Symplectic Propagation of the Map, Tangent Map and Tangent Map Derivative through Quadrupole and Combined-Function Dipole Magnets without Truncation*, D.L. BRUHWILER, <u>J.R. CARY</u>**, and S. SHASHARINA, TECH-X CORPORATION -

The MAPA accelerator modeling code symplectically advances the full nonlinear map, tangent map and tangent map derivative through all accelerator elements. The tangent map and its derivative are nonlinear generalizations of Brown's first- and second-order matrices [1], and they are valid even near the edges of the dynamic aperture, which may be beyond the radius of convergence for a truncated Taylor series. In order to avoid truncation of the map and its derivatives, the Hamiltonian is split into pieces for which the map can be obtained analytically. Yoshida's method [2] is then used to obtain a symplectic approximation to the map, while the tangent map and its derivative are appropriately composed at each step to obtain them with equal accuracy. We discuss our splitting of the quadrupole and combined-function dipole Hamiltonians and show that very few steps are required for typical magnets of a high-energy accelerator.

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[1]   K. Brown, SLAC-75, Rev. 4 (1982), pp. 107-118.
[2]   H. Yoshida, Phys. Lett. A 150 (1990), pp. 262-268.