1145-34-808 **Paul G Warne*** (warnepg@jmu.edu), Department of Mathematics and Statistics, James Madison University, and **Debra A Warne** (warneda@jmu.edu), Department of Mathematics and Statistics, James Madison University. *The Adaptive Parker-Sochacki Pade' Method For Robust Numerical Simulation.* Preliminary report.

For high-resolution numerical simulation involving systems of differential equations, an explicit adaptive procedure using a foundation of the Parker-Sochacki Method (PSM) has significant advantages over many standard adaptive algorithms that use a Runge-Kutta (RK) foundation. These advantages include decreased output data storage size relative to resolution and complexity, built-in series approximations of the state space to find states between time steps, an automatic stepwise a-priori error bound, and a simple way to increase or decrease the order of the method stepwise during the computation. PSM functions that represent the backbone of a future PSM tool for the scientific community are described. At each step across the domain, these functions efficiently and recursively generate both the Taylor polynomial and the remarkably robust Pade' rational approximants of the solution to the governing ODE system. An Adaptive PSM Pade' algorithm is described theoretically and demonstrated on several examples, including a 3 degree of freedom system. Results are compared against standard RK adaptive algorithms; it is noted in the 3 degree of freedom example that Adaptive PSM Pade' runs faster and takes roughly two orders of magnitude fewer steps for similar accuracy. (Received September 15, 2018)