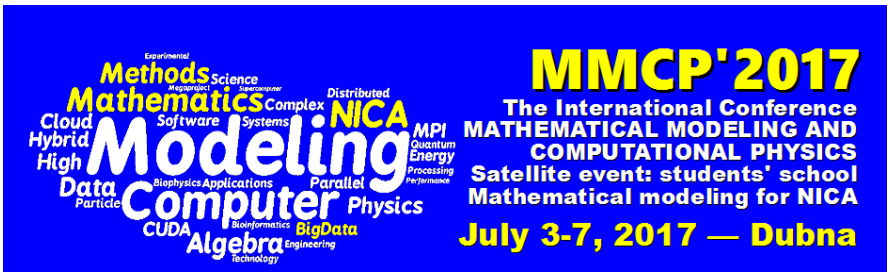

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Generalized Techniques in Numerical Integration

Wednesday 5 July 2017 08:30 (30 minutes)

Integration by parts is one of the most popular techniques in the analysis of integrals and it has frequently been used to create divergent series or asymptotic expansions of integral representations. The product of the technique is usually a divergent series formed from evaluating boundary terms; however, sometimes the remaining integral is also evaluated. Striking examples are the Euler series arising from integrating the Euler integral by parts and examples arising in molecular structure calculations.
In this contribution, we explore a generalized and formalized integration by parts to create equivalent representations to some challenging integrals and we introduce a numerical algorithm, called the staircase algorithm, which is shown to be robust and leads to an unprecedented accuracy.
As a demonstrative archetype, we examine the infinite-range Fresnel integrals, the Twisted Tail, Airy functions and Bessel integrals.

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