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Jean-Philippe Lessard* (jp.lessard@mcgill.ca), , Canada, and **Jason D. Mireles James**, , Canada. *A rigorous implicit C^1 Chebyshev integrator for delay equations.*

In this talk, we introduce a new approach to validated numerical integration of systems delay differential equations. We focus on the case of a single constant delay though the method generalizes to systems with multiple lags. The method provides mathematically rigorous existence results as well as error bounds for both the solution and the Fréchet derivative of the solution with respect to a given past history segment. We use Chebyshev series to discretize the problem, and solve approximately using a standard numerical scheme corrected via Newton's method. The existence/error analysis exploits a Newton-Kantorovich argument. We present examples of the rigorous time stepping procedure, and illustrate the use of the method in computer-assisted existence proofs for periodic solutions of the Mackey-Glass equation. (Received January 13, 2021)