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A Singularity Handling Approach for the Rayleigh-Plesset Equation ASISH BALU, MICHAEL KINZEL, SCOTT MILLER, The Pennsylvania State University - Applied Research Laboratory, COMPUTATIONAL MECHANICS TEAM — Cavitation dynamics of a nuclei are largely governed by the Rayleigh-Plesset Equation. The research focuses on improving the numerical efficiency of integrating the Rayleigh-Plesset equation with the use of “singularity handling” to enable stable integration at much larger time steps, which greatly reduces the computational time while maintaining solution accuracy. In this paper, various singularity-handling algorithms are explored and assessed, where a “triangle Runge-Kutta backtrace method” was found to be most effective. In order to maintain constant time step size while maintaining solution quality, the Rayleigh Plesset equation is solved reverse to ensure the solution recovers symmetry across the collapse event. The results indicate that an error of 7% can be maintained while performing over 980% faster than the conventional constant time step Euler method. In addition, the backtrace method had the lowest percent deviation from the actual solution (-0.22%). This increase in efficiency and accuracy allows the program to provide useful solutions in the field of fluids engineering, particularly in the study of shock tube gas explosions.

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