the parameters of the numerical method to frequencies to provide better approximations to the oscillations. We consider and compare three different approaches. We extend trigonometric and mixed collocation to the family of two step Runge-Kutta methods. We discuss how to derive phase-fitted Runge-Kutta-Nystrom (RKN) methods which result exact in phase for linear problems with periodic solutions. Finally, only assuming that the frequencies are located in a given small interval, we adapt the parameters of the RKN method through least squares minimization.