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Kendall A Gillies* (kendall.gillies@ttu.edu) and **Clyde F Martin**. *Using Osculatory Smoothing Splines To Approximate The Solutions To Ordinary Differential Equations*. Preliminary report.

Using techniques from optimal control and control theoretic splines new methods are developed for the numerical solutions of ordinary differential equations. A new formulation of smoothing splines is developed based on osculatory interpolation. This involves two smoothing parameters. An n th order linear multi-point method is used and this has $2n-1$ parameters. The multi-point algorithm is used to generate a set of data points that approximate the solution of the differential equation $\dot{x} = f(x, t)$. The data set is smoothed using the spline, $y(t)$. Then the integral

$$\int_0^T (\dot{y}(t) - f(y(t), t))^2 dt$$

is minimized with respect to the $2n+1$ parameters creating an optimal multi-point algorithm for the particular differential equation. (Received September 17, 2013)