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School of Natural Sciences

APPLIED MATHEMATICS SEMINAR 291

Polynomial-Based Time Integrators

Tommaso Buvoli
Department of Applied Mathematics
Univeristy of California, Merced

Date: **9/14/18**
Time: **3:00 PM**
Location: **COB1 265**

For more information contact:
Maxime Theillard
mtheillard@ucmerced.edu

ABSTRACT

Time-dependent partial differential equations are widely used to develop accurate mathematical descriptions for a range of physical phenomena. As the scale and complexity of these models increases, so too does the need for efficient computational methods. In this work, we introduce a time-integration framework based on interpolating polynomials in the complex plane. The use of polynomials eliminates the complexity of order conditions, enabling simple construction of methods with a specific architecture (parallel or serial), degree of implicitness (explicit, diagonally implicit, fully implicit) and desired order of accuracy. This allows one to derive integrators that satisfy the stability and accuracy requirements of a specific application problem, and appropriately leverage a specific computer architecture.