

Asymptotic methods for convolution integrals unified and demystified

JOSÉ LUIS LÓPEZ

Dpto. Matemática e Informática, Univ. Pública de Navarra, Pamplona

jl.lopez@unavarra.es

Resumen

We present a new method for deriving asymptotic expansions of $\int_0^\infty f(t)h(xt)dt$ for small x . We only require for $f(t)$ and $h(t)$ to have asymptotic expansions at $t = \infty$ and $t = 0$ respectively. Remarkably, it is a very general technique that unifies a certain set of asymptotic methods. Watson's Lemma and other classical methods, Mellin transform techniques, McClure and Wong's distributional approach and the method of analytic continuation turn out to be simple corollaries of this method. In addition, the most amazing thing about it is that its mathematics are absolutely elemental and do not involve complicated analytical tools as the aforesaid methods do: it consists of simple "sums and subtractions". Many known and unknown asymptotic expansions of important integral transforms are trivially derived from the approach presented here.