

# THE CRM APPLIED MATHEMATICAL PHYSICS (CAMP) SEMINARS



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## **Asymptotic error analysis**

### **Abstract:**

When computing numerical approximations to problems with smooth solutions using regular grids, the error can have additional structure. The historical example of the Euler-McLaurin formula for the approximation of integrals with the trapezoidal rule is shown as a first example. This expansion can be used to justify Richardson extrapolation of the approximations leading to the Romberg integration formula. For approximation of differential equations, similar error expansions can be derived. For standard methods on uniform grids, an expansion for the error can be constructed that is regular in the grid spacing. For some other methods, numerical artifacts (boundary layers and errors that alternate in sign between adjacent grid points) can also be present. Identifying the types of errors that are generated by a given scheme and the order at which they occur is called Asymptotic Error Analysis. Several examples are shown, including the error analysis of cubic spline interpolation which is shown to have numerical boundary layers. A numerical artifact from an idealized adaptive grid with hanging nodes used to approximate a simple elliptic problem is presented. This is a talk suitable for a general mathematical audience.

<b>Date:</b>	<b>October 18th, 2018</b>
<b>Place:</b>	<b>Room A1 CRM, Edifici C, UAB</b>
<b>Time:</b>	<b>12:00</b>
	<b>Master and undergraduate students are welcome.</b>

